Annex 1: Working Paper and Questionnaire

MAHFSA Capacity Development Need and Gap Analysis (CDNGA) Methodology

INTRODUCTION

1.   This document has been prepared to assist in the planning and implementation of the regional programme "Measurable Action for Haze-Free Sustainable Land Management in Southeast Asia (MAHFSA)" Capacity Development Needs and Gap Analysis under Component 1 – Enhancement of data, information and results management system and operational capacity. This process will take approximately two (2) months (i.e., June – August 2020) to gather input and information at national and regional levels from ASEAN Member State (AMS), ASEAN Secretariat (ASEC), relevant regional institutions such as ASEAN statutory bodies, ASEAN Specialised Meteorological Centre (ASMC) and Malaysia Meteorological Department (Met Malaysia), and other relevant stakeholders.

2.   The circulation of this draft analysis report will be through ASEC to the Committee under the Conference of the Parties to the ASEAN Agreement on Transboundary Haze Pollution (COM AATHP) and ASEAN Task Force on Peatlands (ATFP), and later further circulation by the NFPs to key stakeholders within the country for inputs and verification, including the National Monitoring Centres (NMCs). This work is not intended to capture inputs from individual or organisations at local and sub-national levels due to limited timeframe and challenges during this pandemic period where travel has been suspended.

3.   The results from this Analysis will support implementation of the overall five (5) years MAHFSA program, in particular the Component 1:
Output 1.1 – Capacity building package for data and information collection/ sharing and regional results management developed
Activity 1.1.1 – Regional level data, information and capacity gap analysis;
Activity 1.1.2 – Development of guidelines for information and data collection and results management;
Activity 1.1.3 – Development of capacity building package; and
Output 1.2 – Capacity building undertaken at country and regional levels for improved data and information gathering and results management
Activity 1.2.1 – Implementation of capacity building package; and
Activity 1.2.2 – Establishment of regional information and results management systems.

4.   The intended outcome of the Component 1 is to enhance capacity of ASEAN for the establishment and use of information and result management systems for the implementation of the ASEAN Peatland Management Strategy (2006-2020) (APMS), the Roadmap on ASEAN Cooperation towards Transboundary Haze Pollution Control with Means of Implementation (2016-2020) (Haze-Free Roadmap) and for reducing transboundary haze pollution levels. It is expected that capacity building package are tailored to meet country and regional data and results management needs, and that the number of people capable of performing data and information gathering, and results management is increased.

5.   Based on the approval of the First Programme Steering Committee of the MAHFSA on 27 November 2019 in Bangkok, Thailand, five potential areas of focus for Component 1 were identified, presented and listed as below:
  i.   Peatland inventory, mapping, assessment of degradation status, monitoring (APSMPE Key Target 1 All peatland areas in ASEAN are identified and inventoried);
  ii.   Peatland fire prevention measures (APSMPE Key Target 2 Zero-burning is uniformly practiced and controlled-burning only used in exceptional cases to prevent any uncontrolled wildfires on

peatlands and eliminate any widespread smoke haze/ Roadmap Strategy 2 Sustainable management of peatlands for peatland fires prevention) in particular on rewetting and patrolling, and Fire Danger Rating System (FDRS) operation and promotion;

iii. Peatland fire and haze occurrence (APMSPE Key Target 2/ Roadmap Strategy 2), in particular extent of fire prone areas and monitoring fire occurrence (hotspots/burn-scars) using satellite;

iv. Resources allocated and generated for peatland management and fire prevention (APSMPE Focal Area 12 Regional cooperation/ Roadmap Strategy 7 Securing adequate resources from multi-stakeholders for preventing transboundary haze); and

v. Implementation of National Action Plan on Peatlands (NAPP), ASEAN Peatland Management Strategy 2006-2020 (APMS) and the ASEAN Haze-Free Roadmap (ASEAN Roadmap).

Background

6.   The existing regional level implementation mechanism[1] related to land and forest fire and transboundary haze pollution is as in Figure 1 below.
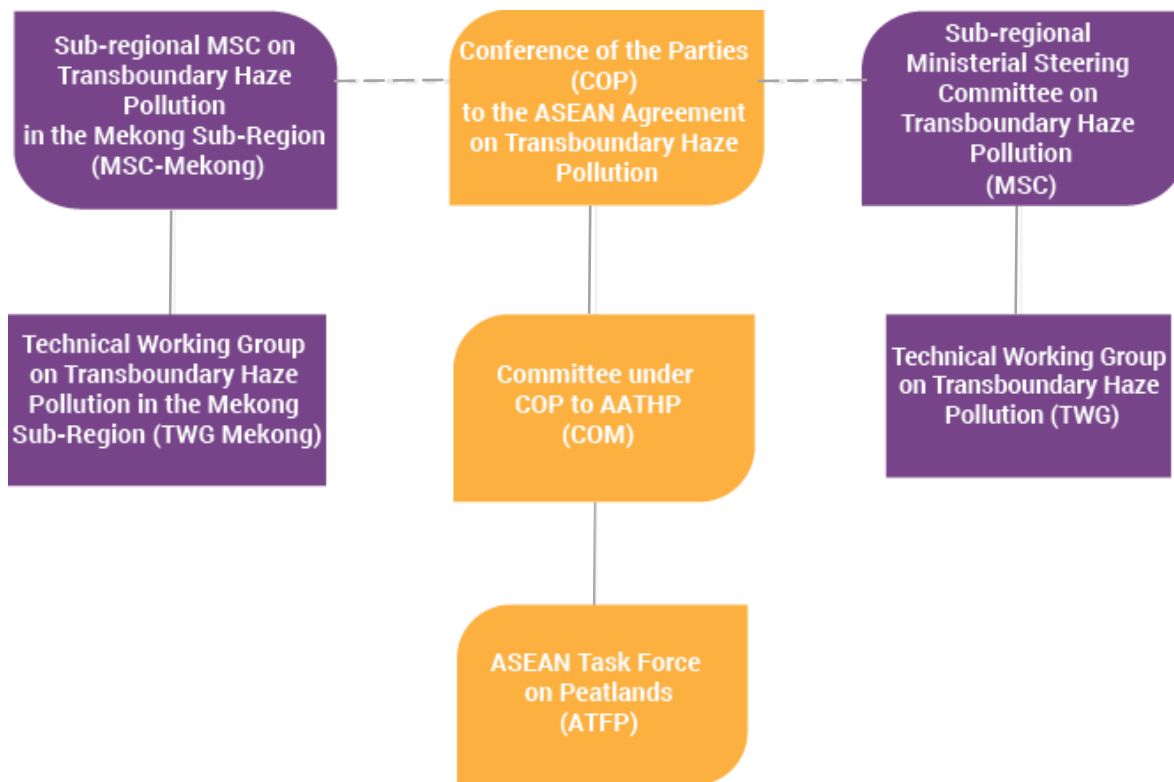

Figure 1: Regional institutional arrangement in ASEAN

7.   As stated on the SOP for Monitoring, Assessment and Joint Emergency Response[2], under the AATHP each NMC should undertake monitoring measures and the ACC (during the interim period, this function is performed by the ASMC) should establish linkages with the NMCs to communicate the data at agreed regular interval. The procedures as listed:

i)   The ACC (during the interim period, the function is performed by the ASEC, the ASMC will alert the ASEC when the dry season starts) will issue weather forecasts and haze outlook on a monthly

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[1] Source from ASEAN Agreement on Transboundary Haze Pollution (AATHP)

[2] This paragraph is derived from the Section III of the SOP for Monitoring, Assessment and Joint Emergency Response

     basis throughout the year and publish the updates on its intranet. During the dry season, the ACC will provide more frequent updates.

ii)   At the start of the dry season, the ACC (during the interim period, the function is performed by the ASEC, the ASMC will alert the ASEC when the dry season starts) will alert the NMCs to submit weekly situation report to the ACC on every Monday. The ACC will consolidate, analyse, and process the information into a user-friendly format.

iii)   The ACC will consolidate and analyse the situation reports received from NMCs and circulate the consolidated report to the NFPs at the end of the day through email 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 will alert the NMCs to provide the situation report on a daily basis.

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

8.   A key element of the support under the MAHFSA programme is to assist AMS and ASEAN in results management. Results management encompasses the management of key information related to the achievement of targeted results related to peatland fire and haze management. This entails the setting of clear indicators of success and the collation and analysis of related information to track progress in achieving results. Given the ASEAN framework, it is important that each AMS has clear targets and systems for tracking progress against the targets and identifying areas needed in additional support or resources. It is also important for the progress at the national level to be clearly documented and articulated to the regional level in a consistent manner – such that it will be possible for regional syntheses of progress to be made to inform key stakeholders and enable adjustments of course corrections to ensure the overall targets are met.

9.   In order to undertake this work, it is important that AMS and ASEC have a common and clear results management and reporting system to collate and synthesise information on progress and constraints in enhancing peatland management, fire and haze prevention. With regards to the haze, in line with the ASEAN Standard Operating Procedure (SOP) for Monitoring, Assessment and Joint Emergency Response, AMS should designate one or more bodies to function as NMCs[3], to undertake the monitoring of (i) all fire prone areas, (ii) all land and/or forest fires, (iii) environmental conditions conducive to such land and/or forest fires, and (iv) haze pollution arising from such land and/or forest fires, in accordance with their respective national procedures.

10.   This gap analysis will therefore gather information from the AMS and regional entities on the nature of results management systems used and range of indicators that are currently tracked and analysed at the country level in relation to peatland and fire management. This can help to identify gaps to be filled through enhanced information collection as well as opportunities for enhancing of national or regional result management systems.

Goal and Objective of the Capacity Development Need and Gap Analysis

11.   With reference to the MAHFSA Design Document, the programme will help close data gaps between and within AMS and propose a comprehensive results management system for effective programme implementation and to harmonise data between several data gathering activities. In this regard, an analysis of needs and gaps in data management at the national and regional level is needed.

12.   To close the data gaps, the Programme will assess the capacity of key regional and national institutions, ministries and departments of the 10 AMS in data collection, analysis and sharing and strengthen regional and country capacities in management and analysis of result and trends as tool to support the implementation of the APMS and ASEAN Haze-Free Roadmap.

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[3] Function of National Monitoring Centres as listed in AATHP Article 7 Monitoring

13.   This Capacity Development Needs and Gap Analysis will detail the different types of capacity building required at the national and regional levels e.g., interim ASEAN Coordinating Centre on Transboundary Haze Pollution Control (ACC THPC) (i.e., ASEC and ASMC), selected national entities particularly institutions related to peatland management and fire prevention, to achieve and track progress in generating key results as specified in the APMS and ASEAN Haze-Free Roadmap.

14.   The results of this Analysis will inform the development of guidelines for information and data collection and results management, and the development of capacity building package in the five potential area of focus (para 5), as well as in supporting establishment and enhancement of regional information and results management systems.

Preliminary Assessment and Analysis

15.   Preliminary assessment was undertaken in 2019 on openly available regional level data and information (**Annex 1.1**) on categories of publicly accessible information i.e. air quality, hotspot, wind direction, history/vintage data, fire scar, haze, rainfall and Fire Danger Rating System (FDRS), remote sensing options commonly used in fire management, hotspot information and air quality information. This can be referred to when AMS are providing feedback.

16.   In addition, according to input provided by AMS in 2014[4] on potential concept ideas to be included in the APSMPE, each AMS has different concerns over the six Key Targets of the APSMPE i.e. inventory, zero burning in eliminating haze, rehabilitation of fire prone area, sustainable livelihoods, biodiversity conservation and NAPP implementation (**Annex 1.2**).

METHODOLOGY

17.   An assessment on the capacity of key Ministries and/or departments of the 10 AMS responsible for monitoring (data and information collection, management and analysis), reporting and results management will be done to understand what are the constraints in compiling, standardising and disseminating data as outlined by the ASEAN Standard Operating Procedure (SOP) for Monitoring, Assessment and Joint Emergency Response (**Annex 1.3**) as well as relating the APMS and ASEAN Haze-Free Roadmap. National Focal Points of AATHP and ATFP should look at information compiled by the preliminary assessment undertaken in 2019 (Annex W1) and provide feedback on national level practices using the questionnaire (**Annex 1.4**).

18.   The methodology of the gap analysis comprises four elements as follows:
    i)   Desk study review of key documents related to regional monitoring, reporting and results management will be done to understand whether what are the constraints in compiling, standardising and disseminating data as outlined by the ASEAN SOP for Monitoring, Assessment and Joint Emergency Response.
    ii)   Information collection through questionnaire, includes the following sections:
        A.   Institutional Analysis of AMS institutions responsible for peatland and fire information and data management in the 10 AMS
        B.   Assessment of availability of key information for tracking results against ASEAN Roadmap Strategy 2
        C.   Information from AMS on current source and use of hotspot data and FDRS
        D.   Review of overall priorities of AMS for information and data management for peatland and fire management
    The list of key Ministries and/or Departments or specialised agencies within the AMS as attached to the SOP for Monitoring, Assessment and Joint Emergency Response (**Annex 1.3**). However, the list needs to be reviewed and updated as it is out of date.

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[4] AMS input to Draft Framework of the ASEAN Programme on Sustainable Management of Peatland Ecosystems 2014-2020 (APSMPE), 2014

iii)   Verification Interview or virtual meetings with key resource persons from the interim ACC (i.e. ASEC and ASMC), Ministries and/or Departments or specialised agencies on the findings of the desk study and questionnaire

iv)   Linkage with other processes

19.   **i. The desk study review** of relevant documents such as SOP for Monitoring, Assessment and Joint Emergency Response, ASEAN Guidelines on Peatland Fire Management, alert levels and trigger points, reports of NMCs, and other relevant analyses/ studies undertaken earlier, will also be reviewed and assessed, in order to provide sound and valid recommendations and to close gaps of the national's and regional's results management systems.

20.   The preliminary assessment on the following issues (see para 15 and **Annex 1.1-1.5**) will be updated and included:

A.   Availability of regional level data and information on remote sensing options commonly used in fire management,

B.   Analysis based on categories of information i.e. air quality, hotspot, wind direction, history/vintage data, fire scar, haze, rainfall and Fire Danger Rating System (FDRS),

C.   Hotspot information,

D.   Air quality information, and

E.   Information layers for improvement of existing applications used for ASEAN Fire Alert Tool.

21.   **ii. Information collection through questionnaire,** in order to compile relevant information to support the analysis, a questionnaire has been developed (**Annex 1.4**) and will be shared to the National Focal Points of AATHP, ASEAN Task Force on Peatlands (ATFP), and later further circulation by the NFPs to key stakeholders within the country for inputs, including the National Monitoring Centres (NMCs).

22.   The list of questions given in the questionnaire has been developed to obtain the various information on the sections (ii. A to D) stated in para 18. The questions related to the institutional analysis for peatland and fire management in AMS are grouped in the following categorised: A.1) Institutional setting for national coordination, A.2) National institutional setting for peatland conservation and rehabilitation, A.3) National institutional setting for fire and haze monitoring; and A.4) National resource mobilisation for peatland management and fire prevention. The questionnaire is provided as **Annex 1.4**.

Details of the different sections in the questionnaire are provided below:

23.   Section A. Institutional Analysis for peatland and fire management in ASEAN Member State. A critical element of the gap analysis is the identification of the institutions responsible for data collection, analysis and dissemination related to peatland management, and fire and haze prevention in ASEAN and significant capacity gaps.

24.   Section B. Assessment of availability of key information for tracking results against ASEAN Haze-Free Roadmap Strategy 2. To align the regional goals of having a common results management system with the national capacity of each AMS, specific key information for tracking results against ASEAN Haze-Free Roadmap Strategy 2. Sustainable Management of Peatlands for Peatland Fires Prevention is assessed.

25.   Specific information requirements have been identified in Strategy 2 of the ASEAN Haze-Free Roadmap to be used to track the progress and success of the effort to prevent peatland fire and associated haze – as follows:

i.   extent of peatlands,

ii.   extent of peatlands affected by fire,

iii.   areas of peatland managed through zero-burning techniques,

iv.   frequency of hotspots in peatland areas,

v.   number of regulations or incentives for haze free and zero burning practices,

vi. application of best management practices for sustainable land and forest management,
vii. land degradation and socio-economic impacts, and
viii. extent of peatland restoration.

26.   As part of the gap analysis, the AMS will be asked about the current collection of the information related to these indicators and whether is readily available and used for national analysis and reporting related to peatland and fire management.

27.   Section C. Information from AMS on current source and use of hotspot data and FDRS. Two key information types currently used in the ASEAN region in relation to fires and haze are hotspot data and FDRS warnings. The gap analysis will gather information on the current types and extent of use of hotspot tracking and FDRS used by AMS and regional entities including by the NFPs for AATHP and NFPs for ATFP, and other agencies. The analysis will also gather information on which dataset have been used and referenced by the AMS for the FDRS.

28.   Section D. Overall Review of priorities of AMS for peatland and fire management. The priorities for peatland and fire management in the ASEAN region have been set by the AMS in the framework of two sets of documents:
   a) ASEAN Peatland Management Strategy 2006-2020 (APMS) and the associated ASEAN Programme on Sustainable Management of Peatland Ecosystems 2014-2020 (APSMPE); and
   b) Roadmap on ASEAN Cooperation his will then guide the prioritisation of support given to AMS for capacity development.

32.   **iii. Verification Interview or virtual meeting** with key resource persons from the regional institutions, Ministries and/or Departments or specialised agencies for information validation. It is critical to have close communication with the official of key Ministries, Departments or specialised agencies, after submission of inputs to questionnaire, to discuss the feedback on the questionnaire and other information requested as well as to identify other key stakeholders/resource persons at national level on managing peatland and fire, according to existing mechanisms. In view that there are many available information and datasets publicly accessible through internet, it is important that clarification is made with key resource persons on which dataset is officially utilised to support decision-making at policy level.

33.   **iv. Linkage with other processes**. The process of undertaking this gap analysis assessment will be linked as appropriate with other related processes such as the Review of the APMS, the Review of the ASEAN Haze-Free Roadmap, and activities to be undertaken under SUPA programme such as stakeholder mapping and training needs assessment. Therefore, close communication will be maintained with related partners to ensure for optimal synergy of the effort. This will be done through the existing coordination mechanism between ASEC, MAHFSA programme and SUPA programme. Since GEC is also involved in the implementation of the APMS Review, it will ensure that whatever feedback is provided by AMS for the APMS Review is utilised (as appropriate) in the gap analysis. Efforts have been taken to minimise any overlap between questions for this Gap analysis and the APMS Review. Contact will also be made with other initiatives related to capacity development for regional monitoring including those related to the Regional Haze Training Network.

ANALYSIS AND REPORT

34.   The above information will be collated, analysed and a draft report will be prepared. The report will include the following:
   A. Analysis of the regional and national institution arrangements; the methods used and data results shared by AMS in relation to requirement of the SOP for Monitoring, Assessment and Joint Emergency Response and other ASEAN frameworks;
   B. Identification of the needs of the 10 AMS to improve data collection, management and analysis for enhancement of peatland management and fire prevention;

C. Identification of options for enhancing regional data collection and results management as per requirement of the SOP and monitoring purposes of the APMS and the Strategy 2 of the ASEAN Haze-Free Roadmap; and

D. Identification of elements to be included in the guidelines on enhancing data and results management (MAHFSA Activity 1.1.2) and the capacity building package (MAHFSA Activity 1.1.3).

35.   The report is anticipated to be ready in draft form by end of August and will be used to further guide the capacity building activities under the MAHFSA programme.

List of Annexes in the working paper:
Annex 1.1: Preliminary analysis on regional and national level data and information publicly accessible on internet
Annex 1.2: Potential concept ideas in APSMPE framework proposed in 2014
Annex 1.3: ASEAN SOP for Monitoring, Assessment and Joint Emergency Response
Annex 1.4: Questionnaire to be completed by targeted respondents
Annex 1.5: List of key Ministries and Departments or specialised agencies of AMS as listed in the SOP for Monitoring, Assessment and Joint Emergency Response

Annex 2: Strategies and Indicators to measure the progress of ASEAN Haze-Free

Action	Responsible Parties	Time Period	Target Areas	Resources	Measure of Progress
Strategy 1: Implementation of the AATHP, i.e., establishment of the ASEAN Coordinating Centre for Transboundary Haze Pollution Control (ACC), provisions on monitoring and prevention preparedness and early response etc.					
1. Establishment of ACC 1.1 Conduct a workshop for the preparation of the establishment of ACC	Indonesia	April 2016	Indonesia	Indonesia (local organising host) and AMS (participation cost)	• ACC established • Institutionalising early international haze assistance • Monitoring and warning systems established and in full operation by all Member States and coordinated by ACC • Preventive measures implemented •
1.2 [Signing/adoption] by the COP on the Agreement on the Establishment of ACC	COM	August 2016	Malaysia	Malaysia (local organising cost) and AMS (participation cost)	
1.3 Development of the Host Country Agreement	Indonesia	2017-2018	Indonesia	AMS	
1.4 Recruitment of the ACC staff	TBC	2017-2018	Indonesia	AMS	
1.5 Full operationalisation of the ACC such as the SOP in place, equipment and facilities installed, staff members recruitment	Executive Director of ACC	2018	Indonesia	AMS	
2. Fully implement the SOP for Monitoring, Assessment and Joint Emergency Response, which includes Alert Levels and Trigger Points on Fire Suppression and further enhance the SOP to enable early response	AMS facilitated by ACC	2018	AMS	AMS	
3. Fully mobilise the Panel of ASEAN Experts on Fire and Haze Assessment and Coordination to assess the fire situation on the ground and further recommend the external fire assistance	AMS facilitated by ACC	2018	AMS	AMS	
4. Review and revise the Fire Fighting Inventory Database	AMS facilitated by ACC	2018	AMS	AMS	

Action	Responsible Parties	Time Period	Target Areas	Resources	Measure of Progress
5. Seek external contributions to the ASEAN Haze Fund	COM, COP, ACC and ASEC	2016	AMS	AMS	
6. Explore increased AMS contributions to the ASEAN Haze Fund	COM, COP, ACC and ASEC	2016	AMS	AMS	
7. Enhance Appropriate Measures in Monitoring, Assessment and Early Warning Systems to Prevent Transboundary Haze Pollution arising from Land and /or Forest Fires	Interim ACC (ASEAN Secretariat), ASMC ACC, ASMC, NMCs	2016 2018	AMS	AMS	
8. Enhance and implement Work Programme	AMS, ASEC, ACC	2016	AMS	AMS	
9. Ensure regular reporting of the Work Programme at the COP	AMS, ASEC, ACC	2016	COP	AMS	
Strategy 2: Sustainable management of peatlands through implementation of the ASEAN Peatland Management Strategy (APMS) to prevent large-scale peatland fires					

1. Inventories all peatlands in the ASEAN region (APSMPE)
1.a. Mekong Sub-region + Philippines
  - Complete identification of all peatlands
  - Complete the assessment of the status of peatlands
1.b. Southern ASEAN Sub-region
  - Complete the assessment of the status of peatlands
	All AMS	1.a. 2018 for identification; 2020 for assessment
		1.b. 2018
			Mekong sub-region + Philippines
			
			Southern ASEAN sub-region
				Provided by APSMPE, AMS	• Protected peatland area increased
					• Reduction in area of peatland burnt
					• Area of peatland managed by companies and communities with zero burning increased
					• Decrease in allowable controlled-burning cases
					• Decrease in the number of hotspots in peatland area

2. Intensify implementation of APMS and national action plan on peatlands [APSMPE, KT 2020, No.6] 2.a. Completion of the national action plan on peatlands (3 countries)	All AMS	2.a. 2020 (after completing inventory) 2.b. Ongoing	ASEAN region	AMS	

Action	Responsible Parties	Time Period	Target Areas	Resources	Measure of Progress
2.b. Implementation and reporting on progress					
3. The integrated management plan of peatland with a focus on water implemented [APMS: 8.2, p.16] 3.a. Mekong sub-region + Philippines 3.b. Southern ASEAN sub-region	All AMS	3.a. 2020 3.b. 2019	ASEAN region (identified peatlands)	Provided by APSMPE, AMS	
4. Conserve priority peatland areas [APMS, p.16]	All AMS	2019	ASEAN region	Provided by APSMPE, AMS	
5. Zero-burning is implemented for peatlands and controlled-burning is allowed only in exceptional cases. [APSMPE KT 2020 No.2]	All AMS	2017	ASEAN region	AMS	
6. Ensure effective prevention and rapid deployment of resources and early suppression of peatland fires (follow ASEAN guideline on Peatland Fire management)	Relevant AMS	2019	ASEAN region	Provided by AMS supported by APSMPE	
7. Rehabilitate burnt, drained and degraded peatland by focusing on root causes of fire [APSMPE, KT 2020, No.3]	Relevant AMS	2020	ASEAN region	Provided by AMS supported by APSMPE	
Strategy 3: Sustainable management of agricultural land and forest (non-peatland) to prevent large-scale land and forest fires					
1. Control fire-prone forest area using early detection for forest management	Government staff and trained local community	Immediate	Provincial level and district level	Government and private sector	• Reduction of the number of hotspots and/or size of burnt area • Decrease open burning activities in the agricultural land and forest areas by local communities and private companies
2. Develop and implement sustainable forest management plan in reserved and protected forest area	National and local government, community, private sector	Immediate	Fire-prone forest area	National and local government, ASEAN dialogue partners, private sector and other international donors	

Action	Responsible Parties	Time Period	Target Areas	Resources	Measure of Progress
3. Promote and support the zero burning and controlled burning for agricultural land management	Government agencies concern with land-use management, private sector, local community	Immediate	All agricultural land: rice field, sugarcane, corn, palm oil, rubber, other crops under which are fire-prone	National and local government, private sector, external funding	• Number of regulations and/or incentives for haze free and/or zero burning practice
4. Strengthen forest and land fire prevention	Government agencies concerned	Immediate, before dry season	Fire-prone areas	National and local government, private sector (plantation owned company), external funding	
5. Assessment of root causes and drivers of large scale land and forest fires to identify priority prevention measures	Government agencies concerned	2016-2017	Fire-prone areas	National	
6. Develop and promote techniques for controlled burning particularly for shifting cultivators and small farmers	AMS, ACC, research institutions	2016-2020	Fire-prone areas	AMS, Haze Fund	
7. Promote appropriate method for disposal or use of agricultural waste including development of market for utilisation of bio-mass	AMS, ACC, research institutions	2016-2020	Fire-prone areas	AMS, Haze Fund	
Strategy 4: Strengthening Policies, Laws, Regulations and their Implementations, including to facilitate exchange of experience and relevant information among enforcement authorities of the Parties in accordance with the AATHP Article 16 (f);					
1. Formulation of regulation and incentives for haze free	National government, relevant agencies	Immediate	National and local levels (province & district)	National and local government budget, external funding	• Adequate laws and regulations developed and effectively enforced
2. Review and improve existing legislative instruments and regulations	National and local government	Immediate	National and local levels (province & district)	National and local government budget, external funding	
3. Conduct regional workshop to share good practices in developing and	COM, ASEAN Secretariat	2017	AMS	AMS, Haze Fund	

Action	Responsible Parties	Time Period	Target Areas	Resources	Measure of Progress
implementing legislative instruments and regulations					
4. Use multi-door approach to law enforcement	National law: criminal, forest conservation, land use, agriculture, environment	Immediate	Fire-prone areas	National and local government budget, external funding	
5. Review current regional procedures and mechanisms, and explore the development of protocols under AATHP	COM, ASEAN Secretariat	Immediate	AMS	AMS	
Strategy 5: Enhancing Cooperation, Exchange of Information and Technology, and Strengthening of Capacity of Institutions at All Levels					
1. Sharing best practice information on forest and agricultural land management at all levels	Regional, sub-regional, national and local level	Immediate	National and local communities	National and local government, external funding (ASEAN haze fund, international partners)	• Capacity of institutions strengthened • Number of success stories shared • Number of cooperation projects implemented
2. Training volunteers to be a part of prevention and fire fighting	Provincial and local level	Immediate	Local communities in the fire prone area	National and local government, external funding, private sector	
3. Strengthen institutions at regional, sub-regional, national and local level on coordination and exchange of information, fire prevention, preparedness, and control.	Regional, sub-regional, national and local level	Immediate	Regional, sub-regional, national and local level	National and local government, external funding (ASEAN haze fund, international partners)	
4. Enhance and implement regional/national cooperation project to strengthen capacity on fire prevention and preparedness	Regional, sub-regional, national and local level	Immediate	Regional, sub-regional, national and local level	National and local government, external funding (haze fund, international partners)	

Action	Responsible Parties	Time Period	Target Areas	Resources	Measure of Progress
5. Explore mechanism for National Monitoring Center and other agencies to share information indicated in AATHP, pursuant to national laws and regulations with all stakeholders	AMS/NMC coordinated by ACC	Immediate and continuous	AMS	AMS, ACC haze fund and donors	
6. Enhance and support scientific and technical research programme related to the root causes and consequences of transboundary haze pollution and means, methods, techniques and equipment for land and/or forest fire management including fires fighting	AMS, research institution	Immediate and continuous	AMS	AMS, ACC, haze fund and donors	
7. Encourage AMS to take necessary actions to operationalise the ASEAN Sub-Regional Haze Monitoring System	MSC Countries	Continuous	MSC Countries	MSC Countries	Report to MSC on progress
Strategy 6: Enhancing public awareness, cross-sectoral and stakeholders participation					
1. Implementing community based forest management (to engage stakeholders in protection of the forest)	Government. agencies of concern, local community	Immediate (depending on national circumstances)	Accessible forest area of ASEAN	National and local government, external funding, private sector	• Number of cross-sectoral and/or multi-stakeholder forums/dialogues • Number of projects with cross-sectoral and/or multistakeholder participation • Number of private sectors implementing CSR
2. Encouraging proactive involvement of local communities to prevent land and forest fire	Provincial and local level	Immediate	Local communities in fire-prone areas	National and local government, external funding, private sector	
3. Formulating a comprehensive education, communication and information campaign programme to address haze pollution including the effects and risks of forest and land fires	Regional level (COM, ACC, ASEAN Secretariat), National level, provincial level, local level	Immediate	National level, provincial level, local level		
4. Conduct dialogues involving relevant sectors and stakeholders to garner	COM, ACC, ACB, and ASEAN	Starting from 2016 (after the	AMS	AMS, Haze Fund, external funding	

Action	Responsible Parties	Time Period	Target Areas	Resources	Measure of Progress
support for the implementation of the Roadmap	Secretariat, SOM-AMAF	Roadmap's endorsement)			
Strategy 7: Securing adequate resources from multi-stakeholders for preventing transboundary haze					
1. Mobilise adequate financial resources (from government, donors, private sector etc.) to fully implement the Road Map	AMS, ACC, ACB, ASEAN Secretariat	Ongoing	AMS	ASEAN dialogue partners, private sector, foundations, climate/ biodiversity related financing mechanisms, (I)NGOs, international organisations	• Amount of resources mobilised • Number of stakeholder contribution
2. Mobilise adequate human resources (from government, donors, private sector etc.) to fully implement the Road Map	AMS, ACC, ACB, ASEAN Secretariat	Ongoing	AMS	Incentives, remuneration as appropriate, private sector, foundations, (I)NGOs, international organisations, communities	
3. Mobilise adequate technological resources (including monitoring, fire suppression equipment)	AMS, ACC, ASMC	Ongoing	AMS	AMS, ASEAN dialogue partners, private sector, foundations, (I)NGOs, international organisations, communities	
Strategy 8: Reducing health and environmental risks and protecting global environment					
1. Establish common database on impacts of haze on public health	All AMS/ACC	2016/2017	Affected areas	AMS, potential donors	• Health and environmental impacts avoided and/or reduced
2. Undertake assessment and monitoring of the health, economic,	All AMS, AWGCC, ATFP	2017	Affected areas	AMS, potential donors	

Action	Responsible Parties	Time Period	Target Areas	Resources	Measure of Progress
social and environmental impacts of haze including climate change/global warming					• Assessment and monitoring of the health, economic, social and environmental impacts of haze undertaken • Database created and maintained
3. Introduce health risk reduction measures [e.g., masks, warnings, evacuation plan]	All AMS	Ongoing	Affected areas	AMS, private sector, potential donors	
4. Increase public awareness about the impacts of haze pollution on health.	All AMS	Immediate	AMS	AMS, potential donors	• Effective communication to raise public awareness about haze pollution, health and environmental risks.

Annex 3: List of COM to AATHP
COMMITTEE UNDER THE CONFERENCE OF THE PARTIES TO THE ASEAN AGREEMENT ON TRANSBOUNDARY HAZE POLLUTION (COM)

(as of June 2021)

Brunei Darussalam

Dr Nor Imtihan Hj Abdul Razak
Permanent Secretary
Ministry of Development
Brunei Darussalam

Myanmar

Mr. Min Maw
Director, Pollution Control Division and
Environmental Quality and Standard Division
Environmental Conservation Department
Ministry of Natural Resources and
Environmental Conservation
Myanmar

Cambodia (Chair)

Dr. Srey Sunleang
Director, Department of Freshwater Wetlands
Conservation
Ministry of Environment
Cambodia

Philippines

Mr. Marcial C. Amaro, JR.
Assistant Secretary for Policy, Planning and
Foreign Assisted and Special Projects and
Director of Forest Management Bureau
Email Address: amaromarsjr@yahoo.com

Indonesia

Dr. Ir. Ruandha Agung Sugardiman, MSc
Director General, Climate Change
Ministry of Environment and Forestry
Indonesia

Singapore

Mr. Bhaskar Ram
Director-General for Environmental Protection,
National Environment Agency
Ministry of the Environment and Water
Resources
Singapore

Lao PDR

Mr. Souksamone Pathammavong
Deputy Director-General
Department of Planning and Finance
Ministry of Natural Resources and
Environment
Lao PDR

Thailand

Mr. Pralong Dumrongthai
Director General of Pollution Control
Department
Ministry of Natural Resources and
Environment
Thailand

Malaysia

Ms. Norlin binti Jaafar
Director General
Department of Environment (DOE)
Ministry of Environment and Water
Malaysia

Viet Nam

Mr. Do Quang Tung
Director
Forest Protection Department
Vietnam Administration of Forestry
Ministry of Agriculture and Rural Development

Annex 4: List of ATFP (based on information received as of June 2021)

National Focal Point	Alternate/Contact Person
Brunei Darussalam	
1. Ms. Martinah Binti Haji Tamit Acting Director Department of Environment, Parks and Recreation, Ministry of Development Tel: (673) 2241262 Email: martinah.tamit@env.gov.bn **Alternate Focal Points:** **1. Ms. Noralinda Binti Haji Ibrahim** Acting Director Forestry Department, Ministry of Primary Resources and Tourism Tel: (673) 2381687 Email: noralinda.ibrahim@forestry.gov.bn **2. Mr. Zaeidi Haji Berudin** Senior Forestry Officer Forestry Department, Ministry of Primary Resources and Tourism Tel: (673) 2381687 Email: zaeidi.berudin@forestry.gov.bn	**Alternate Focal Point:** **Ms. Dk. Haryanti PH Petra** Senior Environment Officer Department of Environment, Parks and Recreation Email: haryanti.petra@env.gov.bn **Contact person:** **Ms. Han Qin Yun** Landscape Architect, Department of Environment, Parks and Recreation Tel: (673) 2241262 Fax: (673) 2241271 Email: joey.han@env.gov.bn
Cambodia (Chair)	
Dr. Srey Sunleang Director Department of Freshwater Wetlands Conservation, Ministry of Environment Mobile: (855) 77333456 sunleangsrey@gmail.com	**Mr. Sun Visal** Chief of Office Department of Freshwater Wetlands Conservation Ministry of Environment Tel: (855) 12-708-836 Email: sunvisal@gmail.com
Indonesia	
Ms. SPM Budi Susanti Director of Peatland Degradation Control Ministry of Environment and Forestry Email: spm_budisusanti@yahoo.com **Alternate Focal Point:** **Mr. Muhammad Askary** Head of Sub Directorate for Preservation of Peatland Ecosystem Ministry of Environment and Forestry Tel/Fax: (62-21) 8520886 / 8580105 Email: 2017askary@gmail.com	**Contact Person:** **Ms. Wahyu Utami Tulis Wiyati** Head of Section for Prevention and Control, Directorate of Peatland Degradation Control Ministry of Environment and Forestry Tel/Fax: (62-21) 8520886 / 8580105 Email: wahyuutami03@gmail.com; wahyu.utami03@gmail.com
Lao PDR	
Mr. Singthong Phanthamala Director of River Basin Planning and Development Division Department of Water Resources, MONRE Mobile: (+856) 20 28970796 stptml@yahoo.com	**Mr. Phingsaliao Sithiengtham** Planning Officer Department of Water Resources, MONRE Mobile: +85620 95557444 phingsaliao@gmail.com

National Focal Point	Alternate/Contact Person
Malaysia	
Dr. Mohd Mokhtar bin Tahar Deputy Secretary General Ministry of Energy and Natural Resources Wisma Sumber Asli, No.25 Persiaran Perdana, Presint 4, 62574 Putrajaya, Malaysia Telephone no.: +603-88861622 Email: mokhtar@ketsa.gov.my **Ms. Norsham Binti Abdul Latip** Senior Secretary Management of Biodiversity and Forestry Management, Ministry of Energy and Natural Resources (KeTSA) Wisma Sumber Asli, No.25 Persiaran Perdana, Presint 4, 62574 Putrajaya, Malaysia Telephone no.: +603-88861442 Email: norsham@ketsa.gov.my	**Contact person:** **Ms. Farrah Shameen binti Mohamad Ashray** Under Secretary Division of Forestry Management Ministry of Energy & Natural Resources, Wisma Sumber Asli, No.25 Persiaran Perdana, Presint 4, 62574 Putrajaya, Malaysia Tel: +603-8886 1447 Email: farrah.ashray@ketsa.gov.my **Ms. Atifa Maryam Norbanan** Assistant Secretary Division of Forestry Management Ministry of Energy & Natural Resources, Wisma Sumber Asli, No.25 Persiaran Perdana, Presint 4, 62574 Putrajaya, Malaysia Tel: +603-8886 1667 Email: maryam@ketsa.gov.my **Mr. Harry Yong** Head of Wetland Forest Section Forestry Department of Peninsular Malaysia Tel: +603-2616 4488 Email: harry@forestry.gov.my
Myanmar	
U Soe Naing Director, Natural Resources Division Environmental Conservation Department Ministry of Natural Resources and Environmental Conservation Building No (53), Nay Pyi Taw, Myanmar Tel: +95 67 431346; Fax: +95 67 431348 nreia.env@gmail.com; usoenaingmoecaf@gmail.com	
Philippines	
Mr. Edilberto D. Leonardo Undersecretary for Special Concerns and OIC Director Biodiversity Management Bureau Department of Environment and Natural Resources bmb@bmb.gov.ph; director@bmb.gov.ph **Copy to:** Office of the DENR Undersecretary for Policy, Planning and International Affairs (+632) 928-1186 / 929-6626 local 2268 oueiea.denr@gmail.com	**Ms. Amelita DJ. Ortiz** Assistant Director Biodiversity Management Bureau – Department of Environment and Natural Resource Email: bmb@bmb.gov.ph **Mr. Anson Tagtag** OIC Chief Caves, Wetlands, and other Ecosystems Division Biodiversity Management Bureau – Department of Environment and Natural Resource Email: cawed@bmb.gov.ph; anson.tagtag@bmb.gov.ph

National Focal Point	Alternate/Contact Person
	Supt. Dennis A. Molo Deputy Director for Operations Bureau of Fire Protection Department of the Interior and Local Government Tel./Fax.: (+632) 376-0117 E-mail: forestfirely_503@yahoo.com **Ms. Joy M. Navarro** Senior Ecosystems Management Specialist Caves, Wetlands, and other Ecosystems Division Biodiversity Management Bureau Department of Environment and Natural Resources Tel: (+632) 924-6031 to 35 T/F: (+632) 925-8590 or 51 Email: joy.navarro@bmb.gov.ph **Ms. Zoisane Geam G. Lumbres** Ecosystem Management Specialist II Caves, Wetlands and other Ecosystems Division Biodiversity Management Bureau Email: zoisane.lumbres@bmb.gov.ph
Singapore	
Mr. Daryl Gomes Assistant Director International Relations Department National Environment Agency Daryl_Gomes@nea.gov.sg	**Mr. Ow Yau Loong** Executive Manager International Relations Department National Environment Agency OW_Yau_Loong@nea.gov.sg
Thailand	
Ms. Chatchaya Buaniam Forestry Technical Officer Department of National Parks, Wildlife and Plant Conservation Tel: (662) 5610777 ext 1346 Fax: (662) 9407059 Kunying_b@hotmail.com	**Ms Piraporn** Department of Pollution Control piraporn.p@pcd.go.th
Viet Nam	
	Mr. Dinh Van Tuyen Officer Forest Protection Department, Vietnam Administration of Forestry tuyenhlnp@gmail.com **Mr. Nguyen Ngoc Thanh** Officer Forest Protection Department, Vietnam Administration of Forestry thanhnn@kiemlam.org.vn

Annex 5: List of NMC (as of June 2021)

BRUNEI DARUSSALAM	
National Monitoring Centre	
Institution:	Department of Environment, Parks and Recreation
Contact person:	Ms Martinah Hj Tamit
Designation:	Acting Director, Department of Environment, Parks and Recreation
Address:	Department of Environment, Parks and Recreation, Ministry of Development Bandar Seri Begawan BA2111, Brunei Darussalam
Phone/ Fax:	(673-2) 241262 / 241290
E-mail:	jastre.brunei@env.gov.bn

CAMBODIA	
National Monitoring Centre	
Institution:	Ministry of Water Resources and Meteorology
Contact person:	
Designation:	
Address:	No. 48 Preah Sihanouk, Tonle Basac, Chamkar Mon Phnom Penh, Cambodia
Phone/ Fax:	(855-23) 215925, 212540
E-mail:	

INDONESIA	
National Monitoring Centre	
Institution:	Ministry of the Environment and Forestry
Contact person:	R. Basar Manullang
Designation:	Directorate of Forest and Land Fire Management Directorate General of Climate Change
Address:	Manggala Wanabakti Building, Block 7, 13th Floor Jl. Jend. Gatot Subroto, Senayan- Jakarta
Phone/ Fax:	(62-21) 5704618
E-mail:	rbasarm62@gmail.com

LAO PDR	
National Monitoring Centre	
Institution:	Department of Meteorology and Hydrology, MONRE
Contact person:	Dr. Mayphou MAHACHALEUN
Designation:	Head of Climate and Agro-meteorological Division
Address:	
Phone/ Fax:	+856 20 5566 2565
E-mail:	mayphou@gmail.com

MALAYSIA	
National Monitoring Centre	
Institution:	Department of Environment, Ministry of Environment and Water
Contact person:	Mr. Wan Abdul Latiff Wan Jaffar
Designation:	Deputy Director General (Operation)
Address:	Level 1 - 4, Podium Block 2 & 3, Wisma Sumber Asli 25, Persiaran Perdana, Precinct 4 Federal Government Administrative Centre 62574 PUTRAJAYA
Phone/ Fax:	(603) 8871 2275 / (603) 8889 4020
E-mail:	walj@doe.gov.my

MYANMAR	
National Monitoring Centre	
Institution	Department of Meteorology and Hydrology
Contact person	Daw Thet Htar Soe Hlaing
Designation	Assistant Director
Address	Office Building No.5, Department of Meteorology and Hydrology, Ministry of Transport, Nay Pyi Taw
Phone/Fax	095-67-411446, 095-67-411449
E-mail	dg.dmh@mptmail.net.mm
Institution	Fire Service Department
Contact person	U Kyaw Thura
Designation	Director
Address	Fire Service Department (HQ), Mayangone Township, Yangon
Phone/Fax	095-1-666908 (Office), 095-1-252044 (Resident) 098020048 (Mobile), 095-1-666154 (Fax)
E-mail	kyawthura.ktr@gmail.com

PHILIPPINES	
National Monitoring Centre	
Institution:	Forest Management Bureau – Department of Environment and Natural Resources
Contact person:	Marcial C. Amaro, Jr.
Designation:	Assistant Secretary for Policy, Planning, and Foreign-Assisted and Special Projects, and Director, in concurrent capacity
Address:	G/F, FMB Main Building, Visayas Avenue, Diliman, 1100 Quezon City, Philippines
Phone/ Fax:	+63289274788; +6328928-9313
E-mail:	fmb@denr.gov.ph
Institution	
Contact person	Mr. Raul Briz
Designation	Chief, Forest Protection Section and Support Staff of NMC
Address	2/F, FMB Annex Building, Visayas Avenue, Diliman, 1100 Quezon City, Philippines
Phone/Fax	Phone: +632 89272491 / Fax: +632 89282891
E-mail	briz_raul@yahoo.com

SINGAPORE	
National Monitoring Centre	
Institution:	Meteorological Service Singapore
Contact person:	Ms Patricia Ee
Designation:	Director Weather Services Department
Address:	PO Box 8 Singapore Changi Airport, Singapore 918141
Phone/ Fax:	(65) 6542 2863/ (65) 65457192
E-mail:	Patricia_Ee@nea.gov.sg

THAILAND	
National Monitoring Centre	
Institution:	Department of National Park, Wildlife and Plant Conservation
Contact person:	Mr. Sakchai Jongkijvivat
Designation:	Director of Forest Fire Control Division
Address:	61 Phaholyothin rd., Ladyao, Chatuchak, Bangkok 10900 Thailand
Phone/ Fax:	66 2579 8892
E-mail:	kunying_b@hotmail.com

VIET NAM	
National Monitoring Centre	
Institution:	Centre for Environmental Monitoring
Contact person:	Mr. Nguyen Van Thuy
Designation:	Deputy Director
	Centre for Environmental Monitoring, Vietnam Environment Administration, Ministry of Natural Resources and Environment
Address:	67 Nguyen Du, Hanoi, Viet Nam
Phone:	(844) 3577 1816
Fax:	(844) 3577 1855
Mobile:	(84) 913379577
E-mail:	tathuy@vea.gov.vn

Annex 6: Country Profiles

a) Brunei Darussalam
Institutional Arrangement
i.   National Focal Points (NFPs) on ASEAN Agreement on Transboundary Haze Pollution (AATHP), ASEAN Task Force on Peatlands (ATFP) and National Monitoring Centre (NMC)

NFP of COM AATHP	NFP of ATFP	NMC
Ministry of Development	Department of Environment, Parks and Recreation (DEPR), alternate Forestry Department	Department of Environment, Parks and Recreation (DEPR)

ii.   Nominated NFP and supporting agencies on peatland management in AMS (inputs from AMS to questionnaire)

NFP / Lead Agency	Agencies supporting the NFP
Department of Environment, Parks and Recreation, alternate Forestry Department	• Department of Environment, Parks and Recreation (DEPR) • Brunei Fire Rescue Department (BFRD) • Brunei Darussalam Meteorological Centre (BDMD)

iii.   NFP for Haze Management and Monitoring and its supporting agencies

NFP /Lead Agency	Agencies supporting NFP
Department of Environment, Parks and Recreation (DEPR)	

Policies
Peatland management is being governed by the Forest Act, Chapter 46 Laws of Brunei Darussalam. Planning and management of peatlands are subject to the guiding principles of sustainable forest management as stipulated within the National Forest Policy 1989. In July 2020, Brunei Darussalam National Council on Climate Change (BNCCC) launched Brunei Darussalam National Climate Change Policy. One of the strategies of this policy is to increase Brunei Darussalam carbon sinks through afforestation and reforestation programme with a target of planting 500,000 trees by 2035, including in peatland areas.

The Department of Environment, Parks and Recreation (DEPR) is the appointed NMC for Brunei Darussalam. In 2020, Brunei Darussalam achieved 366 days (100%) of GOOD air quality with no haze occurrences. Daily air quality information is being shared in the Department's official website (http://www.env.gov.bn/Theme/Home.aspx). The ambient air quality monitoring carried out by the Department of Environment, Parks and Recreation since early 2005 is done through an automatic air quality monitoring network. This comprise of a total of 7 air quality monitoring stations strategically located in the four districts throughout Brunei Darussalam, linked to the central monitoring centre at the Department's headquarters in Bandar Seri Begawan. These stations measure particulate matter i.e. PM10 and PM2.5 (**Table A1).**

The air quality is being classified into 4 different PSI categories namely Good (less than 50), Moderate (51-100), Unhealthy (101-200) and Very Unhealthy to Hazardous (more than 201). The air quality information is being updated thrice daily.

Table A1: Information by national agency related to air pollution

Air quality monitoring station	Parameter measured	Website	Update frequency	Index measurement
7	PM10, PM2.5	http://www.env.gov.bn/Theme/Home.aspx	Daily	Pollutants Standards Index (PSI)

NMC undertakes a close partnership with national meteorological agency namely Brunei Darussalam Meteorological Department (BDMD). BDMD provides daily information of rainfall, temperature, wind speed, wind direction and climate outlook through their website (http://www.bruneiweather.com.bn/). BDMD also provides relative humidity information, however the information is not updated properly.

In case of haze occurrences and peat forest fire risk, significant information has been disseminated through several platforms such as television and radio broadcast, newspaper, social media and official website of relevant agencies. As an example for the 1994 incident, the Ministry of Health issued a 'haze warning' where the public were advised to restrict outdoor activities that involve physical exertion. The Ministry also urged the public to refrain from open burning activities.

The Brunei Forestry Department's Disaster Management Committee Taskforce was established in 2017 to lead prevention, mitigation, preparedness, response and recovery measures for disasters including for forest fires. Routine patrol and monitoring to forest reserves are also being conducted during dry season.

Gaps and capacity development needs
The government of Brunei Darussalam encourages collaboration with other countries and international organisations to enhance its capacity and capability in managing biodiversity in many aspects, in particular peatland related research. The Heart of Borneo (HOB) biodiversity conservation project is an initiative led by government and supported by NGOs to strengthen collaboration of three countries namely Malaysia, Indonesia and Brunei Darussalam in the Borneo Island. Forestry Department has conducted several research projects in collaboration with local and international agencies, in particular to understand the role of peat swamp forest (PSF) for better management, protection and conservation. Partnership with Singapore – MIT Alliance for Research and Technology (SMART) has been undertaken in carbon exchange on peat studies. Research on hydrology and fire risk after the construction of canal blocking in Badas PSF had also been undertaken by collaboration between Forestry Department, SMART, University of Brunei Darussalam (UBD), Wetland International, Stanford University, Nanyang Technological University and Massachusetts Institute of Technology (MIT). The research activities on peat swamp forests and the results obtained support and promote the conservation of the country's peat swamp forests and its biodiversity. However, more support for scientific research study are needed in rehabilitation aspect to increase the successful rate of the activity. Awareness activity also needs to be enhanced. Documentation of data collection, monitoring practices and reporting to regional level remain unclear.

Future Priorities for Peatland Management
Priorities in Brunei Darussalam for the period 2021 to 2030 as identified by feedback by ATFP NFP and other national stakeholders in response to the APMS Review, include the following:
1. Recognition of the Brunei's PSF
2. Encourage awareness and participation from community level
3. Encourage exchange knowledge through peat symposium
4. Encourage technology transfer in fire prevention and rehabilitation effort

5. Attract more funding opportunities and private sectors engagement

Priorities for Capacity Development

Capacity development needs as identified from the feedback in the questionnaire from the final review of the implementation of the ASEAN Peatland Management Strategy (APMS, 2006-2020) and other sources are shown in **Table A2**. The types of capacity development have been classified based on the 5 potential areas of focus as presented to the First MAHFSA Programme Steering Committee Meeting in November 2019.

Table A2: Proposed priorities for capacity development for Brunei Darussalam as identified through this CDNGA

Focus 1: Peatland inventory, mapping, assessment of degradation status, Monitoring (APSMPE T1)	
Low priority	
Focus 2: Peatland Fire Prevention Measures (APSMPE T2/Roadmap S2)	
1. Capacity development	*Training on fire risk warning (including Fire Danger Rating System operation and promotion) and fire prevention*
Possible trainer	• Interim ACC/ASMC • GEC • Brunei Fire and Rescue Department • Department of Environment, Parks and Recreation • Brunei Darussalam Meteorological Department
Institution/people to be trained	• National Monitoring Centre (DEPR related divisions) • Forestry Department • Supporting agencies • Field patrollers
2. Capacity development	*Technology transfer in fire prevention and rehabilitation effort including using of satellite*
Possible trainer	• Forestry Department • University of Brunei Darussalam
Institution/people to be trained	• Department of Environment, Parks and Recreation • Supporting agencies • Stakeholders
Focus 3: Peatland Fire and Haze Occurrence (APSMPE T2/Roadmap S2)	
3. Capacity development	*Monitoring and reporting of peatland fire and haze occurrence (Result Management System)*
Possible trainer	• Forestry Department • Brunei Fire and Rescue Department
Institution/people to be trained	• Department of Environment, Parks and Recreation • Supporting agencies Stakeholders
Focus 4: Resources allocate and generated for peatland management and fire prevention	
4. Capacity development	*Explore collaboration on peatland management and fire prevention*
Possible trainer	• Forestry Department

Institution/people to be trained	• Supporting agencies • Local government • Stakeholders
5. Capacity development	***Awareness raising on peatland values, sustainable use and ecosystem services to communities and public***
Possible trainer	• GEC • Forestry Department
Institution/people to be trained	• Department of Environment, Parks and Recreation • Supporting agencies • Stakeholders
Focus 5: Implementation of NAPPs, APMS, Roadmap	
6. Capacity development	***Capacity development in rehabilitation and conservation***
Possible trainer	Forestry Department
Institution/people to be trained	• Department of Environment, Parks and Recreation • Supporting agencies
7. Capacity development	***Awareness enhancement and peer learning from regional BMPs for community activities***
Possible trainer/facilitator	• Forestry Department • Regional platform via ASEAN Framework
Institution/people to be trained	• Department of Environment, Parks and Recreation • Supporting agencies
8. Capacity development	***Knowledge exchange to enhance peatland governance and policies***
Possible trainer	• Forestry Department • Regional platform via ASEAN Framework
Institution/people to be trained	• Supporting agencies • Private sector • Research institutions
9. Capacity development	***Peatlands and climate change***
Possible trainer	• GEC • Brunei Darussalam Climate Change Secretariat (BCCS) • Regional platform via ASEAN Framework
Institution/people to be trained	• Department of Environment, Parks and Recreation • Forestry Department • Supporting agencies • Private sector • Research institutions

b) Cambodia

Institutional Arrangement

i. National Focal Points (NFPs) on ASEAN Agreement on Transboundary Haze Pollution (AATHP), ASEAN Task Force on Peatlands (ATFP) and National Monitoring Centre (NMC)

NFP of COM AATHP	NFP of ATFP	NMC
Department of Freshwater Wetlands Conservation, Ministry of Environment	Department of Freshwater Wetlands Conservation, Ministry of Environment	Ministry of Water Resources and Meteorology

ii. Nominated NFP and supporting agencies on peatland management in AMS (inputs from AMS to questionnaire)

NFP / Lead Agency	Agencies supporting the NFP
Department of Freshwater Wetlands Conservation, Ministry of Environment	• Sub-national level • Department of Environment in Koh Kong Province

iii. NFP for Haze Management and Monitoring and its supporting agencies

NFP /Lead Agency	Agencies supporting NFP
Department of Freshwater Wetlands Conservation, Ministry of Environment	General Directorate of Environment Protection, Local authorities, Department of Environments in the provincial level

Policies

Forest fires occur frequently in the deciduous, pine and bamboo forests during the dry season. The relevant agencies have minimal capacity to put out forest fire, whenever it happens due to lacking of expertise, funding and equipment. As a fire prevention measure, each province is meant to establish a forest fire commission during the dry season which includes Provincial, District, Village Governments and forestry authorities.

Data monitoring practices

The appointed NMC for Cambodia is Ministry of Water Resources and Meteorology (MOWRAM). MOWRAM provides daily weather information through Department of Meteorology (DOM). DOM is mandated to provide weather related services and plays a vital role in disaster management with the role of a member of the National Committee for Disaster Management (NCDM). DOM provides daily weather information such as rainfall, temperature, humidity, wind direction, wind speed and drought. DOM provides weather forecast for subsequent 3 days and regular awareness of extreme events through their website (http://www.cambodiameteo.com/map?menu=3&lang=en). The meteorology system in Cambodia is equipped with radar technology and updating real-time rainfall information every 15 minutes to support flood and drought prediction.

Information on air quality is mandated under Department of Air Pollution Control, Ministry of Environment. Currently, there are 41 air quality monitoring stations that have been deployed over 24 provinces across the country, using Air Quality Index (AQI) system with monitoring of 7 main parameters namely SO_2, NO_2, CO, O_3, VOC, PM_{10} and $PM_{2.5}$ (**Table B1**). According to air quality monitoring from 2017-2019, PM2.5 concentration remains within Cambodian air quality standard.

Table B1: Information by national agencies related to air pollution

Air quality monitoring station	Parameter measured	Website	Update frequency	Index measurement
41	Ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), PM10, PM2.5, VOC	https://www.facebook.com/Ministry-of-Environment-314699302002531/	Daily	Air Quality Index (AQI)

Information regarding air quality, haze and forest fire risk has been disseminated through newspaper, electronic media or telegram group within the responsible agency and other social media applications. There are also collaboration effort undertaken with NGO to disseminate daily fire risk update through WhatsApp group application. The fire risk information later is being used to update local authorities and site managers within protected area under the mandate of MOE. Air quality monitoring data is recorded daily and broadcast[5] through MOE Facebook Page and LED Screen in front of the MOE Building.

There are good practices in utilizing hotspot and FDRS data for fire and haze monitoring measures in Cambodia (**Table B2**). Both the hotspot and FDRS information has been integrated with ground verification and fire suppression execution at the site. There are only two verified peatland areas in Cambodia namely Peam Krasop Wildlife Sanctuary and Botum Sakor National Park. Both of the peatland areas are mangrove peatlands (which are not prone to fire) located inside the protected area with established Management Plans where the site managers will monitor the hotspot and FDRS regularly especially during dry season in November to April every year. However, peatlands are believed to occur in other parts of the country including in the Ton-le Sap basin where peatlands are thought to dry out during the dry season and be vulnerable to fire. Following the monitoring activity at the site, detailed technical report will be prepared for decision makers. On the other hand, MOE will integrate the report with daily air pollution quality data and undertake analysis for further decision support. During critical dry seasons, immediate mitigation steps are being taken by authorizing rangers and local authorities to report the forest fire occurrences direct to the ministries without going through normal administrative procedures.

Table B2: Assessment of information routinely gathered for fire and haze monitoring.

Information	Source	Remarks
Hotspot	• ASMC	• Ground verification and suppression with patrollers
FDRS	• ASMC	• Inform stakeholders and site managers within protected area under the mandate of MOE
Burned area	NA	• Technical report to decision maker
Weather information and forecast	• ASMC • National agency	• Guidance in fire prevention and patrolling • Low burned area monitoring activity

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[5] The data on air quality is transferred from server of the company who procured the air monitoring equipment – as MOE lacks the capacity to store the data

Gaps and capacity development needs

There are limited resources and technology for on-time and immediate response for fire management and prevention. Further enhancement is needed in technical support from stakeholders, in particular NGO and active involvement from local community for fire control and suppression. However, there has been limited support available in early warning system for forest fire. Hotspot detection in Cambodia remains high each year. Utilization and knowledge about hotspot and FDRS also need further enhancement for all relevant agencies and stakeholders.

Based on information available on public accessible sources, there is no proper platform to share the air quality information for Cambodia. There are limited capacity and expertise to handle monitoring the air quality and haze occurrences in the country. There has also been insufficient technical guidelines and policy on air pollution management related to haze from forest and land fire occurrence. No SOP has been developed with regards to fire prevention, fire suppression or post-fire incident rehabilitation works at national level. There is also limited cooperation between ministries in promoting information and data sharing. Documentation of data collection activity, monitoring practices and reporting to regional level remain unclear.

Future Priorities for Peatland Management

Priorities in Cambodia for the period 2021 to 2030 as identified by feedback of the ATFP NFP and other national stakeholders in response to the APMS Review, include the following:

1. High priority to identify and map all peatland areas in the country
2. Capacity building and enhance human resources on technical aspects
3. Develop a national peatland management plan
4. Awareness of stakeholder especially local community on importance of peatlands
5. Capacity training and modern equipment on fire suppression
6. Early warning system for forest fire
7. Capacity building on data utilisation for hotspot detection and monitoring

Priorities for Capacity Development

Capacity development needs as identified from the feedback in the questionnaire from the final review of the implementation of the APMS, 2006-2020 and other sources are shown in **Table B3**. The types of capacity development have been classified based on the 5 potential areas of focus as presented to the First MAHFSA Programme Steering Committee Meeting in November 2019.

Table B3: Proposed priorities for capacity development for Cambodia as identified through this CDNGA

Focus 1: Peatland inventory, mapping, assessment of degradation status, Monitoring (APSMPE T1)	
1. Capacity development	*Peatland assessment and mapping*
Possible trainer	• GEC
Institution/people to be trained	• Department of Freshwater Wetlands Conservation • Supporting agencies
Focus 2: Peatland Fire Prevention Measures (APSMPE T2/Roadmap S2)	
2. Capacity development	*Training on fire risk warning (including Fire Danger Rating System operation and promotion) and fire prevention*
Possible trainer	• Interim ACC/ASMC • Department of National Park, Wildlife and Plant Conservation (DNP), Thailand • Regional Southeast Asia Wildland Fire Network

Focus 2: Peatland Fire Prevention Measures (APSMPE T2/Roadmap S2)	
2. Capacity development	*Training on fire risk warning (including Fire Danger Rating System operation and promotion) and fire prevention*
	• The Center for People and Forests (RECOFTC)
Institution/people to be trained	• NMC (Ministry of Water Resources and Meteorology) • Department of Freshwater Wetlands Conservation • Local government • Supporting agencies • Field patrollers
3. Capacity development	*Technology transfer in fire prevention and rehabilitation effort including using of satellite*
Possible trainer	• Regional expert e.g. Indonesia and Thailand • Regional platform via ASEAN Framework
Institution/people to be trained	• Department of Freshwater Wetlands Conservation • Supporting agencies
4. Capacity development	• *Training for rangers and forest fire-fighter team on fire prevention and management*
Possible trainer	• DNP Thailand • Regional Southeast Asia Wildland Fire Network • Fire Department
Institution/people to be trained	• Management team of the protected areas • Supporting agencies • Field patrollers
Focus 3: Peatland Fire and Haze Occurrence (APSMPE T2/Roadmap S2)	
Low priority	Currently identified peatlands are mangrove peatlands not prone to fire
Focus 4: Resources allocate and generated for peatland management and fire prevention	
5. Capacity development	*Awareness raising on peatland value, sustainable use and ecosystem services to communities and public*
Possible trainer	• Department of Freshwater Wetlands Conservation • Department of Environment
Institution/people to be trained	• Department of Freshwater Wetlands Conservation • Department of Environment • Local government • Supporting agencies • Stakeholders
Focus 5: Implementation of NAPPs, APMS, Roadmap	
6. Capacity development	*Capacity development in rehabilitation and conservation*
Possible trainer	• GEC • IUCN • Department of Freshwater Wetlands Conservation
Institution/people to be trained	• Provincial and local offices of Department of Freshwater Wetlands Conservation • Management team/authorities of the protected area • Supporting agencies

Focus 5: Implementation of NAPPs, APMS, Roadmap	
6. Capacity development	*Capacity development in rehabilitation and conservation*
	• Stakeholders (including CSOs and local community groups)
7. Capacity development	*Awareness enhancement and peer learning from regional BMPs for community activities*
Possible trainer/facilitator	• GEC • IUCN • Regional platform via ASEAN Framework
Institution/people to be trained	• Department of Freshwater Wetlands Conservation • Provincial and local offices of Department of Freshwater Wetlands Conservation • Management team/authorities of the protected area • Supporting agencies • Stakeholders (including CSOs and local community groups)
8. Capacity development	*Knowledge exchange to enhance peatland governance and policies*
Possible trainer	• Department of Freshwater Wetlands Conservation • Regional platform via ASEAN Framework
Institution/people to be trained	• Supporting agencies • Private sector • Research institutions • NGOs/CSOs
9. Capacity development	*Peatland and climate change*
Possible trainer	• GEC • Paññāsāstra University of Cambodia • Regional platform via ASEAN Framework
Institution/people to be trained	• Department of Freshwater Wetlands Conservation • Supporting agencies • Research institutions

c) Indonesia

Institutional Arrangements

i. National Focal Points (NFPs) on ASEAN Agreement on Transboundary Haze Pollution (AATHP), ASEAN Task Force on Peatlands (ATFP) and National Monitoring Centre (NMC)

NFP of COM AATHP	NFP of ATFP	NMC
Directorate of Forest and Land Fire Management (DFLFM), Ministry of the Environment and Forestry (MOEF)	Directorate of Peat Degradation Control, Ministry of the Environment and Forestry (MOEF)	Directorate of Forest and Land Fire Management (DFLFM), Ministry of the Environment and Forestry (MOEF)

ii. Nominated NFP and supporting agencies on peatland management in AMS (inputs from AMS to questionnaire)

NFP / Lead Agency	Agencies supporting the NFP
Directorate of Peatland Degradation Control, Ministry of Environment and Forestry (MOEF)	• Directorate of Forest and Land Fire Management (DFLFM), Ministry of the Environment and Forestry (MOEF) • Peatland and Mangrove Restoration Agency (BRGM)

iii. NFP for Haze Management and Monitoring and its supporting agencies

NFP /Lead Agency	Agencies supporting NFP
Directorate of Forest and Land Fire Management (DFLFM), Ministry of Environment and Forestry (MOEF)	• BMKG • LAPAN • BNPB • Army • Police • Ministry of Agriculture • BPPT • There are 5 regional Implementation Technical Unit (Balai PPIKHL/Forest and Land Fire Control and Climate Change Agencies) under the Directorate General of Climate Change that conduct various activities to tackle the forest and land fire problems including 1,875 personnel of Manggala Agni (forest and land fire brigades) in 34 zonal fire stations in fire-prone provinces and voluntary groups called Masyarakat Peduli Api (Fire Care Communities) in 28 provinces in Indonesia.

Policies

Indonesia has high commitment in dealing with peatland issues and has initiated effective peatland management practices as well as preventing and monitoring peat fire. Indonesia has significant policy progress on peatland management with the issuance of Government Regulation on Management and Protection of Peatland Ecosystem, which includes the mainstreaming of peatland issues in all development sectors. Ministries and agencies are in regular communication and consultations with provincial, district and sub-district levels to undertake appropriate measures in rehabilitating and monitoring the vulnerable peatland areas. The ASEAN Peatland Fire management Guidelines is being referred to by including the elements of prevention, preparedness, response and recovery in the development of the national SOP.

Data monitoring practices
Monitoring and evaluation of peatland condition and management are conducted through systems developed by MOEF and BRG (in 2021, BRG has scope expanded and renamed to Badan Restorasi Gambut dan Mangroves/BRGM). MOA is mandated to monitor and control zero burning implementation in peatland area used for agriculture and plantations. BMKG is providing and further developing Fire Danger Rating System (FDRS), and the National Institute of Aeronautics and Space (LAPAN) to monitor land and forest fire indicators.

Fire Hotspot have been used as an indicator for forest and land fire and have been compiled and analysed by LAPAN as main national hotspot data source. All ministries or agencies should refer to the hotspot data source, which can be accessed in the website of http://modis-catalog.lapan.go.id/monitoring. The hotspot data can be extracted for the whole Indonesia, as well as for provinces, in the form of excel tables as well as maps. It is derived from various satellites including Aqua, Terra, SNPP, NOAA 20, and Landsat 8. MOEF has developed a forest and land fire monitoring system (http://sipongi.menlhk.go.id/home/main) which shares important information on burned area and hotspots as fire indicators for the whole Indonesia in the form of data, graphs and maps, and other fire control information.

The Monitoring System on Ground Water Level (GWL) of 0.4m (SIMATAG-0.4) has been launched since 2019 to track compliance with the government regulation on peatland water management. The Peatland Directorate of the MOEF, through SIMATAQ-0.4, oversees a network of nearly 11,000 water level monitoring stations on 3.6 million ha of land mainly installed by private sector plantation companies. 10% of the sampling sites are real-time data loggers that help the Directorate track the real time water levels in plantations and direct corrective action when water levels fall. More than 150 units of GWL monitoring equipment have been installed in seven priority fire prone provinces by BRGM to provide early warning alert and trigger preparation for forest and land fire prevention through the Peatland GWL Monitoring System (SIPALAGA). This has a function for recording of GWL by telemetry-based, real-time data publishing on website (intranet). The system is recording the GWL, peat moisture content and rainfall every 10 minutes. In the near future, Indonesia will integrate all the existing systems by developing SiPPEG for better data management and monitoring. **Table C1** shows the data monitored by Indonesia.

Table C1: Data routinely gathered to support fire monitoring and prevention activities in Indonesia

Information	Remarks	Sources
Burn scar	Monitored regularly as needed by Directorate of Forest and Land Fire Control, MOEF	Limited sharing for information
Peat ground water level	• Real-time monitoring for public area by BRG • Bi-weekly monitoring for concession area by Directorate of Peat Degradation Control, MOEF (limited sharing for information)	Information shared to public through BRG website for public area: http://sipalaga.brg.go.id
Soil Moisture	• Field monitoring and real-time monitoring by BRG • Monthly satellite monitoring by Directorate of Peat Degradation Control, MOEF • Monthly satellite monitoring by BRG	• Real-time information shared to public through BRG website: http://sipalaga.brg.go.id • Monthly information shared to public through MOEF website: http://pkgppkl.menlhk.go.id

Information	Remarks	Sources
		• Monthly information shared to public through BRG website: http://prims.brg.go.id
Soil temperature	• Field monitoring and real-time monitoring by BRG	• Information shared to public through BRG website: http://sipalaga.brg.go.id
Status of peat degradation	• Monthly satellite monitoring by Directorate of Peat Degradation Control	• Information shared to public through MOEF website: http://pkgppkl.menlhk.go.id
Vegetation change	• Monthly satellite monitoring by Directorate of Peat Degradation Control	• Information shared to public through MOEF website: http://pkgppkl.menlhk.go.id
Haze trajectory	• Daily basis by BMKG	• Information shared to public through MOEF website: https://www.bmkg.go.id/satelit/satelit.bmkg?Sat=17&id=0
Site level activities	• Daily basis by Directorate of Forest and Land Fire Management	• Limited sharing for information

Peatland mapping in Indonesia has been completed, by the Government of Indonesia, since 2011 at a scale of 1:250,000 with the extent of peatland approximately 15 million ha, within 865 peatland hydrological units (PHUs) covering 24,667,804 ha, distributed particularly in big islands of Sumatera, Kalimantan, Sulawesi and Papua. Indonesia is preparing maps at 1:50,000 scale with information such as peat depth, peat type, and land cover including mapping of PHUs and level of degradation. Peatlands in other locations such as the Molucca Islands and in montane areas in Sumatra and Papua Islands have yet to be surveyed in any detail.

Air quality measurement in Indonesia is based on Air Pollution Standard Index or *Indeks Standard Pencemar Udara (ISPU)*. The air quality retrieved through a network of 46 active monitoring stations. Several pollutants parameters are monitored namely SO_2, NO_2, CO, O_3, PM_{25} and PM_{10} (**Table C2**). However, the number of stations equipped with $PM_{2.5}$ monitoring in Indonesia need to be increased. The air pollution index is classified into 5 different categories namely Good (less than 50), Moderate (51-100), Unhealthy (101-199), Very Unhealthy (200-299) and Hazardous (300 and above). The air quality information updated hourly through http://iku.menlhk.go.id/map/.

Table C2: Information by national agencies related to air pollution

Air quality monitoring station	Parameter measured	Website	Update frequency	Index measurement
46	Ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), PM10, PM2.5, GHG	http://iku.menlhk.go.id/map/ and https://www.bmkg.go.id/kualitas-udara/informasi-partikulat-pm25.bmkg	Hourly	Air Pollution Standard Index (PSI) or *Indeks Standard Pencemar Udara (ISPU)*

Gaps and capacity development needs
Generally, the relevant agencies have sufficient capacity and resources to undertake fire and haze prevention work on peatlands. However, additional resources are desired to strengthen the organizational capacity through technical training, establishment of monitoring base camp and procurement of equipment in combating fire. Support to enhance ground water level monitoring in peatland areas are necessary – especially in community land and government managed land such as protected areas. Mapping of upland peatlands needs to be enhanced.

Future Priorities for Peatland Management
Priorities in Indonesia for the period 2021 to 2030 as identified by feedback by ATFP NFP and other national stakeholders in response to the Final Review of the APMS 2006-2020, include the following:
1. To accelerate inventory on peatland ecosystem characteristics at scale of 1:50.000 based on Peatland Hydrological Unit (KHG) and map degraded peatland in detail
2. To recover hydrological function and rehabilitation as well as improve local community livelihood
3. Monitoring on canal, land cover, ground water level (GWL), hotspot, burned scar, pyrite and quartz layers
4. To study on commodity site matching for each PHU, including oil palm/ acacia adaptive to flooding
5. To study on environmental services from peatland
6. To establish *Desa Mandiri Peduli Gambut* (Peatland Care Independent Villages/DMPG) and integrate with '*Masyarakat Peduli Api'* (Fire Care Community)
7. To establish working group on peatland management and protection (TK-PPEG) in each village with support from BUMDes (Village Enterprises) in regions with peat
8. To integrate information system of Management and Protection of Peatland Ecosystem (SIPPEG)
9. To promote information dissemination to communities at site level
10. To include multi-stakeholder approach in information sharing
11. To strengthen implementation of peatland management plan (RPPEG) in provincial and district levels
12. To strengthen patrol system and zero burning implementation
13. To strengthen fire monitoring and integrate monitoring system (LAPAN MODIS Catalog, SiPongi, FDRS, SIPALAGA, SIMATAG)
14. To identify endemic species of flora and fauna in peatlands
15. To strengthen site conservation and germplasm
16. To promote Ramsar Sites management
17. To strengthen multi-stakeholder partnership in supporting DMPG
18. To implement sustainable peatland management based on peatland hydrological unit (KHG)
19. Need to develop FDRS using water level in peatland area as an indicator
20. To develop paludiculture technology in peatland area
21. To promote agroforestry and sylvofishery using species site matching for better peatland management and enhance community livelihood
22. To identify and document best practices in peatland management (conservation and cultivation areas)
23. To extent rehabilitation of degraded peatland area
24. To strengthen multi-stakeholder partnership for climate change mitigation
25. To implement climate change mitigation from related sectors (Forestry and Agriculture)
26. To incorporate peatlands into National Action Plan for Climate Change Adaptation (RAN-API)

27. To strengthen collaboration among AMS in peatland management
28. To promote exchange knowledge and experience on best practices at national and regional levels
29. To incorporate peatland related program with the International Tropical Peatland Center (ITPC) launched in Jakarta on 30 October 2018.
30. To enhance the role of and scaling-up the BMPs of multi-stakeholder programmes on peatland management
31. To identify, search and attract funding allocation from national and international sources for peatland management

Priorities for Capacity Development

Capacity development needs as identified from the feedback in the questionnaire from the final review of the implementation of the APMS, 2006-2020 and other sources are shown in **Table C3**. The types of capacity development have been classified based on the 5 potential areas of focus as presented to the First MAHFSA Programme Steering Committee Meeting in November 2019.

Table C3: Proposed priorities for capacity development for Indonesia as identified through this CDNGA

Focus 1: Peatland inventory, mapping, assessment of degradation status, Monitoring (APSMPE T1)	
Low priority – Indonesia has been undertaking detailed mapping of its peatlands for monitoring purposes guided by policies and regulations	
Focus 2: Peatland Fire Prevention Measures (APSMPE T2/Roadmap S2)	
1. Capacity development	*Training on fire risk warning (including Fire Danger Rating System operation and promotion) and fire prevention*
Possible trainer	• Interim ACC • MOEF • BMKG, LAPAN, BPPT • Regional platform via ASEAN Framework
Institution/people to be trained	• Provincial and local government • Supporting agencies • Field patrollers • Local communities
2. Capacity development	*Technology transfer in fire prevention and rehabilitation effort including using of satellites*
Possible trainer	• MOEF • BMKG, LAPAN, BPPT • Regional platform via ASEAN Framework
Institution/people to be trained	• Provincial and local government • MOEF's relevant provincial and local offices • Supporting agencies • Private sector and communities at site level
Focus 2: Peatland Fire Prevention Measures (APSMPE T2/Roadmap S2)	
3. Capacity development	*Training for rangers and forest fire-fighter team on fire management*
Possible trainer	• BPBN/BPBD/Manggala Agni

Institution/people to be trained	• Provincial and local government • Field patrollers • Communities (*Masyarakat Peduli Api*) • Private sector (medium/small plantations)
4. Capacity development	***Ground water level monitoring in peatland areas***
Possible trainer	• Peatland Directorate, MOEF
Institution/people to be trained	• MOEF related agencies • Provincial and local governments • Supporting agencies including research institutes and universities • Private sector (plantations) • Stakeholders • Field patrollers
Focus 3: Peatland Fire and Haze Occurrence (APSMPE T2/Roadmap S2)	
5. Capacity development	***Monitoring and reporting of peatland fire and haze occurrence (Result Management System)***
Possible trainer	• MOEF • BMKG, LAPAN, BPPT • Regional Southeast Asia Wildland Fire Network
Institution/people to be trained	• MOEF related agencies • Provincial Governments • Supporting agencies
6. Capacity development	***Establishment of monitoring base camp***
Possible trainer	• MOEF
Institution/people to be trained	• MOEF and its relevant provincial and local offices • Supporting agencies
Focus 4: Resources allocate and generated for peatland management and fire prevention	
7. Capacity development	***Explore collaboration on peatland management and fire prevention***
Possible trainer/facilitator	• MOEF
Institution/people to be trained	• MOEF and its relevant provincial and local offices • Fire Department • Research Institutes and universities with long experience working on peatland related matters e.g. IPB University, UNRI, UNTAN, CIFOR, etc. • Supporting agencies • Stakeholders
Focus 4: Resources allocate and generated for peatland management and fire prevention	
8. Capacity development	***Procurement and operate of tools and equipment for combating of fire***
Possible trainer	• MOEF • Fire Department
Institution/people to be trained	• MOEF's provincial and local offices • Stakeholders (private sector and community groups)

9. Capacity development	*Awareness raising on peatland value, sustainable use and ecosystem services to communities and public*
Possible trainer	• MOEF • BRGM • Research Institutes and universities with long experience working on peatland related matters e.g. IPB University, UNRI, UNTAN, CIFOR, etc.
Institution/people to be trained	• MOEF and its relevant provincial and local offices • Supporting agencies • Stakeholders • Public
Focus 5: Implementation of NAPPs, APMS, Roadmap	
10. Capacity development	*Capacity development for peatland rehabilitation and conservation*
Possible trainer/facilitator	GEC, MOEF, BRGM
Institution/people to be trained	• MOEF's provincial and local offices • Research Institutes and universities • Private sector • Supporting agencies • Local communities
11. Capacity development	*Awareness enhancement and peer learning from regional BMPs for community activities*
Possible trainer/facilitator	• GEC • MOEF • BRGM • Regional platform via ASEAN Framework
Institution/people to be trained	• Provincial and local government • Supporting agencies • Stakeholders (e.g. NGOs/CSOs and local communities)
12. Capacity development	*Knowledge exchange to enhance peatland governance and policies*
Possible trainer	• MOEF • Regional platform via ASEAN Framework
Institution/people to be trained	• National Agencies • Supporting agencies • Private sector • Research institutions
Focus 5: Implementation of NAPPs, APMS, Roadmap	
13. Capacity development	*Peatland and climate change*
Possible trainer	• MOEF, DG Climate Change • Regional platform via ASEAN Framework
Institution/people to be trained	• National Agencies • Supporting agencies • Private sector • Research institutions

d) Lao PDR

Institutional Arrangement

i. National Focal Points (NFPs) on ASEAN Agreement on Transboundary Haze Pollution (AATHP), ASEAN Task Force on Peatlands (ATFP) and National Monitoring Centre (NMC)

NFP of COM AATHP	NFP of ATFP	NMC
Ministry of Agriculture and Forestry	Department of Water Resources, MONRE	• Meteorology and Hydrology Department, MONRE

ii. Nominated NFP and supporting agencies on peatland management in AMS (inputs from AMS to questionnaire)

NFP / Lead Agency	Agencies supporting the NFP
Department of Water Resources, Ministry of Natural Resources and Environment	• Department of Environment, MONRE • Natural Resources and Environment Statistics and Research Institute (NRESRI), MONRE. • Department of Land, MONRE • Lao National Mekong Committee Secretariat, MONRE • Department of Forest, MAF • Department of Agricultural Land Management and Development, MAF • Provincial Departments of Natural Resources and Environment (PONRE) • District Offices of Natural Resources and Environment (DONRE) • IUCN Lao PDR • CAWA project (Climate Change Adaptation in Wetland Areas) • MRWP project (Lower Mekong Basin Wetland Management and Conservation Project) • National University of Laos • Lao Women's Union

iii. NFP for Haze Management and Monitoring and its supporting agencies

NFP /Lead Agency	Agencies supporting NFP
Ministry of Agriculture and Forestry	

Policies

Lao PDR has a number of wetland sites covering approximately 1 million ha (the Lao Wetland Management Project, in 1993, estimated the area of wetlands in Lao PDR within 50km of the mainstream of the Mekong river was 965,000ha (Anon, 1993[6]). The area of peatlands is a small subset of the wetland area - however, the exact peatland area in the whole country has not been confirmed. There have been a series of peatland surveys undertaken since 2010 mainly in two provinces namely Vientiane and Champasak. Further peatland assessment is underway in preparation for development of the NAPP with support from the Mekong Peatlands Project. Currently there is no specific peat policies but peatland elements have been included in existing policies and plans such as wetland policy and action plan for biodiversity and protected areas.

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[6] Anon (1993) Progress Report of the Wetland Management Programme Project Activities during July 1992 – June 1993. Office of the Lao Wetland Management Project in Lao PDR.

Peatland management has been integrated into the National Water Resources Strategy. Beung Kiet Ngong in Champasak Province is a Ramsar site with a peatland area and being governed under Lao PDR National Biodiversity Strategy and Action Plan (2016 - 2025). The peatland area is located at northern area of the Ramsar site. There are three types of peatlands in Lao PDR which have been described so far which are floating peatland mats, peat soil and buried peatland. In Lao PDR, the Department of Water Resources (DWR) of MONRE is the lead agency to manage and conserve wetlands and peatlands.

There is a relatively low fire occurrence in peatland in Lao PDR. Forest fire and transboundary haze is particularly linked to land clearing by fire and burning of agricultural residues in mineral soil areas. Active community patrolling and monitoring program undertaken supported by IUCN within the Beung Kiet Ngong Ramsar site to prevent fire. IUCN has also designed a guideline for community patrolling. During dry season, Ministry of Agriculture and Forestry distributes awareness on preventing bushfire and conducts an outreach campaign program on negative impacts of the forest fire.

Data monitoring practices
For information on monitoring practices, compilation of air pollution and haze inventories is not performed routinely. Monitoring of the concentrations air quality remains on an ad-hoc project basis and has limited scope. Emissions inventory data for common pollutants such as particulate matter (PM), Sulphur dioxide (SO2), and Nitrogen dioxide (NO2) are not currently available.

Flood and drought are the main hazards in Lao PDR and both are dependent on the amount of rainfall. Rainfall and weather forecast information is disseminated from national to village levels through mobile phones, high frequency radio transceivers, radio, TV and newspaper. Weather forecasts are updated daily through Department of Meteorology and Hydrology facebook page (https://www.facebook.com/HydrometLao/about/?ref=page_internal. Three-day forecasts are issued for key cities in Lao PDR and weekly forecasts are also available. Fire hotspot and FDRS monitoring is not a practice in Lao PDR (**Table D1**). However, there are currently collaboration efforts being undertaken with the MAHFSA project to disseminate daily fire risk update through WhatsApp group application. The hotspot and FDRS information have been used to verify fire incidence in the country and share with MONRE.

Table D1: Assessment of information routinely gathered for fire and haze monitoring.

Information	Source	Remarks
Hotspot	NA	• Low in hotspot and burned area monitoring activity
FDRS	DNP	
Burned area	NA	
Weather information and forecast	National agency	

Gaps and capacity development needs
Generally, there are several gaps observed related to peatland in Lao PDR. Relatively limited sustainable management practices and knowledge about peatland. Peatlands have been newly documented in Lao PDR, therefore, no clear understanding of the extent of peatlands and no official national definition of peatland established yet. Additional challenges are less mandate from government on the peatland management and protection. There are also challenges in securing sufficient and sustaining national resources for peatland management actions.

Peatland subsidence due to drainage, as in the case of Beung Kiat Ngong and other peat swamps in Champasak, Savannakhet, and Vientiane, is a threat that will bring more damages during flood. However, ground water level (GWL) is monitored inside Ramsar site since 2018. Coordination among all stakeholders within the same peatland landscape needs to be strengthened, to ensure sustainable and effective peatland management implementation.

In general, support is needed for peatland assessment, knowledge enhancement, equipment for monitoring of peatland water levels; and peatland conservation and rehabilitation. In terms of peatland assessment, support is needed to establish methodology on mapping using remote sensing and ground survey and mapping. Capacity enhancement is needed for fire detection and monitoring system. Awareness raising activities and sustainable practices to improve understanding of peatlands are important among the stakeholders and relevant agencies. Documentation of data collection activity, monitoring practices and reporting to regional level remain unclear.

The majority of fires and land fires and associated local and transboundary haze from Lao PDR is linked to fire in mineral soil not peatland areas. Lao PDR is ranked number two in ASEAN in terms of number of Fire Hotspots between 2013-2020 (average 39,866 hotspots per year – see Annex 7 this report). Support is needed to enhance monitoring national level monitoring of and response to, fire hotspots and FDRS by the NFP, as well as support to the NMC to monitor enhance warning of FDRS and reporting to ASEC on fire and haze occurrence. Action is also needed at the provincial and local levels to prevention of land and forest fires

Future Priorities for Peatland Management
Priorities in Lao PDR for the period 2021 to 2030 as identified by feedback by ATFP NFP and other national stakeholders in response to the APMS Review, include the following:
1. High priority to identify and map all peatland areas in the country
2. High priority to enhance public awareness for local communities on the importance and sustainable use of peatlands.
3. High priority to enhance capacity of government staff and relevant agencies at national and local level on peatland assessment and management.
4. To develop specific regulations for peatlands and integrate peatlands into other relevant policies and legislation
5. To conduct inventory on peatlands sites and its natural resources including flora and fauna.
6. High priority to engage local community due to their traditional knowledge on valuing the peatland (identification of peatland is needed for management and conservation)
7. To exchange knowledge and lessons learnt on peatland management at the regional level and require experts to support Lao PDR on peatland assessment

Priorities for Capacity Development
Capacity development needs as identified from the feedback in the questionnaire from the final review of the implementation of the APMS, 2006-2020 and other sources are shown in **Table D2**. The types of capacity development have been classified based on the 5 potential areas of focus as presented to the First MAHFSA Programme Steering Committee Meeting in November 2019.

Table D2: Proposed priorities for capacity development for Lao PDR as identified through this CDNGA

Focus 1: Peatland inventory, mapping, assessment of degradation status, Monitoring (APSMPE T1)	
1. Capacity development	*Peatland mapping, survey and assessment*
Possible trainer	• GEC, IUCN
Institution/people to be trained	• Department of Water Resources • Supporting agencies
Focus 2: Peatland Fire Prevention Measures (APSMPE T2/Roadmap S2)	
2. Capacity development	*Training on fire risk warning (including Fire Danger Rating System operation and promotion) and fire prevention*
Possible trainer	• Interim ACC/ASMC • Department of National Park, Wildlife and Plant Conservation (DNP), Thailand
Institution/people to be trained	• Department of Forest • Department of Water Resources • National Monitoring Centre • Supporting agencies • Field patrollers • Stakeholders (NGO/CSOs)
3. Capacity development	*Technology transfer in fire prevention and rehabilitation effort including using of satellite*
Possible trainer	• Regional platform via ASEAN Framework • Regional expert e.g. Indonesia and Thailand • Regional Southeast Asia Wildland Fire Network
Institution/people to be trained	• Department of Water Resources • National Monitoring Centre • Supporting agencies
4. Capacity development	*Training for rangers and forest fire-fighter team on fire management*
Possible trainer	• Regional experts e.g. Indonesia and Thailand
Institution/people to be trained	• Department of Forest • National Monitoring Centre • Supporting agencies • Field patrollers
Focus 3: Peatland Fire and Haze Occurrence (APSMPE T2/Roadmap S2)	
Low priority	The known extent of peatlands is limited in Lao PDR and peatland fire is not a major issue according to current knowledge.

Focus 4: Resources allocate and generated for peatland management and fire prevention	
5. Capacity development	*Awareness raising on peatland value, sustainable use and ecosystem services to communities and public*
Possible trainer	• GEC, IUCN
Institution/people to be trained	• Department of Water Resources • Provincial agencies in provinces with peatlands • Supporting agencies • National University of Laos
Focus 5: Implementation of NAPPs, APMS, Roadmap	
6. Capacity development	*Capacity development in peatland rehabilitation and conservation*
Possible trainer	• GEC, IUCN • Regional platform via ASEAN Framework
Institution/people to be trained	• Department of Water Resources • Supporting agencies • Stakeholders
7. Capacity development	*Awareness enhancement and peer learning from regional BMPs for community activities*
Possible trainer/facilitator	• Regional platform via ASEAN Framework
Institution/people to be trained	• Department of Water Resources and its provincial and local office • Department of forest • Protected area management • Supporting agencies
8. Capacity development	*Knowledge exchange to enhance land and forest governance and policies*
Possible trainer/facilitator	• Regional platform via ASEAN Framework • Regional Southeast Asia Wildland Fire Network
Institution/people to be trained	• Department of Forest • Department of Land • Department of Water Resources • Supporting agencies
9. Capacity development	*Peatland and climate change*
Possible trainer	• Regional platform via ASEAN Framework • RECOFTC
Institution/people to be trained	• Department of Land • Ministry of Natural Resources and Environment • Supporting agencies • Private sector • Research institutions
10. Capacity development	*Procurement and use of tools and equipment for combating fire*
Possible trainer	• Regional experts e.g., Thailand • Regional Southeast Asia Wildland Fire Network

Focus 5: Implementation of NAPPs, APMS, Roadmap	
10. Capacity development	*Procurement and use of tools and equipment for combating fire*
Institution/people to be trained	• Department of Forest • Department of Water Resources • Supporting agencies • Provincial and local offices

e) Malaysia

Institutional Arrangement

i. National Focal Points on ASEAN Agreement on Transboundary Haze Pollution (AATHP), ASEAN Task Force on Peatlands (ATFP) and National Monitoring Centre (NMC)

NFP of COM AATHP	NFP of ATFP	NMC
Department of Environment, Ministry of Environment and Water (KASA)	Ministry of Energy and Natural Resources (KeTSA)	Department of Environment, Ministry of Environment and Water (KASA)

ii. Nominated National Focal Point and supporting agencies on peatland management in AMS (inputs from AMS to questionnaire)

NFP / Lead Agency	Agencies supporting the NFP
Ministry of Energy and Natural Resources (KeTSA)	• Forestry Department Peninsular Malaysia (FDPM/JPSM) • Forest Research Institute Malaysia (FRIM) • Sarawak Forest Department • Sabah Forestry Department • Department of Agriculture • Malaysian Space Agency • Department of Environment • Fire and Rescue Department • Department of Irrigation and Drainage • Mineral and Geoscience Department • State and local governments

iii. NFP for Haze Management and Monitoring and its supporting agencies

NFP /Lead Agency	Agencies supporting NFP
Ministry of Environment and Water (KASA)	• Department of Environment (DOE/JAS) • Malaysian Meteorological Department (MET Malaysia) • National Disaster Management Agency (NADMA) • Fire and Rescue Department of Malaysia (BOMBA) • Department of Mineral and Geoscience Malaysia (JMG) • Department of Irrigation and Drainage (JPS) • Malaysian Space Agency (MYSA)

Policies

Human activity is the main cause of peatland fires in Malaysia. Normally it is due to the land clearing activity for agriculture and plantations, unsystematic drainage system as well as human negligence. The main challenges in peatland management in Malaysia are large scale peatland drainage, poor water management, land use conflicts and limited collaboration between stakeholders.

To address peatland fires, the Malaysian Department of Environment (DOE) has taken proactive action by establishing SOP aimed to standardize the procedures in implementing the Peatland Fire Prevention Program to Overcome Haze since 2009. The SOP has been regularly reviewed and updated with the latest version being approved in 2019. The national peatland fire prevention program prioritizes water management methods in peat areas by building infrastructure such as check dams, tube wells, reservoirs, reservoirs, water pipelines and observation towers. The main objective is to increase the ground water level in the peatlands to lower the fire risk during the dry

season as well as to supply water resources for extinguishing fires. Monitoring measures are undertaken using surveillance towers, drones and field monitoring as a precautionary measure. A draft national masterplan for management of fire prone peatlands was prepared in 2019.

The ASEAN SOP is being referred to in the development of the national SOP by using Integrated Fire Management approach. A National Peatland Steering Committee has been established to discuss on peatland issues but has not met regularly. Malaysia is committed to extend the existing NAPP to cover the period 2021-2030 as stated in the National Policy on Biological Diversity (2016-2025). Several states with peatland area have developed Integrated Management Plan (IMP) for selected peatland landscapes. The revision of the IMPs will be undertaken through the upcoming SMPEM project.

Data monitoring practices
Good practices for fire and haze monitoring undertaken by the relevant agencies. Daily weather forecasts are provided by Malaysia Meteorological Department (MET Malaysia, https://www.met.gov.my/). MET Malaysia issues seasonal weather forecasts and warning including seasonal, dry season and El-Niño forecasts. Warning information is distributed to the relevant agencies in the area that has been experiencing a period of no rain for 7 days continuously. MET Malaysia also generates FDRS information for ASEAN region in GIS file format and share the information in ASMC website. However, work is still in progress to provide FDRS advance prediction information.

Daily hotspot information is referred to ASMC and FIRMS followed by verification on the ground (**Table E1**). The Forest Fire Information System (FORFIS) has been developed by the Malaysian Space Agency to provide hotspot information of MODIS and NOAA, forest fire occurrence images from SPOT and MODIS as well as air quality information. The system has been fully operational since June 2011 with access limited to the relevant agency at http://forfis.mysa.gov.my/. Agencies that used this system includes Department of Environment, Fire and Rescue Department of Malaysia, Forestry Department and Department of Civil Defence Malaysia.

Table E1: Assessment of information routinely gathered for fire and haze monitoring

Information	Source	Remarks
Hotspot	• ASMC • FIRMS • FORFIS	• Burned area monitored within Permanent Reserved Forest • Ground verification and suppression with patrollers • Inform stakeholders at local and national level • Technical report to decision maker • Integrate with GIS for further analysis[7]
FDRS	• MET Malaysia	
Burned area	NA	
Weather information and forecast	• National agency • ASMC	

Air quality measurement in Malaysia is based on Pollution Standard Index (PSI) that has been accepted at the international level by United States Environmental Protection Agency (USEPA). The Department of Environment monitors air quality through a network of 68 monitoring stations (**Table E2**). Six pollutants parameters are monitored namely SO_2, NO_2, CO, O_3, PM_{10} and $PM_{2.5}$.

[7] https://enviro2.doe.gov.my/ekmc/wp-content/uploads/2019/07/Modul-5-6-PEMANTAUAN-PT-HOTSPOT-PELAPORAN.pdf

The air pollution index is classified into 5 different categories namely Good (less than 50), Moderate (51-100), Unhealthy (101-199), Very Unhealthy (200-299) and Hazardous (300 above). The air quality information is updated hourly and shared through its website at http://apims.doe.gov.my/public_v2/home.html.

Table E2: Information by national agencies related to air pollution

Air quality monitoring station	Parameter measured	Website	Update frequency	Index measurement
68	Ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), PM10, PM2.5	http://apims.doe.gov.my/public_v2/home.html	Hourly	Pollution Standard Index (PSI)

Gaps and capacity development needs

Generally, the responsible agencies lack sufficient capacity and resources to fully undertake their work due with insufficient manpower for field monitoring and inadequate funding for fire prevention measures. However, there are ongoing efforts to enhance the involvement of community, stakeholders and private agencies in mitigation measure of peatland fire at selected sites. Assistance is needed in capacity building for technical officers as well as scaling up financial support for prevention measures. Burnt areas are being monitored inside permanent forest reserve only. Data sharing between agencies and to publics also needs enhancement. Currently, no archive data provided by MET Malaysia to support more research work.

Future Priorities for Peatland Management

Priorities in Malaysia for the period 2021 to 2030, as identified by feedback by ATFP NFP and other national stakeholders in response to the APMS Review, include the following:

1. High priority to determine extent and status of peatland in Malaysia; information (spatial data/maps/dataset) to be accessible for sharing for better management
2. To identify problems and constraints; different perception by different stakeholder on peatlands (plantation, agriculture, etc.)
3. Medium/high priority to monitor and evaluate the peatland including develop an integrated management and monitoring system, and with sufficient budget to operate the system
4. High priority to enhance CEPA programmes to improve public awareness especially at local peat-dependence communities and through educational events with young generation
5. High priority to enhance competency and capacity of institutions/agencies to monitor and manage the peatlands, also enhancing enforcement, with financial support to prevent fire on prone area
6. Medium priority on information sharing as there are existing platforms for sharing
7. Sharing information through publications, information centre, websites, workshops, conferences and field advisory, need media engagement
8. Being coordinated and facilitated through State Steering Committee, National Peatland Working Committee and National Peatland Steering Committee, National Steering Committee on Wetlands
9. High priority to strengthen implementation of policies and action plans in relation to peatland management – NAPP 2021-2030 and NPBD 2016-2025, National Policy on Wetlands (being finalized)
10. Need close coordination between national and state levels for acceptance and implementation (policy development at federal vs adoption at state level) and state agencies with plantation sector (e.g. Sarawak companies with NREB)

11. Strengthen peatland issues in the Environment Quality Act
12. To strengthen enforcement and reference to existing guidelines (SOP by DOE and Bomba)
13. High priority to have multi-stakeholder collaboration in preventing peat fire
14. Reference to all relevant SOP (DOE and Bomba) and guidelines, need more commitment and enforcement on the regulations and national programme on peatland management
15. Need budget
16. Continue dissemination of FDRS and hotspot information, good to have fire scars information to prevent repeated peat fires
17. Linkage to climate change and Nationally Determined Contributions (GHG emission)
18. High priority to provide comprehensive biodiversity information through assessment at locations to identify endemic species of flora and fauna in peatlands
19. Need greater protection and connectivity and proper land-use planning
20. Develop more seed banks for suitable species for rehabilitation
21. Consider to develop incentive scheme for State that gazette peatland as protected area, for carbon financing mechanism to help offset emission and opportunity to encourage the State Government to protect and manage the peatlands more sustainably (e.g. Pahang and Selangor on carbon offset programmes)
22. Meet CBD target of 17% of peatlands in totally protected areas
23. High priority to improve coordination and commitment of agencies for cross-sectoral collaboration, and information sharing for integrated practices to conserve the biodiversity and undertake rehabilitation work
24. To strengthen multi-stakeholder partnership (government, private sector, research institute, CSOs and community) – identify strategic partners
25. To develop State Action Plans on Peatlands (SAPP) for peat states (SMPEM project and departmental fund)
26. High priority to have sufficient background information (baseline) on topo-hydrological information and systematic data for water management as most important aspect for peatland management
27. Medium/High priority to promote and revise IMP – some expired and IMP NSPSF active in implementation (2014-2023); JPSM has guidelines and format for developing IMP; need competent officer, sufficient manpower and funding
28. Medium/High priority to document BMPs and promote as demonstration sites
29. Need to widely promote the BMPs and replicate the BMPs to other areas
30. Need to optimize function of Centre of Excellence at North Selangor Peat Swamp Forest and Klias Peat Swamp Field Centre and at other PAs such as Maludam National Park and Loagan Bunut National Park
31. To identify and document best practices in peatland management (conservation and cultivation areas)
32. To promote exchange knowledge and experience on best practices
33. High priority on restoration and rehabilitation of peatland ecosystems
34. To Identify valuable species adaptable to peatland condition and seed banks
35. To promote agroforestry in peatland
36. Need better coordination to collate relevant research and tested techniques
37. High priority to increase investment/ development fund for innovative technologies and application of tested techniques at the site (some available cost effective techniques identified and to be replicated at site)
38. High priority to strengthen multi-stakeholder partnership for climate change mitigation
39. To explore possible carbon financing mechanisms to encourage peatland protection and conservation (results from long term carbon flux assessment as reference/baseline)

40. Medium priority to incorporate peatlands into climate change adaptation – NDC, SDGs, REDD+
41. Medium priority to strengthen collaboration among AMS in peatland management and establishment of "networks or centres of excellence"
42. To promote exchange of knowledge and experience on best practices in regional level
43. Ongoing regional programmes/projects: EU-SUPA, IFAD-MAHFSA
44. High priority in securing financing to implement the APMS – national (e.g. RMK-12 and RMK-13) and international funding (development organisations – GEF-IFAD SMPEM, EU-SUPA)
45. To identify, search and attract financial support for peatland e.g. carbon projects, CSR, etc.
46. Develop rules and incentives for private sector engagement

Priorities for Capacity Development

Capacity development needs as identified from the feedback in the questionnaire from the final review of the implementation of the APMS, 2006-2020 and other sources are shown in **Table E3**. The types of capacity development have been classified based on the 5 potential areas of focus as presented to the First MAHFSA Programme Steering Committee Meeting in November 2019.

Table E3: Proposed priorities for capacity development for Malaysia as identified through this CDNGA

Focus 1: Peatland inventory, mapping, assessment of degradation status, Monitoring (APSMPE T1)	
1. Capacity development	*Peatland assessment and mapping*
Possible trainer	- Department of Agriculture - Forestry Department of Peninsular Malaysia - Research institute e.g. Universities, FRIM, Sarawak TROPI
Institution/people to be trained	- KeTSA and its relevant departments (e.g. Forestry Department) - State Government Agencies - Supporting agencies
Focus 2: Peatland Fire Prevention Measures (APSMPE T2/Roadmap S2)	
2. Capacity development	*Training on fire risk warning (including Fire Danger Rating System operation and promotion) and fire prevention*
Possible trainer	- Interim ACC/ASMC - GEC - MET Malaysia, DOE, Malaysian Space Agency
Institution/people to be trained	- National Agencies - National Monitoring Centre - Supporting agencies including State agencies - Private sector (in particular oil palm plantation and/or forest plantation companies with peat areas within concessions) - Field patrollers
3. Capacity development	*Technology transfer in fire prevention and rehabilitation effort including using of satellite*
Possible trainer/facilitator	- Regional expert e.g. Indonesia - Regional platform via ASEAN Framework
Institution/people to be trained	- KeTSA and related agencies - KASA and related agencies

	• Ministry of Primary Industries and Commodities (MPIC) • Supporting agencies
4. Capacity development	***Training for rangers and forest fire-fighter team on fire management***
Possible trainer	• Fire and Rescue Department • State Forestry Department
Institution/people to be trained	• Peatland and forest management agencies • Supporting agencies • Local communities and field patrollers • Private sector (in particular oil palm plantation and/or forest plantation companies with peat areas within concessions)
5. Capacity development	***Ground water level monitoring in peatland areas***
Possible trainer/facilitator	• GEC • MOEF, Indonesia
Institution/people to be trained	• Peatland and forest management agencies • Supporting agencies • Local communities and field patrollers • Private sector (in particular oil palm plantation and/or forest plantation companies with peat areas within concessions)
Focus 3: Peatland Fire and Haze Occurrence (APSMPE T2/Roadmap S2)	
6. Capacity development	***Monitoring and reporting of peatland fire and haze occurrence (Result Management System)***
Possible trainer	• GEC • Department of Environment • MET Malaysia, Malaysian Space Agency
Institution/people to be trained	• National Monitoring Centre • Forestry Department of Peninsular Malaysia • Fire and Rescue Department • Supporting agencies • Field patrollers
Focus 4: Resources allocate and generated for peatland management and fire prevention	
7. Capacity development	***Explore collaboration on peatland management and fire prevention***
Possible trainer	• Forestry Department of Peninsular Malaysia • GEC and Regional experts
Institution/people to be trained	• KeTSA and its relevant departments • KASA and its relevant departments • Fire and Rescue Department • Supporting agencies • Stakeholders
8. Capacity development	***Awareness raising on peatland value, sustainable use and ecosystem services to communities and public***
Possible trainer	• GEC • Forestry Department of Peninsular Malaysia
Institution/people to be trained	• National Agencies • State governments with significant peatlands stakeholders

	• Supporting agencies • Stakeholders
Focus 5: Implementation of NAPPs, APMS, Roadmap	
9. Capacity development	***Capacity development in peatland rehabilitation and conservation***
Possible trainer	• Forestry Department of Peninsular Malaysia • Forest Research Institute Malaysia • State Forestry Departments • GEC
Institution/people to be trained	• KeTSA and its relevant departments • KASA and its relevant departments • Supporting agencies • Stakeholders
10. Capacity development	***Awareness enhancement and peer learning from regional BMPs for community activities***
Possible trainer	• Regional platform via ASEAN Framework
Institution/people to be trained	• KeTSA and its relevant departments • KASA and its relevant departments • Private sector (in particular oil palm plantation and/or forest plantation companies with peat areas within concessions) • Supporting agencies • Stakeholders
11. Capacity development	***Knowledge exchange to enhance peatland governance and policies***
Possible trainer/facilitator	• KeTSA and KASA • Regional platform via ASEAN Framework
Institution/people to be trained	• Ministry of Energy and Natural Resources (KeTSA) • Ministry of Environment and Water (KASA) • Supporting agencies • Stakeholders (e.g. private sector, research institutions, NGOs/CSOs, community groups)
12. Capacity development	***Peatlands and climate change***
Possible trainer	• KASA • Experts from research institutes and NGOs • Regional platform via ASEAN Framework
Institution/people to be trained	• KeTSA • Supporting agencies • Stakeholders (e.g. private sector, research institutions, NGOs/CSOs, community groups)

f) Myanmar

Institutional Arrangement

i. National Focal Points on ASEAN Agreement on Transboundary Haze Pollution (AATHP), ASEAN Task Force on Peatlands (ATFP) and National Monitoring Centre (NMC)

NFP of COM AATHP	NFP of ATFP	NMC
Environmental Conservation Department (ECD)	Environmental Conservation Department (ECD)	• Department of Meteorology and Hydrology • Agriculture Department • Fire Service Department

ii. Nominated National Focal Point and supporting agencies on peatland management in AMS (inputs from AMS to questionnaire)

NFP / Lead Agency	Agencies supporting the NFP
Environmental Conservation Department (ECD), MONREC	• Forest Department • Department of Agriculture • Department of Agricultural, Land Management and Statistics • Water Resource and Irrigation Department • Department of Agriculture Research • General Administrative Department • State and Regional Government • Yezin Agricultural University • University of Forestry and Environmental Science • International Union for Conservation of Nature (IUCN) • Forest Resource Environment Development and Conservation Association (FREDA)

iii. NFP for Haze Management and Monitoring and its supporting agencies

NFP /Lead Agency	Agencies supporting NFP
Environmental Conservation Department	• General Administrative Department • Fire Services Department • Department of Agriculture • Department of Agriculture Land Management and Statistics • Department of Meteorology and Hydrology • Department of Disaster Management • Department of Public Health • Department of ASEAN Affairs • Forest Department • Dry Zone Greening Department • City Development Committees • Environmental Conservation Department

Policies

Myanmar encounters dry spell around November to May every year. During dry season, forest fire become a serious problem with Myanmar has the highest burn rate in the region[8]. Even though drought not a major reason to fire, it increases the risk of fire occurrences. Forest fire and

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[8] Reference to Myanmar FAO Newsletter, June 2019 http://www.fao.org/3/ca5318en/ca5318en.pdf

transboundary haze is particularly linked to land clearing from agricultural expansion and burning of agricultural residues.

A draft of Action Plan for Transboundary Haze Pollution Control in Myanmar had been developed to prevent and mitigate the pollution by transboundary haze, forest fires and other types of fires in Myanmar. Work is progressing in developing National Strategic Action Plan on Fire Management with assistance from FAO. A National Consultation Meeting for controlling haze pollution in Myanmar with relevant departments is planned in every dry season to prepare mitigation plan.

A total of estimated 11,232 ha of peatlands have been identified at more than seven sites in five provinces in Myanmar. Unique peatland ecosystems have been documented include calcareous mound spring peatlands in northern Myanmar as well as lake and marsh basin peatlands in Inle Lake Basin.

Peatland management is included under National Biodiversity Strategy and Action Plan. Peatland assessment is underway in preparation for development of the NAPP with support from the Mekong Peatlands Project.

Data monitoring practices

For information monitoring practices, hotspot information was monitored daily with the support from ASMC and further analysis undertaken using GIS by the national team (**Table F1**). There is collaboration effort undertake with MAHFSA project to disseminate daily fire risk update through WhatsApp group application. The hotspot information is shared with relevant agencies at local and national level. Generally, information regarding fire prone areas and monitoring of the fire occurrences were disseminate through television, radio and regular communication medium such as telephone.

Table F1: Assessment of information routinely gathered for fire and haze monitoring.

Information	Source	Remarks
Hotspot	• ASMC • FIRMS	• Ground verification and suppression with patrollers
FDRS	NA	• Inform stakeholders at local and national level
Burned area	NA	• Technical report to decision maker
Weather information and forecast	• National agencies	• Integrate with GIS for further analysis • Low in FDRS and burned area monitoring activity

Daily weather information is disseminated by Department of Meteorology and Hydrology (https://www.moezala.gov.mm/). More comprehensive information in rainfall and temperature is provided by Myanmar Climate Data Portal (http://dmh-cdp.wowspace.org/team/homex.php).

There is lack of reliable actual data on air quality in Myanmar and no air quality monitoring network established yet. Myanmar adopted National Ambient Air Quality Standards (NAAQS) and monitored air quality at two monitoring station in Mandalay and Yangon (**Table F2**). The monitoring parameters are particulate matter with diameter of less than 10 microns (PM10), particulate matter with diameter of less than 2.5 microns (PM2.5), sulphur dioxide (SO_2), nitrogen

dioxide (NO_2) and ozone (O_3)[9]. However, several efforts are underway to improve air quality assessment in Myanmar with collaboration from Japan International Cooperation Agency (JICA)[10].

Table F2: Information by national agencies related to air pollution

Air quality monitoring stations	Parameters measured	Website	Update frequency	Index measurement
2	Ozone (O_3), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), PM10, PM2.5	NA	Hourly	National Ambient Air Quality Standards (NAAQS)

Gaps and capacity development needs

Work has been initiated to analyse relevant policy and institutional framework as well as existing fire management practices under Integrated National Strategic Action Plan on Fire Management Project by FAO.

There are limited assessment and monitoring on the transboundary haze, forest fires and other types of fires. This is due to lack of capacity in transboundary haze pollution control by the relevant agencies. Currently, Department of Meteorology and Hydrology (DMH) is monitoring PM2.5 concentration at the only two stations in urban areas (Yangon and Mandalay). Documentation of data collection activity, monitoring practices and reporting to regional level remain unclear. There is minimum monitoring activity of FDRS and burnt area by NFP. Support by NMC to monitor weather elements also unclear.

In general, information on function of peatlands is still limited for public of Myanmar. Peatlands have not been fully inventoried and only included under the departmental management plan. Additional surveys and assessment are needed. Since peat is a newly discovered subject, technical staff and communities have a minimum knowledge about peatland. Support is needed for policy development on peatland management.

Capacity building on remote sensing and GIS application for peatland identification and mapping is essential. Education and awareness raising on importance of peatlands also needs to be enhanced. Empowerment is also necessary in conservation activity through training and developing guidelines for rehabilitation. Further support on sustainable practices is necessary to improve community's livelihoods and linked to Climate Change mitigation.

Future Priorities for Peatland Management

Priorities in Myanmar for the period 2021 to 2030 as identified by feedback by ATFP NFP and other national stakeholders in response to the APMS Review, include the following:
1. High priority to identify and map all peatland areas in the country
2. Capacity building on remote sensing and GIS application for peatland identification and mapping is essential
3. Education and awareness raising on importance of peatlands is also essential
4. To establish a Peatland Task Force
5. To enhance understanding of peatlands and mainstream the peatlands elements onto policy and institutional frameworks

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[9] Myanmar Factsheet for EANET https://www.eanet.asia/wp-content/uploads/2020/04/8-Myanmar_Factsheet_compressed.pdf
[10] Referred to The Project for the Improvement of Capability of Air Quality Monitoring in Myanmar https://projectbank.gov.mm/en/profiles/activity/PB-ID-1317/

6. To assess effectiveness of current regulations and policies to mitigate/ manage impacts on peatlands
7. High priority to tackle increasing hotspot count due to forest fires and other types of fires during dry season, prevention measures are necessary for haze from huge forest fire
8. To form a Technical Group on peatland survey and assessment, GIS and spatial analysis, community engagement and sustainable livelihoods, peatland management and policy.
9. Need to develop a plan on integrated and sustainable peatland management and reducing impacts on peatlands
10. To develop a restoration and rehabilitation plan for peatlands in Myanmar
11. Development of common guidelines for conservation and sustainable use of peatland resources to enhance peatland management in ASEAN region
12. APMS to support climate-responsible peatland management

Priorities for Capacity Development

Capacity development needs as identified from the feedback in the questionnaire from the final review of the implementation of the APMS, 2006-2020 and other sources are shown in **Table F3**. The types of capacity development have been classified based on the 5 potential areas of focus as presented to the First MAHFSA Programme Steering Committee Meeting in November 2019.

Table F3: Proposed priorities for capacity development for Myanmar as identified through this CDNGA

Focus 1: Peatland inventory, mapping, assessment of degradation status, Monitoring (APSMPE T1)	
1. Capacity development	***Peatland assessment and mapping***
Possible trainer	• GEC
Institution/people to be trained	• ECD • FREDA • Universities • Supporting agencies
Focus 2: Peatland Fire Prevention Measures (APSMPE T2/Roadmap S2)	
2. Capacity development	***Training on fire risk warning (including Fire Danger Rating System operation and promotion) and fire prevention***
Possible trainer	• Interim ACC/ASMC • Department of National Park, Wildlife and Plant Conservation (DNP), Thailand • GEC
Institution/people to be trained	• National Monitoring Centre • MONREC and its relevant departments • Supporting agencies • Field patrollers
3. Capacity development	***Technology transfer in fire prevention and rehabilitation effort including using of satellite***
Possible trainer	• Regional expert e.g. Indonesia and Thailand • Regional platform via ASEAN Framework • Regional Southeast Asia Wildland Fire Network • The Center for People and Forests (RECOFTC)

Institution/people to be trained	• MONREC and its relevant departments • FREDA • Supporting agencies
4. Capacity development	*Training for rangers and forest fire-fighter team on fire management*
Possible trainer	• MONREC (e.g. Forestry Department) • Fire Services Department • FAO
Institution/people to be trained	• MONREC and its relevant departments • Provincial and local governments • Supporting agencies • Stakeholders (e.g. NGOs/CSOs, Field patrollers)
Focus 3: Peatland Fire and Haze Occurrence	
Low priority	
Focus 4: Resources allocate and generated for peatland management and fire prevention	
5. Capacity development	*Awareness raising on peatland values, sustainable use and ecosystem services to communities and public*
Possible trainer	• ECD, MONREC • FREDA
Institution/people to be trained	• MONREC departments and agencies • Provincial and local stakeholders in areas with peatlands • Other Stakeholders
Focus 5: Implementation of NAPPs, APMS, Roadmap	
6. Capacity development	*Capacity development in peatland rehabilitation and conservation*
Possible trainer	• GEC, IUCN, FREDA • MONREC (e.g. ECD, Forestry Department)
Institution/people to be trained	• MONREC and its relevant departments • Peatland site mangers • Supporting agencies • Stakeholders
7. Capacity development	*Awareness enhancement and peer learning from regional BMPs for community activities*
Possible trainer/facilitator	• ECD, MONREC • Regional platform via ASEAN Framework
Institution/people to be trained	• MONREC and its relevant stakeholders • Supporting agencies • Stakeholders (private sector, NGOs/CSOs and community groups)
8. Capacity development	*Knowledge exchange to enhance peatland governance and policies*
Possible trainer	• ECD, MONREC • Food and Agriculture Organization (FAO)[11] • Regional platform via ASEAN Framework

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[11] http://www.fao.org/myanmar/news/detail-events/ru/c/1200518/

Institution/people to be trained	• MONREC and its relevant departments • National agencies
9. Capacity development	***Peatland and climate change***
Possible trainer	• ECD, MONREC • Regional platform via ASEAN Framework
Institution/people to be trained	• MONREC and its relevant departments • Supporting agencies • Stakeholders (e.g. private sector, research institutions, NGOs/CSOs)
10. Capacity development	***Monitoring of land and forest fire and haze occurrence***
Possible trainer	• Forestry Department • FAO • Regional platform via ASEAN Framework (ASMC, DNP Thailand) • Regional Southeast Asia Wildland Fire Network
Institution/people to be trained	• MONREC and its relevant departments (ECD, Forestry Department) • National Monitoring Centre • Supporting agencies • Stakeholders

g) Philippines
Institutional Arrangement
i. National Focal Points on ASEAN Agreement on Transboundary Haze Pollution (AATHP), ASEAN Task Force on Peatlands (ATFP) and National Monitoring Centre (NMC)

NFP of COM AATHP	NFP of ATFP	NMC
Philippines		
Department of Environment and Natural Resources (DENR)	Biodiversity Management Bureau (BMB), Department of Environment and Natural Resources (DENR)	Forest Management Bureau, Department of Environment and Natural Resources (DENR)

ii. Nominated National Focal Point and supporting agencies on peatland management in AMS (inputs from AMS to questionnaire)

National Focal Point (NFP) / Lead Agency	Agencies supporting the NFP
Biodiversity Management Bureau (BMB), Department of Environment and Natural Resources (DENR)	• DENR Offices - Forest Management Bureau; Ecosystems Research and Development Bureau; DENR field offices • Bureau of Fire Protection (BFP) – Dept. of the Interior and Local Government (DILG) • Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) • Bureau of Soils and Water Management – Dept. of Agriculture • Local Government Units (LGUs) with peatland areas

iii. NFP for Haze Management and Monitoring and its supporting agencies

NFP /Lead Agency	Agencies supporting NFP
Forest Management Bureau-DENR (National Monitoring Center for AATHP & National Focal Agency for forest fire)	• Environmental Management Bureau (EMB)-DENR • Bureau of Fire Protection (BFP) • Philippine Atmospheric, Geophysical &Astronomical Services Administration (PAGASA)

Policies
Since 2006, assessment of possible peatlands was conducted starting from Caimpugan PSF and Leyte Sab-a Peatland. In 2016, the Atlas of Philippine Inland Wetlands and Caves published by the BMB had recorded nine (9) peatland areas. As of 2019, a total of 24 possible peatlands areas all over the country had been reported, with 15 new records of peatlands added. The peatland coverage in the country is estimated to be 20,000 hectares. Peatland assessment activity is actively progressing in Philippines.

Regulations related to peatlands have been developed at the local level such as Municipal Ordinances in the Philippines. Three local governments have adopted "Peatland Protection and Conservation Ordinances" (Municipality of San Francisco, Agusan del Sur; Municipality of Talacogon, Agusan del Sur; and Sangguniang Bayan of Alangalang, Leyte). Peatland management concerns have been incorporated under the Technical Working Group on Inland Wetlands of the country.

Peatland fire is not a significant problem compared to dryland forest or agriculture fires in contributing to local and national level haze in Philippines. However, in September 2019 haze was blown by monsoon winds from fires in Indonesia and affecting some areas in Mindanao, Visayas and Cebu City[12]. Increased forest fire occurrences on peatland have been reported in recent years[13].

Data monitoring practices
Philippines monitors haze or air pollution through Environmental Management Bureau (EMB) under DENR. There were 96 air quality monitoring stations available nationwide[14]. These stations are situated in highly urbanized cities as well as rural areas in different regions of the country. Monitoring stations keep track of criteria pollutants or air pollutants for which National Ambient Air Quality Guideline (NAAQGV) values have been established (**Table G1**). These pollutants include Total Suspended Particulates (TSP), Particulate matter with diameter of less than 10 microns (PM10), Particulate matter with diameter of less than 2.5 microns (PM2.5), sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and ozone (O_3).

Table G1: Information by national agencies related to air pollution

Air quality monitoring stations	Parameters measured	Website	Update frequency	Index measurement
94	Ozone (O_3), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), PM10, PM2.5, TSP	https://air.emb.gov.ph/	Daily	Air Quality Index (AQI)

A pollution standard index of air quality, called the Air Quality Index (AQI) was formulated in line with Republic Act (RA) 8749 or Clean Air Act (CAA). Daily reports of the AQI have been made available through DENR-EMB website: https://air.emb.gov.ph/ambient-air-quality-monitoring/. The air quality is classified into 6 different AQI categories namely Good (less than 25), Fair (25.1-35), Unhealthy for Sensitive Groups (35.1-45), Very Unhealthy to Hazardous (45.1-55), Acutely Unhealthy (55.1-90) and Emergency (Above 91).

The Philippine Atmospheric, Geophysical and Astronomical Services Administration abbreviated as PAGASA is the national meteorological agency mandated to provide various daily weather information of rainfall, temperature, wind speed, wind direction, relative humidity and climate outlook through their website (http://bagong.pagasa.dost.gov.ph/). These datasets are the suggested information to be monitored according to ASEAN SOP. There are another system developed by PAGASA to provide near real time weather analysis namely NOAH (http://noah.up.edu.ph/#/weather/all) and PHILSENSORS (http://philsensors.asti.dost.gov.ph). PAGASA monitors drought occurrence through several indicator such as rainfall, precipitation and NDVI[15]. Monthly drought assessment prepared by PAGASA are classified into 4 categories namely drought, dry spell, dry condition and not affected[16].

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[12] Referred to https://www.straitstimes.com/asia/se-asia/haze-reaches-cebu-in-central-philippines
[13] Referred to https://www.pna.gov.ph/articles/1082580 and https://mindanaodailynews.com/news/front-page/todays-top-stories/officials-move-to-prevent-recurring-peatland-fire
[14] Referred to http://air.emb.gov.ph/wp-content/uploads/2020/11/National-Air-Quality-Status-Report-2008-2015_With-message-from-D.pdf
[15] https://knowledge.unccd.int/sites/default/files/country_profile_documents/1%2520FINAL_NDP_Philippines.pdf
[16] Referred to
https://knowledge.unccd.int/sites/default/files/country_profile_documents/1%2520FINAL_NDP_Philippines.pdf

Regional Climate Centre (RCC) are Centres of Excellence that assist WMO Members in a specific region to deliver climate services and products. In ASEAN, the RCC is set up as a network (SEA RCC-Network). Each member in the RCC Network is referred to as a 'node' and performs one or more of the RCC functions and its related functions. Each node is led by an institution and SEA RCC-Network started with three nodes. The three nodes are represented by BMKG, PAGASA and Meteorological Service Singapore (MSS). The SEA RCC-Network entered demonstration phase in November 2017.

Under this mandate, PAGASA has developed Southeast Asia Climate Monitoring web application that provides operational and regularly updates information to help monitor the climate. Useful climate information available are typhoon tracks, soil moisture, Vegetation Health Index, Standard Precipitation Index, rainfall, temperature wind and monthly climate bulletin. In near future, these products will be enhanced and more will be added to better meet the requirements of the region. At a later stage, the RCC will expand its work to cover climate projections as well as outlook and monitoring products on the sub-seasonal timescales.

Hotspot and burn scar information are collected regularly by Agusan Marsh Wildlife Sanctuary (AMWS) management as this information needs to be monitored according to the Fire Management Plan. This information was collected daily during dry season with supported by drone monitoring in peatland forest areas. By integrating the data into GIS, the drone shots were mapped into the peatland map of Agusan Marsh peatlands and overlaid with hotspot map for further analysis to estimate of the damaged areas. However, there are limited technical knowledge to monitor hotspot and measurement of the extent of fire or haze by national relevant agencies (**Table G2**). There are also limited capacity for fire prevention and need more work to educating community and public.

Table G2: Assessment of information routinely gathered for fire and haze monitoring by NFP and NMC

Information	Source	Remarks
Hotspot	ASMC	• Ground verification and suppression with patrollers in protected area • Unclear documentation to regional level
FDRS	NA	
Burned area	NA	
Weather information and forecast	National agencies	

Gaps and capacity development needs
Generally, there are several gaps in technical knowledge, skills and manpower related to peatland management in Philippines. The extent of peatland areas is not fully determined as there is a lack of equipment and resources to undertake the mapping and assessment works. There are also limited budget for delineation and mapping extent of peatland area subject to ground verification. Limited research and documentation available on peatland in Philippines to serve as reference. However, collaborative peatland assessment work with university and education institutes shows that the Philippines has the capacity in Remote Sensing mapping methods and applications.

In terms of fire management, there are lack of technical knowledge and skills in terms of land and peatland fire suppression, prevention and monitoring. Documentation of data collection activity, monitoring practices and reporting to regional level remain unclear. Support by NMC to monitor

weather elements related to forest fire also unclear. Hotspot, FDRS and burnt area monitoring is not currently practiced.

High priority in the conduct of scientific research on drought and fire risk assessment are needed. Outcome from the scientific research will support the establishing of early warning system for fire detection and prevention. This is also crucial in starting up values for different fire weather index based data and eventually national FDRS. Currently, Memorandum of Agreement between the Bureau of Fire Protection and PAGASA has been signed for the development of national FDRS system.

In general, Philippines needs supports in terms of technical skill especially in peatland assessment, hotspot, FDRS, burnt area and haze monitoring. Training on peatland assessment including carbon stock assessment and GHG flux emission are much needed. Besides that, support in GIS and other applicable software for peatland mapping is also important. While training on peatland was conducted in 2010, there is no follow up trainings for the new technical staffs especially in the field offices. In the 2010 training, the Philippines followed and used as reference the peatland definition criteria of "65% organic matter" which is not fully applicable to some areas in the Philippines and should be broadened to include sites with more than 30% organic matter in line with FAO and other international definitions. Training on proper peatland assessment is required prior to peatland mapping activity. This training is very important especially for the field offices who conduct the actual assessment and mapping as part of their jurisdiction. Apart from that, capacity development in equipment handling, operation, and maintenance also much needed in peatland assessment and fire management aspect.

Future Priorities for Peatland Management

Priorities in Philippines for the period 2021 to 2030 as identified by feedback by ATFP NFP and other national stakeholders in response to the APMS Review, include the following:
1. High priority to increase capacity of trained personnel to conduct assessment
2. High priority to assess problems and constraints. Profiling and assessment of peatland area and inclusion of peatland in Permanent Protected Area
3. High priority for research. Support needed to local academe (financial, equipment, infrastructure) to conduct scientific R&D activities
4. Research and Development in peatland for Carbon Storage, Assessment of Flora and Fauna population and extensive Hydrology Study, Flood Risk - Assessment and Impact including Mitigation Measures.
5. High priority in the conduct of scientific R & D on drought and fire risk assessment
6. Medium/High priority to scale up awareness to various institutions, stakeholders and community especially policy makers, need more local experts
7. To enhance CEPA programmes to improve public awareness especially for local communities and through educational events with young generation
8. Medium/High priority to share peatland management related information (i.e. peat area, drought monitoring)
9. Need continuity effort through publications, information centre, websites, workshops, conferences and field advisory, need media engagement
10. High priority to develop and strengthen policies and legislation
11. Mainstreamed peatland in the Work and Financial Plan of the concerned agencies
12. High priority to have multi-stakeholder collaboration
13. Linkage to climate change and NDC (GHG emission)
14. High priority to promote biodiversity conservation for peatlands
15. Implementation of Philippine Biodiversity Strategy and Action Plan (2015-2028); Agusan Marsh acknowledged as a key biodiversity area in PBSAP

16. High priority to promote IPM
17. Include the Leyte Sab-a on the current Masterplan Formulation of Leyte River basin planning facilitated by the DENR RBCO
18. Enhance stakeholder engagement and support include delineate boundaries
19. High priority to identify and document best practices in peatland management (conservation and cultivation areas)
20. To promote the BMPs and replicate the BMPs to other areas
21. Provide appropriate peatland friendly livelihood support/trainings to the local organization/community to effectively manage the peatland
22. High priority to develop appropriate techniques include identify indigenous and typhoon-resistant species
23. A direct intervention program under the Philippine Biodiversity Strategy and Action Plan (PBSAP)
24. To increase investment/ development fund for innovative technologies and application of tested techniques at the site (some available cost effective techniques identified and to be replicated at site)
25. Reinstatement and Reversion of "CARPed distributed lands" in the Leyte Sab-a Peat Swamp through DENR and DAR collaboration and partnership
26. High priority to improve peatland function for carbon storage and incorporate into climate change adaptation processes
27. Mainstreaming climate change in biodiversity planning and management
28. To promote rehabilitation and restoration of degraded peatlands for carbon sequestration and storage.
29. Medium/high priority to strengthen collaboration among AMS in peatland management
30. Ongoing regional programmes/projects: EU-SUPA, IFAD-MAHFSA
31. High priority to identify, search and attract financial support for peatland e.g. carbon projects, CSR, etc. (domestic and international funding)

Priorities for Capacity Development

Capacity development needs as identified from the feedback in the questionnaire from the final review of the implementation of the ASEAN Peatland Management Strategy (APMS, 2006-2020) and other sources are shown in **Table G3**. The types of capacity development have been classified based on the 5 potential areas of focus as presented to the First MAHFSA Programme Steering Committee Meeting in November 2019.

Table G3: Proposed priorities for capacity development for Philippines as identified through this CDNGA

Focus 1: Peatland inventory, mapping, assessment of degradation status, Monitoring (APSMPE T1)	
1. Capacity development	*Peatland assessment and mapping*
Possible trainer	• GEC
Institution/people to be trained	• Biodiversity Management Bureau (BMB), Department of Environment and Natural Resources (DENR) • Supporting agencies
Focus 2: Peatland Fire Prevention Measures (APSMPE T2/Roadmap S2)	
2. Capacity development	*Training on fire risk warning (including Fire Danger Rating System operation and promotion) and fire prevention*
Possible trainer	• Interim ACC/ASMC • GEC

	• Regional platform via ASEAN Framework • BMKG/LAPAN Indonesia
Institution/people to be trained	• National Monitoring Centre • DENR • PAGASA • Supporting agencies • Field patrollers
3. Capacity development	***Technology transfer in fire prevention and rehabilitation effort including using of satellite***
Possible trainer	• Regional expert i.e. Indonesia • Regional platform via ASEAN Framework
Institution/people to be trained	• DENR • Supporting agencies
4. Capacity development	***Training for rangers and forest firefighter team on fire suppression***
Possible trainer	• Bureau of Fire Protection
Institution/people to be trained	• DENR provincial and protected area units • Provincial and local government including fire-fighters • Field patrollers
Focus 3: Peatland Fire and Haze Occurrence (APSMPE T2/Roadmap S2)	
5. Capacity development	***Monitoring and reporting of peatland fire and haze occurrence (Result Management System)***
Possible trainer	• DENR (BMB and Forest Management Bureau) • ASMC • Regional Southeast Asia Wildland Fire Network
Institution/people to be trained	• DENR • National Monitoring Centre • Supporting agencies Field patrollers
Focus 4: Resources allocate and generated for peatland management and fire prevention	
6. Capacity development	***Explore collaboration on peatland management and fire prevention***
Possible trainer	BMB, DENR
Institution/people to be trained	• DENR • Bureau of Fire Protection (BFP) • Bureau of Soils and Water Management – Dept. of Agriculture • Supporting agencies • Stakeholders
7. Capacity development	***Awareness raising on peatland value, sustainable use and ecosystem services to communities and public***
Possible trainer	• Biodiversity Management Bureau (BMB), Department of Environment and Natural Resources (DENR)
Institution/people to be trained	• DENR Offices - Forest Management Bureau; Ecosystems Research and Development Bureau; DENR field offices

	• Bureau of Soils and Water Management – Dept. of Agriculture • Local Government Units (LGUs) with peatland areas • NGO • Universities • Supporting agencies • Stakeholders
Focus 5: Implementation of NAPPs, APMS, Roadmap	
8. Capacity development	***Capacity development in rehabilitation and conservation***
Possible trainer	• BMB, DENR • Regional platform via ASEAN Framework
Institution/people to be trained	• DENR • Supporting agencies • Stakeholders
9. Capacity development	***Awareness enhancement and peer learning from regional BMPs for community activities***
Possible trainer/facilitator	• BMB, DENR • Regional platform via ASEAN Framework
Institution/people to be trained	• DENR • Supporting agencies • Local stakeholders
10. Capacity development	***Knowledge exchange to enhance peatland governance and policies***
Possible trainer	• BMB, DENR • Regional platform via ASEAN Framework
Institution/people to be trained	• DENR • Supporting agencies • Private sector • Research institutions
11. Capacity development	***Peatland and climate change***
Possible trainer	• Regional platform via ASEAN Framework
Institution/people to be trained	• BMB, DENR • Supporting agencies • Private sector • Research institutions
12. Capacity development	***Operation of tools and equipment for combating of land and forest fire***
Possible trainer	• Bureau of Fire Protection (BFP)
Institution/people to be trained	• DENR • LGUs • Supporting agencies

h) Singapore

Institutional Arrangement

i. National Focal Points on ASEAN Agreement on Transboundary Haze Pollution (AATHP), ASEAN Task Force on Peatlands (ATFP) and National Monitoring Centre (NMC)

NFP of COM AATHP	NFP of ATFP	NMC
National Environment Agency	National Environment Agency	Meteorological Service Singapore

ii. Nominated National Focal Point and supporting agencies on peatland management in AMS (inputs from AMS to questionnaire)

National Focal Point (NFP) / Lead Agency	Agencies supporting the NFP
National Environment Agency, Singapore	NA

iii. NFP for Haze Management and Monitoring and its supporting agencies

NFP /Lead Agency	Agencies supporting NFP
National Environment Agency, Singapore	• The Government of Singapore convenes the "Haze Task Force", comprising 28 government agencies and is led by the National Environment Agency.

Singapore has no significant reported peatlands in the country. However, it is affected by transboundary haze pollution. Singapore supports the regional effort in mitigating transboundary haze pollution through activities such as (i) enhanced hotspot monitoring of peatlands; (ii) advocacy on sustainable management of peatlands; and (iii) conducting workshops that contribute towards capacity building in ASEAN in the domain of fire prevention and peatland management. Singapore has also been supporting the regional action on haze and fire monitoring, weather prediction and research on peatlands.

Data Monitoring practices

The air quality in Singapore is continuously monitored by The National Environment Agency (NEA). The parameters measured are Sulphur Dioxide (SO_2), particulate matter smaller than 10 microns (PM10), particulate matter smaller than 2.5 microns (PM2.5) Nitrogen Dioxide (NO_2), Carbon Monoxide (CO) and Ozone (O_3). The Pollutants Standard Index (PSI) is computed from the six air pollutants and categorised as Good, Moderate, Unhealthy, Very Unhealthy or Hazardous depending on the concentration of these air pollutants (**Table H1**).

The air quality monitoring stations are strategically located to accurately assess the air quality in different parts of Singapore. Of the 22 fixed stations, 18 monitor general ambient air quality and 4 roadside air quality[17]. The ambient stations are sited to represent air quality that the population is exposed to for the different types of environments found in Singapore such as in urban, industrial and suburban area. The roadside stations are used to assess the effectiveness of Singapore's vehicular emission control programmes.

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[17]

https://va.ecitizen.gov.sg/CFP/CustomerPages/NEA_google/displayresult.aspx?MesId=1068830&Source=Google&url=va.ecitizen.gov.sg

Table H1: Information related to air pollution

Air quality monitoring stations	Parameters measured	Website	Update frequency	Index measurement
22	Ozone (O_3), nitrogen dioxide (NO_2), carbon monoxide (CO), sulphur dioxide (SO_2), PM10, PM2.5	https://www.haze.gov.sg/ https://www.nea.gov.sg/index	Hourly	Pollutants Standard Index (PSI)

The Meteorological Service Singapore hosts the ASMC which serves as the designated regional centre for the monitoring and assessment of land/forest fires and smoke haze and the provision of early warning of transboundary smoke haze in the region. The alerts are disseminated through the ACC, currently managed by the ASEC. ASMC's remit also covers research and development in tropical weather, climate systems, climate variability/change and regional capability-building.

ASMC leverages the latest satellites from the US, Japan, Korea and China to improve the detection of land fires/smoke haze. It also operates an advanced dispersion modelling system customised for the Southeast Asia region to forecast the transport of smoke haze.

ASMC's Regional Capability Building Programme aims to help ASEAN countries address the evolving needs and challenges in four key areas: weather forecasting, sub-seasonal to seasonal prediction, climate projections and fire/smoke haze monitoring. ASMC hosts a website (https://asmc.asean.org/home/) which provides regional haze, weather and climate information including the transboundary haze Alert Levels and air quality information from selected AMS monitoring stations.

Future Priorities for Peatland Management
Priorities in Singapore for the period 2021 to 2030 as identified by feedback by ATFP NFP and other national stakeholders in response to the APMS Review, include the following:
1. High priority to provide regional or bilateral support to neighbouring AMS.
2. Enhance prevention, control and monitoring of peatland fires and transboundary haze through collective efforts among the AMS.
3. Promote and enhance regional cooperation through information exchange and sharing
4. Stimulate awareness and understanding on peatland issues and build capacity on sustainable management of peatlands in the region.

i) Thailand
Institutional Arrangement
i.   National Focal Points on ASEAN Agreement on Transboundary Haze Pollution (AATHP), ASEAN Task Force on Peatlands (ATFP) and National Monitoring Centre (NMC)

NFP of COM AATHP	NFP of ATFP	NMC
Pollution Control Department (PCD), MNRE	Department of National Park, Wildlife and Plant Conservation, MNRE	Department of National Park, Wildlife and Plant Conservation, MNRE

ii.   Nominated National Focal Point and supporting agencies on peatland management in AMS (inputs from AMS to questionnaire)

National Focal Point (NFP) / Lead Agency	Agencies supporting the NFP
Department of National Parks, Wildlife and Plant Conservation (DNP)	• Royal Forestry Department (RFD) • Pollution Control Department (PCD) • Geo-Informatics and Space Technology Development Agency (GISTDA)

iii.   NFP for Haze Management and Monitoring and its supporting agencies

NFP /Lead Agency	Agencies supporting NFP
Pollution Control Department (PCD)	• Department of National Parks, Wildlife and Plant Conservation (DNP) • Royal Forestry Department • Geo-Informatics and Space Technology Development Agency (GISTDA)

Policies
Thailand has a comparatively small area of peatland. It covers about 65,000ha which is less than 0.15% of the total land area of the country. Peatlands are found in certain areas in the southern provinces occur in central and southern Thailand, mostly in the peninsular region and located inside protected areas. A National Action Plan on Peatlands was developed in 2014 to guide action on peatland management.

Forest fires in Thailand annually occur during the dry season from December to May with their peak in February or March. All fires are man-caused, especially by the rural people who live in or adjacent to forests. Slash-and-burn practices from unsustainable agricultural practices also a cause of the fires.

Peatland elements have been incorporated into various frameworks such as the National Economic and Social Development Plan, Wetland Policy and National Forest Policy. The National Forest Policy stated that a substantial plan for tackling deforestation problem such as shifting cultivation and forest fire including on peatland must be determined. Suppression of forest fire and law enforcement must be clearly stated. All peatland management have been practiced in line with existing laws including the Constitutional Code (1997) which is the highest law with elements of sustainable management of natural resources and environment. Biodiversity conservation and ecosystem management in development and planning have been incorporated in national acts such as the National Parks Act 1961, the National Reserved Forests Act 1964 and the Wildlife Preservation and Protection Act 1992. Thailand has their 5 year rolling Development Plans which includes promotion of natural resources management. Land and

natural resources are being managed by and under the authority of the provincial government, who has respective policies and regulations to govern the resources.

Data monitoring practices
During dry season, forest fire and haze prevention measures are undertaken by mobilizing both land and aerial tools and equipment. Fire risk area are define using Remote sensing and GIS technology and integrated with ground patrolling activity. Information on the fire prone areas and monitoring of the fire occurrences are shared to public under integrated system (http://fire.gistda.or.th/). The information provided by GISTDA covers the northern ASEAN region. Hotspot information from MODIS is updated 4 times daily while hotspot information from VIIRS are updated twice daily. Apart from hotspots, the platform also shares air quality information, measurement from particulate matter with diameter of less than 10 microns (PM10), particulate matter with diameter of less than 2.5 microns (PM2.5) as well as regular comprehensive report in PDF format of forest fire occurrences in the country. However, the system is only available in Thai language.

DNP shares FDRS information through (http://www2.dnp.go.th/gis/FDRS/FDRS.php) with a 5 day forecast. The FDRS information covers the northern ASEAN region. Air quality are monitored and updated hourly by PCD through website (http://air4thai.pcd.go.th/webV2/region.php?region=0). The air quality classified into 5 different AQI categories namely Excellent (less than 25), Satisfactory (26-50), Moderate (51-100), Unhealthy (101-200), Very Unhealthy (201 and above) (**Table I1**). Monitoring of hotspot, FDRS and air quality were integrated with ground patrolling and aerial monitoring from drone and UAV (**Table I2**).

Table I1: Information by national agencies related to air pollution

Air quality monitoring stations	Parameters measured	Website	Update frequency	Index measurement
111	Ozone (O_3), nitrogen dioxide (NO_2), carbon monoxide (CO), sulphur dioxide (SO_2), PM10, PM2.5	http://air4thai.pcd.go.th/webV2/region.php?region=0	Hourly	Air Quality Index (AQI)

Table I2: Assessment of information routinely gathered for fire and haze monitoring.

Information	Source	Remarks
Hotspot	• ASMC • GISTDA	• Ground verification and suppression with patrollers
FDRS	• DNP	• Inform stakeholders at local and national level
Burned area	• GISTDA	• Technical report to decision maker
Weather information and forecast	• National agencies • ASMC	• Integrate with GIS for further analysis and scientific research

Gaps and capacity development needs

Generally, the agencies have sufficient capacity and resources to undertake work in fire and haze prevention. However, additional resources and support in new innovation technology will help the agencies to better undertaking fire and haze prevention measures. Documentation of data collection activity, monitoring practices and reporting to regional level remain unclear. Thailand Fire Monitoring System by GISTDA is a comprehensive system cover the Northern ASEAN region. However, it is only available in Thailand language.

Future Priorities for Peatland Management

Priorities in Thailand for the period 2021 to 2030 as identified by feedback by ATFP NFP and other national stakeholders in response to the Final Review of the APMS (2006-2020), include the following:

1. High priority to determine the extent and status of peatlands in the ASEAN region
2. High priority to Monitor and evaluate peatland status and management
3. High priority to undertake priority research activities
4. High priority to enhance public awareness on importance of peatlands, their vulnerability to fire and the threat of haze through implementation of a comprehensive plan
5. High priority to develop or strengthen policies and legislation to protect peatlands and reduce peat fire
6. High priority to reduce and minimise occurrence of fire and associated haze
7. High priority to promote conservation of peatland biodiversity
8. High priority to promote integrated forest and peatland management
9. High priority to promote best management practices through documentation and demonstration sites
10. Medium priority to develop appropriate techniques for the restoration or rehabilitation of degraded peatlands
11. High priority to protect and improve function of peatlands for carbon sequestration and storage
12. High priority to support incorporation of peatlands into climate change adaptation processes
13. High priority to generate financial resources and incentives required for the programmes and activities to achieve targets of the strategy

Priorities for Capacity Development

Capacity development needs as identified from the feedback in the questionnaire from the final review of the implementation of the APMS 2006-2020 and other sources are shown in **Table I3**. The types of capacity development have been classified based on the 5 potential areas of focus as presented to the First MAHFSA Programme Steering Committee Meeting in November 2019.

Table I3: Proposed priorities for capacity development for Thailand as identified through this CDNGA

Focus 1: Peatland inventory, mapping, assessment of degradation status, Monitoring (APSMPE T1)	
Low priority	
Focus 2: Peatland Fire Prevention Measures (APSMPE T2/Roadmap S2)	
1. Capacity development	*Training on fire risk warning (including Fire Danger Rating System operation and promotion) and fire prevention*
Possible trainer	• Interim ACC/ASMC • DNP, MNRE • Regional Southeast Asia Wildland Fire Network

Institution/people to be trained	• National Monitoring Centre • DNP, MNRE • Pollution Control Department (PCD), MNRE • Royal Forestry Department, MNRE • Supporting agencies • Field patrollers • Stakeholders (NGO/CSOs)
2. Capacity development	***Technology transfer in fire prevention and rehabilitation effort including using satellite***
Possible trainer	• Regional platform via ASEAN Framework • Regional expert i.e., Indonesia • DNP, MNRE • Geo-Informatics and Space Technology Development Agency (GISTDA)
Institution/people to be trained	• DNP, MNRE • Royal Forestry Department, MNRE • Supporting agencies
3. Capacity development	• ***Training for rangers and forest fire-fighter team on fire management***
Possible trainer	• DNP, MNRE
Institution/people to be trained	• Supporting agencies • Forest and protected area management agencies • Field patrollers • Local communities
Focus 3: Peatland Fire and Haze Occurrence (APSMPE T2/Roadmap S2)	
4. Capacity development	***Monitoring and reporting of peatland fire and haze occurrence (Result Management System)***
Possible trainer	• DNP, MNRE • GISTDA • Regional Southeast Asia Wildland Fire Network
Institution/people to be trained	• DNP, MNRE • PCD, MNRE • Royal Forestry Department, MNRE • Ministry of Interior (MOI): Department of Disaster Prevention and Mitigation • National Monitoring Centre
4. Capacity development	***Monitoring and reporting of peatland fire and haze occurrence (Result Management System)***
	• Supporting agencies • Field patrollers
Focus 4: Resources allocate and generated for peatland management and fire prevention	
5. Capacity development	***Explore collaboration on peatland management and fire prevention***
Possible trainer	• DNP, MNRE • The Center for People and Forests (RECOFTC)

Institution/people to be trained	• Department of National Park, Wildlife and Plant Conservation, MNRE • Royal Forestry Department, MNRE • Ministry of Agriculture and Cooperatives (MOAC), Ministry of Transport, Ministry of Defence and The Prime Minister's Office • Supporting agencies • NGO • Stakeholders
6. Capacity development	***Awareness raising on peatland value, sustainable use and ecosystem services to communities and public***
Possible trainer	• DNP, MNRE • RECOFTC
Institution/people to be trained	• DNP, MNRE • PCD, MNRE • Royal Forestry Department, MNRE • Supporting agencies • MOAC, Ministry of Transport, Ministry of Defence and The Prime Minister's Office • MOI: Department of Disaster Prevention and Mitigation • Stakeholders
Focus 5: Implementation of NAPPs, APMS, Roadmap	
7. Capacity development	***Capacity development in rehabilitation and conservation***
Possible trainer	• DNP, MNRE • Regional platform via ASEAN Framework • RECOFTC
Institution/people to be trained	• Royal Forestry Department, MNRE • Peatland management agencies • Supporting agencies • Stakeholders
8. Capacity development	***Awareness enhancement and peer learning from regional BMPs for community activities***
Possible trainer	• DNP, MNRE • RECOFTC • Regional platform via ASEAN Framework
Institution/people to be trained	• DNP, MNRE • PCD, MNRE • Royal Forestry Department, MNRE • MOAC, Ministry of Transport, Ministry of Defence and The Prime Minister's Office • MOI: Department of Disaster Prevention and Mitigation • Supporting agencies • Stakeholders
9. Capacity development	***Knowledge exchange to enhance peatland governance and policies***
Possible trainer	• DNP, MNRE • RECOFTC

	• Regional platform via ASEAN Framework • Regional Southeast Asia Wildland Fire Network
Institution/people to be trained	• DNP at provincial level • PCD, MNRE • Royal Forestry Department, MNRE • MOAC, Ministry of Transport, Ministry of Defence and The Prime Minister's Office • MOI: Department of Disaster Prevention and Mitigation • NGO • Supporting agencies • Private sector • Research institutions
10. Capacity development	*Peatland and climate change*
Possible trainer	• MNRE • Ministry of Energy (MoE) • GIZ[18] • Regional platform via ASEAN Framework
Institution/people to be trained	• DNP, MNRE • PCD, MNRE • Royal Forestry Department, MNRE • MOAC, Ministry of Transport, Ministry of Defence and The Prime Minister's Office • MOI: Department of Disaster Prevention and Mitigation • Ministry of Energy (MoE) • Supporting agencies • Private sector • Research institutions • NGOs/CSOs

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[18] https://www.giz.de/en/worldwide/53592.html

j) Viet Nam

Institutional Arrangement

i. National Focal Points on ASEAN Agreement on Transboundary Haze Pollution (AATHP), ASEAN Task Force on Peatlands (ATFP) and National Monitoring Centre (NMC)

NFP of COM AATHP	NFP of ATFP	NMC
Forest Protection Department, Ministry of Agriculture and Rural Development (MARD)	Forest Protection Department, Ministry of Agriculture and Rural Development (MARD)	Centre for Environmental Monitoring, Ministry of Natural Resources and Environment (MONRE)

ii. Nominated National Focal Point and supporting agencies on peatland management in AMS (inputs from AMS to questionnaire)

National Focal Point (NFP) / Lead Agency	Agencies supporting the NFP
Forest Protection Department, Ministry of Agriculture and Rural Development	• Ministry of Nature Resources and Environment/ Ministry of Agriculture and Rural Development

iii. NFP for Haze Management and Monitoring and its supporting agencies

NFP /Lead Agency	Agencies supporting NFP
Forest Protection Department, Ministry of Agriculture and Rural Development	Ministry of Agriculture and Rural Development

Policies

Forest fires in Vietnam are mainly linked to conversion of forests into other land use types such as for agriculture as well as disposal of agricultural residues. A Master plan has been implemented on improving forest fire prevention and suppression capacity by invest in technical facilities and equipment as well as consolidate the organization of the specialized fire prevention and fighting force of the forest protection service. An annual plan has been developed for preventing forest fire at national and local levels by implementing forest fire control and monitoring activities. There are also targets to achieve a decrease forest fire counts and forest damaged. In accordance with the law of Viet Nam "Organizations, households, individuals and communities have the responsibility to promptly notify competent state agencies or forest owners of forest fires; obey the mobilization of human and vehicle when a forest fire occurs". Related policies in fire prevention are the Law on fire prevention and fighting; and Forest Law.

There is a relatively small area of remaining peatlands as most have been lost of severely degraded over the past 40 years due to fire, drainage and extraction of peat for fertiliser. The only significant remaining peatlands are in the U Minh Thoung and U Minh Ha National Parks in the south of the country. A national action plan on peatlands was prepared, but has yet to be approved.

Data monitoring practices

Forest Protection Department (FPD), Ministry of Agriculture and Rural Development of Vietnam has deployed a satellite data receiving station in Hanoi with the primary purpose of early forest fire detection over Vietnam. The system named FireWatchVN, which includes near real-time active fire hotspot detection, interactive web-mapping fire visualization, fire database and statistical analysis functions (**Table J1**). Built on the Web technology, FireWatchVN provides updated fire detection information from MODIS, NOAA data; updates low resolution image for fire; allows to search fires in history data according to date and by location; and provides information

fire warning and statistical fire data. It is publicly accessible at (http://firewatchvn.kiemlam.org.vn/gioi-thieu).

An air quality monitoring system is relatively new in Viet Nam, but some donors have provided sensors to monitor air quality mainly in Hanoi (https://moitruongthudo.vn/). The developed systems are run in collaboration with government agency (**Table J2**). However, the number of monitoring station is still increasing over time[19]. Distribution of ground-based air quality are focusing in some parts of the country only and this increases the challenge in monitoring the occurrence of transboundary haze.

Table J1: Assessment of information routinely gathered for fire and haze monitoring.

Information	Source	Remarks
Hotspot	• ASMC • FireWatchVN[20]	• Ground verification and suppression with patrollers • Inform stakeholders at local and national level • Technical report to decision maker • Integrate with GIS for further analysis
FDRS	• Forest Protection Department	
Burned area	• FireWatchVN	
Weather information and forecast	• National agencies • ASMC	

Table J2: Information by national agencies related to air pollution

Air quality monitoring station	Parameter measured	Website	Update frequency	Index measurement
34	Ozone (O3), nitrogen dioxide (NO2), carbon monoxide (CO), sulphur dioxide (SO2), PM10, PM2.5	https://moitruongthudo.vn/	Daily	Air Quality Index (AQI)

Gaps and capacity development needs
Generally, there are limited research related to peatland and sustainable agriculture practices on peatland. A national action plan on peatlands has been developed but has yet to be adopted.

Assistance is needed to develop legislative and regulatory measure on forest fire management. Capacity development training also needed for fire management especially training of forest fire specialised units. More support is necessary in strengthening air quality monitoring capacity. Documentation of data collection activity, monitoring practices and reporting to regional level remain unclear.

[19] Referred to https://www.rmit.edu.au/about/our-values/sustainable-development-goals/goal-3/air-quality-monitoring-stations-vietnam
https://www.envea.global/hanois-11th-air-quality-monitoring-station-installed-at-french-embassy/
https://www.giz.de/en/worldwide/75901.html
[20]
https://www.researchgate.net/publication/317871188_A_Review_of_Forest_Fire_Information_Technologies_in_Vietnam https://www.restec.or.jp/geoss_ap1/materials/PDF/ForestFire/2day/2day_8_Hien.pdf

Future Priorities for Peatland Management

Priorities in Vietnam for the period 2021 to 2030 as identified by feedback by ATFP NFP and other national stakeholders in response to the APMS Review, include the following:

1. High priority to identify and mapping all peatland areas in the country
2. High priority for monitoring and evaluating peatland management and use
3. High priority to raise community awareness about peat conservation, development and sustainable use
4. Medium priority on information sharing as there are existing platforms
5. High priority to complete policies for effective management of peatland management and use
6. High priority to reduce occurrence of fire
7. High priority to identify species of flora and fauna in peatlands
8. High priority to strengthen the capacity of management agencies at national and local levels, especially for the national focal agency in the management and use of peatlands in the country
9. High priority to integrate management of water and fire prevention
10. High priority to promote integrated forest and peatland management
11. Medium priority to manage agriculture in peatland areas in integrated manner
12. High priority to support development of community livelihoods to protect peatland resources
13. Medium priority to promote integrated community livelihood and peatland management
14. Medium priority to promote best management practices
15. Medium priority to develop a restoration and rehabilitation plan for peatlands

Priorities for Capacity Development

Capacity development needs as identified from the feedback in the questionnaire from the final review of the implementation of the APMS 2006-2020 and other sources are shown in **Table J3**. The types of capacity development have been classified based on the 5 potential areas of focus as presented to the First Programme Steering Committee Meeting in November 2019.

Table J3: Proposed priorities for capacity development for Viet Nam as identified through this CDNGA

Focus 1: Peatland inventory, mapping, assessment of degradation status, Monitoring (APSMPE T1)	
1. Capacity development	*Peatland assessment and mapping*
Possible trainer	• GEC • Center for Environmental Science and Ecology (CESE), National University (national expert)
Institution/people to be trained	• MONRE • MARD • Supporting agencies
Focus 2: Peatland Fire Prevention Measures (APSMPE T2/Roadmap S2)	
2. Capacity development	*Training on fire risk warning (including Fire Danger Rating System operation and promotion) and fire prevention*
Possible trainer	• Interim ACC/ASMC • Department of National Park, Wildlife and Plant Conservation (DNP), Thailand • Forest Protection Department

	• Regional Southeast Asia Wildland Fire Network
Institution/people to be trained	• MONRE • MARD and related agencies at national and provincial levels • Forest and protected area management agencies
3. Capacity development	***Technology transfer in fire prevention and rehabilitation effort including using of satellite***
Possible trainer	• Regional expert i.e. Indonesia and Thailand • Regional platform via ASEAN Framework
Institution/people to be trained	• MONRE • MARD • Supporting agencies
4. Capacity development	***Training for rangers and forest fire-fighter team on fire suppression***
Possible trainer	• Forest Protection Department
Institution/people to be trained	• MARD and related agencies • Forest and protected area management agencies • Supporting agencies • Field patrollers
Focus 3: Peatland Fire and Haze Occurrence (APSMPE T2/Roadmap S2)	
Low Priority	
Focus 4: Resources allocate and generated for peatland management and fire prevention	
5. Capacity development	***Awareness raising on peatland value, sustainable use and ecosystem services to communities and public***
Possible trainer	• Forest Protection Department • CESE, National University (national expert) • IUCN • The Center for People and Forests (RECOFTC)
Institution/people to be trained	• MONRE • MARD • Supporting agencies Stakeholders
Focus 5: Implementation of NAPPs, APMS, Roadmap	
6. Capacity development	***Capacity development in rehabilitation and conservation***
Possible trainer	• CESE, National University (national expert) • Forest Protection Department • Regional platform via ASEAN Framework
Institution/people to be trained	• MARD • Peatland site management agencies (UMTNP and UMHNP) • Supporting agencies • Stakeholders

7. Capacity development	*Awareness enhancement and peer learning from regional BMPs for community activities*
Possible trainer/facilitator	• MONRE • Regional platform via ASEAN Framework • RECOFTC
Institution/people to be trained	• MONRE • MARD • Supporting agencies
8. Capacity development	*Knowledge exchange to enhance peatland governance and policies*
Possible trainer	• Forest Protection Department • Regional platform via ASEAN Framework
Institution/people to be trained	• MONRE • MARD • Supporting agencies • Research institutions

Annex 7: Trends of hotspot detected in the region

Based on available hotspot information from open sources in particular from ASMC website, further analysis was undertaken to understand better the trend of hotspots in the region. **Table 7.1** show the cumulative of annual hotspot detected in AMS that has been recorded in 8 years within 2013 to 2020. Hotspot in 8 AMS namely Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Thailand and Viet Nam, have been compared due to the significant amount of hotspot detected annually. The hotspots data were captured from satellite NOAA19 for dataset recorded within 2013 to 2019, while dataset for 2020 were captured from satellite NOAA20. Only high confidence level data were chosen.

Table 7.1: Total annual hotspot accumulation in AMS for 2013-2020 (Source: ASMC[21])

Total Annual Hotspots by Countries 2013 - 2020 (High Confidence Level)											
Country	2013	2014	2015	2016	2017	2018	2019	2020	Total	Average	Rank
Cambodia	29,231	27,971	33,776	31,936	17,765	24,212	28,002	28,838	221,731	27,716	3
Indonesia	25,619	49,084	58,106	9,379	5,547	13,712	32,416	5,721	199,584	24,948	4
Lao PDR	39,093	42,487	44,316	40,953	28,765	30,285	48,301	44,728	318,928	39,866	2
Malaysia	2,457	4,253	2,706	2,556	783	1,489	2,146	1,006	17,396	2,175	8
Myanmar	60,959	59,788	51,681	48,180	43,672	39,805	51,623	56,580	412,288	51,536	1
Philippines	2,927	4,262	5,998	6,804	2,205	2,778	5,417	4,894	35,285	4,411	7
Thailand	26,164	24,918	22,308	23,795	13,679	13,426	22,923	19,275	166,488	20,811	5
Viet Nam	14,396	19,453	17,747	16,078	7,904	9,276	12,797	12,307	109,958	13,745	6
Total	**200,846**	**232,216**	**236,638**	**179,681**	**120,320**	**134,983**	**203,625**	**173,349**	**1,481,658**		

There have been more than 1.4 million hotspots detected in ASEAN region within 2013 to 2020. The highest numbers of hotspot were detected in 2 continuous years from 2014 to 2015. The high number of hotspots detected at this time is linked to the significant dry season with regards to El Nino/Indian Ocean Dipole incident in 2014-15[22]. From the total hotspot detected annually, the general trend shows decreasing number of hotspots recorded from 2016 onwards with a slight peak in 2019 associated with the drought connected with the Indian Ocean Dipole. However, observation show that quite a high total number of hotspots recorded in 2020 (173,349 total hotspot) despite of La Nina condition and Covid-19 pandemic. Under the Covid-19 pandemic, 2 country recorded increase in the annual hotspot count compared to hotspot recorded in 2019, namely Myanmar and Cambodia. This was linked to the severe drought affecting the Mekong region for more than 5 months in early 2020.

The country with the highest number of hotspots detected is Myanmar. On average, Myanmar recorded 51,536 hotspots each year. The second highest hotspot count was detected in Lao PDR, followed by Cambodia and Indonesia. The lowest number of hotspots was detected in Malaysia. High number of accumulated hotspots were detected in countries located in northern ASEAN region. However, due to a small number of peat areas in the northern AMS, the hotspots detected were distributed all over the countries and not necessarily occurring in peat areas and were mainly

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[21] Annual hotspot count is available on ASMC website http://asmc.asean.org/asmc-haze-hotspot-annual-new#Hotspot
[22] Rupic et al, 2018
https://www.ncdc.noaa.gov/sites/default/files/attachments/ENSOTT_Report_02.26.2018%20FINAL%20draft.pdf

associated with land clearing and shifting cultivation. Due to the large scale of fires in this sub-region, it did result in several severe transboundary haze events.

There were increasing number of hotspots detected in Indonesia from 2013 to 2015. However, a significant decrease in hotspot detection was recorded in the following years of 2016-2020. This was due to a combination of wetter weather as well as enhanced action by the government in fire prevention. Indonesia ranked as the fourth country with the highest hotspot in ASEAN. However, with large area of the country as well as the large area of peatland in the country, many of the hotspot were detected on peat and led to transboundary haze problem within the region. Therefore, strengthening peat management and awareness programme in this country is a wise move.

Figure 7.1 shows the distribution of monthly hotspots which have been recorded by ASMC for 8 AMS within 2013 to 2020. From the graphs, there are a significant difference in hotspot distribution trends between countries located in the northern part of ASEAN region and countries located in the southern part of ASEAN region. This trend is aligned with the climate pattern and monsoon season in the region. Climatologically, two main monsoon seasons predominate in the region namely northeast monsoon from December to March and the southwest monsoon from June to September. Southwest monsoon season is characterised by rainy conditions in the northern ASEAN region and dry weather in the southern ASEAN region. The reverse applies for the southwest monsoon. This monsoon season affects the distribution of hotspots, forest fires and the occurrence of transboundary haze recorded in this region.
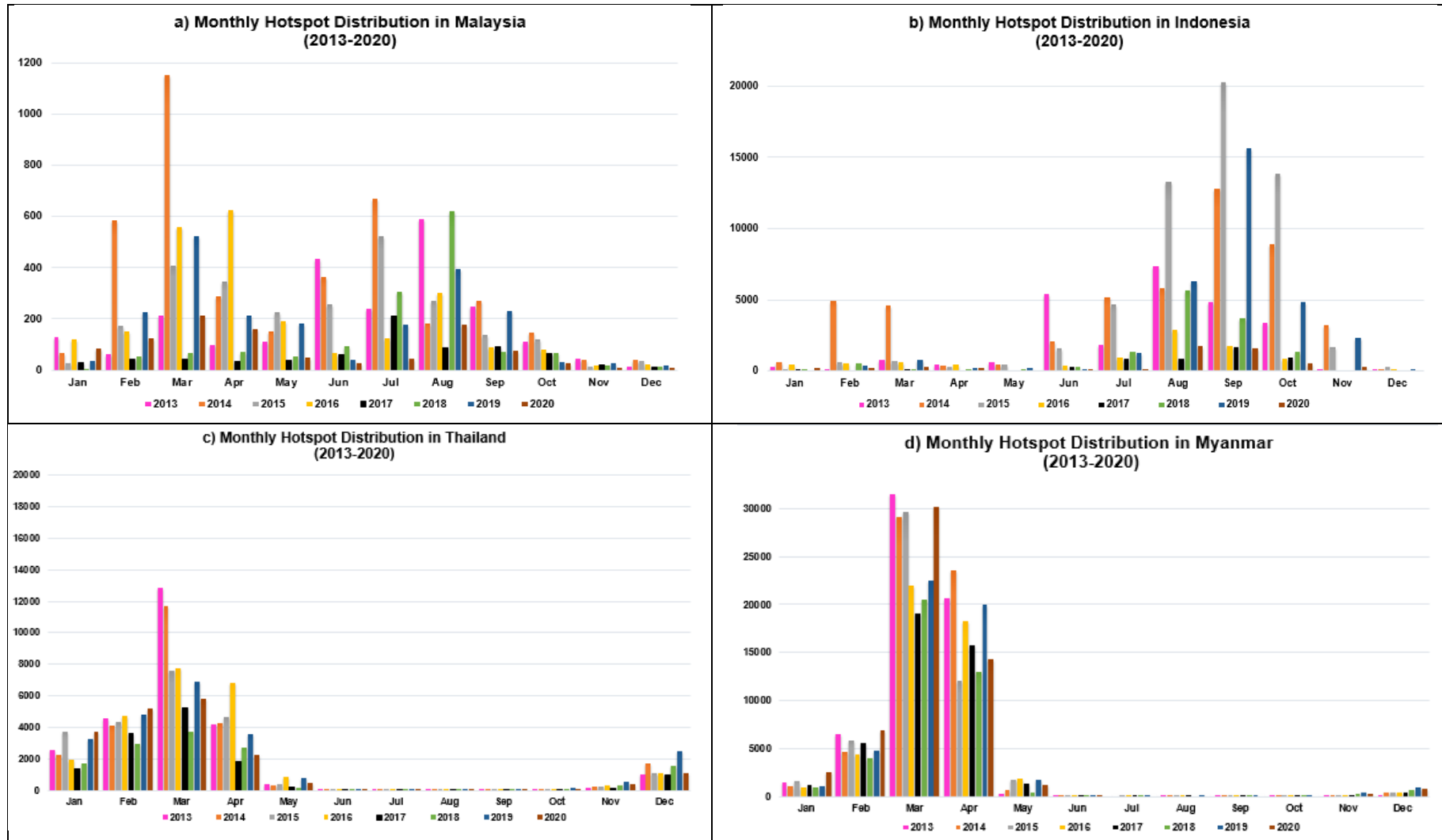
For countries located in the northern part of ASEAN region consisting of Cambodia, Lao PDR, Myanmar, Thailand, Viet Nam and Philippines, hotspots start to be recorded in November each year. The hotspots detected gradually increase when dry season begins with the onset of the northeast monsoon which started at end of the year around November and extended until May every year. Around June, with the onset of rainy season over northern ASEAN countries, hotspot activities are subdued. From observation, the number of hotspots recorded peaks around March and April each year and gradually decrease until end of the monsoon season around June.

For countries located in the southern ASEAN region which includes Indonesia and Malaysia, less rainfall normally occurs in February until March each year which will increase the likelihood to a high number of hotspots detected. The next dry season typically sets in around June until September. An increase in hotspot activities can be expected in the fire-prone provinces especially in Sumatra and Kalimantan during periods of drier weather. This may lead to transboundary haze pollution affecting parts of the region. From observation, the number of hotspots in southern ASEAN region shows a slight peak around February and March each year and another significant peak around August with respect to the dry season.
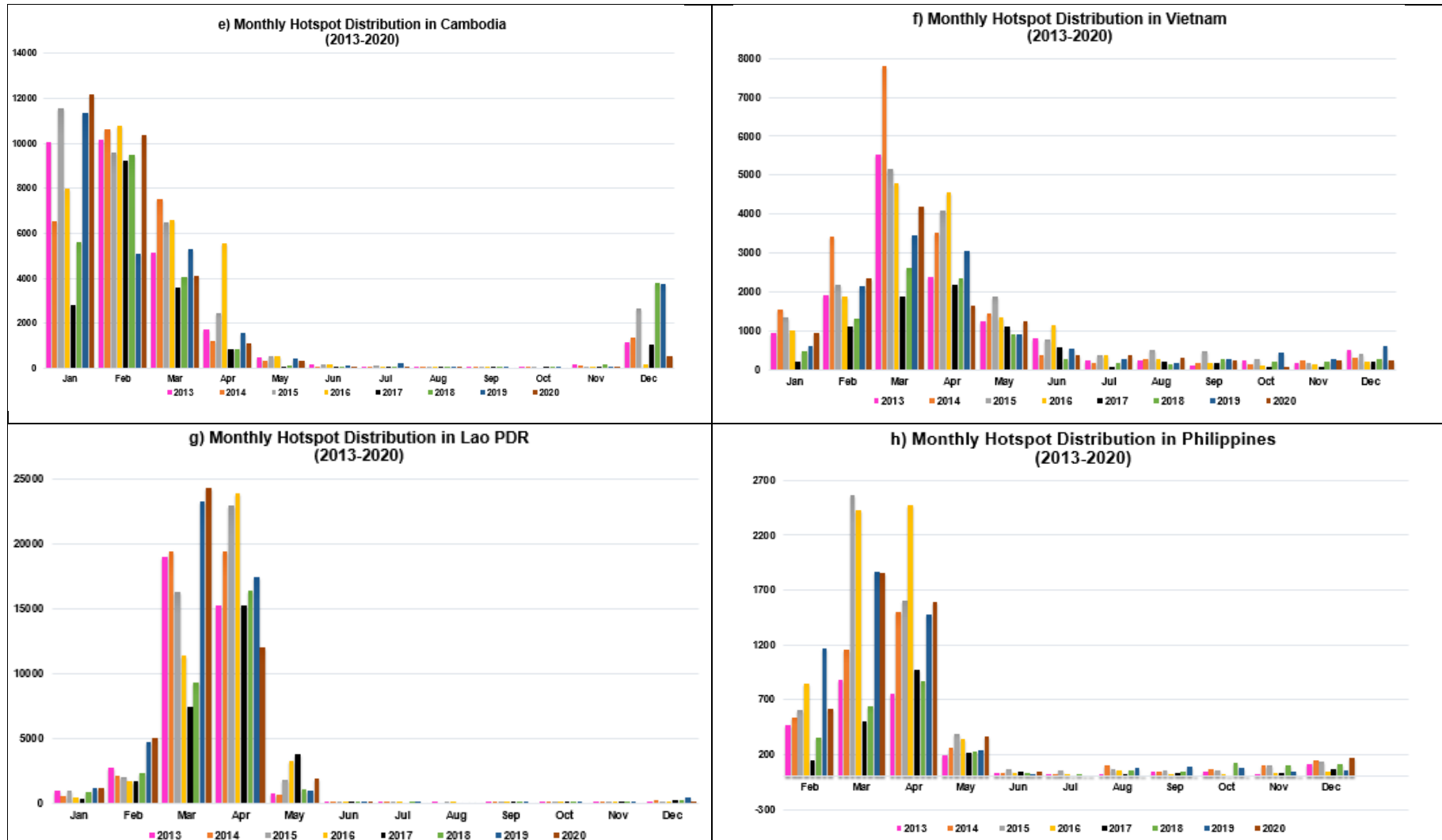
According to data on the ASMC website[23], there was a significant increase of hotspot recorded in Indonesia in 2014 and 2015. The total number of hotspots recorded in these 2 years is 107,190 contribute to 55% from the total hotspot recorded in 8 years in Indonesia. From the total number of hotspots detected within 8 years in Indonesia, 45% of them were detected in Sumatra and the remaining 55% were detected in Kalimantan. High number of hotspots were detected in August, September and October. The average number of hotspots in these 3 months were 5,268, 7,581 and 4,266, respectively. The numbers of hotspot detected peak in September.

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[23] http://asmc.asean.org/asmc-haze-hotspot-annual-new#Hotspot

a) Monthly Hotspot Distribution in Malaysia (2013-2020)

b) Monthly Hotspot Distribution in Indonesia (2013-2020)

c) Monthly Hotspot Distribution in Thailand (2013-2020)

d) Monthly Hotspot Distribution in Myanmar (2013-2020)

Figure 7.1: Distribution of monthly hotspot recorded in AMS within 2013 to 2020 for (a) Indonesia; (b) Malaysia; (c) Cambodia; (d) Lao PDR; (e) Myanmar; and (f) Thailand (Source: ASMC)

The annual average number of hotspots in Myanmar is 51,536. In reflection to this hotspot numbers, according to FAO[24], Myanmar has the highest burn rate in Southeast Asia and ranks 11th globally in terms of forest fires. **Table 7.2** shows the total burned area in 7 AMS based on information from FAO[25] from the latest available information in 2016 with several information not recorded in FAO database. From these statistics, a total of 2.17 MHa of area were burned in the region. 0.9 MHa or 42% occurred on forest area. The country with the most area affected by fire is Myanmar, followed by Cambodia. The third country in the rank was Indonesia and the fourth was Thailand. However, only 14% of the fire in Thailand occurred on forest area.

Table 7.2: Statistics of total area affected by fire (Source: FAO)

Country	Total land area affected by fire (ha)	Total forest area affected by fire (ha)
Cambodia	583,000	318,000
Indonesia	438,360	
Lao PDR	44,830	25,150
Malaysia	20,850	20,850
Myanmar	859,000	514,400
Philippines	5,000	1,840
Thailand	220,690	30,160
Total	**2,171,730**	**910,400**

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[24] http://www.fao.org/myanmar/news/detail-events/en/c/1200518/
[25] Referred https://fra-data.fao.org/AS/fra2020/areaAffectedByFire/

Annex 8: 19 additional capacity development suggested by Stakeholders in MAHFSA regional workshop in March 2021

1. **Community awareness on importance of peatland conservation** and also what action or options that has been practices by other countries in successfully maintaining the peatland area
2. **Improving awareness** on sustainable use of peatland for local youth and female group
3. **Peatland map analysis**
4. **Peatland policy development**
5. Capacity development in **enhancing access to finance** for sustainable peatland management
6. Strengthening AMS capacity to **implement ASEAN SOP**
7. **Institutionalize Management Scheme** that will focus and accountable to pursue or push **policy advocacy** and program on sustainable peatland management
8. **Peatland inventory and assessment techniques** in northern ASEAN Member State
9. Using local wisdom and methods in **peatland sustainable use**
10. Training on the development of **haze-free sustainable business models for communities**
11. Training on **community based agriculture industry**
12. **Update on controlled burning method**
13. Using more accessible and participatory **fire detection and monitoring technology** such as drones, cell phones, mobile application
14. **Improving stakeholder relationship** for knowledge sharing and implementation
15. Developing an **application for fire detection** in the local area, which can be used easily by local peatland users
16. **Sustainable business model** and relevant **policies** that will avoid fires on peatland
17. Connecting **peat fire avoidance monitoring system** with jurisdiction management approach in Near Real Time System
18. **Alternatives to slash and burn agriculture** especially in Northern ASEAN region
19. Common AMS **method for mapping annual burned area**