Measurable Action for Haze-Free Sustainable Land Management in Southeast Asia (MAHFSA) Programme

Policies and guidelines for consistent national burned area mapping and estimation by ASEAN member states

Michael Brady, CIFOR-ICRAF

5th GWIS and GOFC-GOLD Fire IT meeting

21-23 June 2022, Stresa

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MAHFSA

CIFOR-ICRAF - Our research expertise

Our research is organized around the following topics:

Trees and forests genetic resources and biodiversity

Sustainable value chains and investments

Climate change, energy and low-carbon developmen t

Soil and land health

Governance, equity and wellbeing

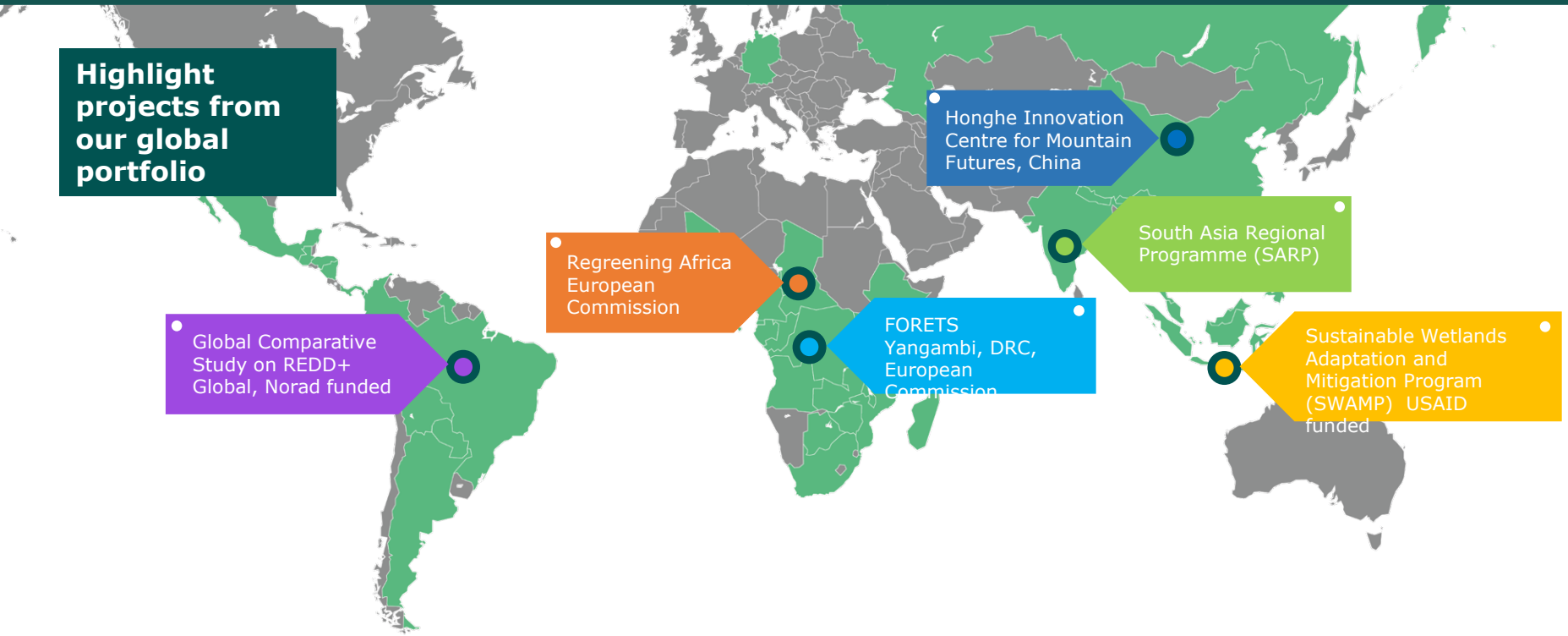
CIFOR

World Agroforestry

Global Landscapes Forum

Resilient Landscapes

Worldwide presence and impact



USD $2bn
total invested in research

750
staff in 30 countries

+2,200
projects completed in 92 countries

+190
active partnerships

25,000
research products

CIFOR

World Agroforestry

Global Landscapes Forum

Resilient Landscapes

Fire research at CIFOR-ICRAF

- Worked in the field of wildland fire and haze pollution since 1994
- Collection of 251 published journal articles, books and book chapters, flyers, briefs and papers
- Research encompasses a wide range of fire topics
- About 44% of publications are directly linked to wildland fire and haze pollution in Indonesia
- Remaining publications cover Africa, South America, Southeast Asia, and other locations
- In Indonesia and Africa, CIFOR has managed numerous projects related to fire and restoration of degraded landscapes

- Actor network
- Agroforestry
- Air quality
- Best practices
- Biodiversity
- Biomass
- Carbon emissions
- Carbon stocks
- Climate anomalies
- Climate change adaptation and mitigation
- Climate regulation
- Costs of fire and haze
- Degradation
- Drivers
- Ecological restoration
- Fire behavior
- Fire in peatlands
- Fire resistant tree species
- Forest and land management
- Governance
- Greenhouse gas emission from fire
- Historical ecology
- Human-fire interactions
- Impact of fires
- Indigenous people
- Institutions
- Land cover change
- Land rehabilitation
- Land use change
- Local livelihoods
- Natural resource management
- Non-timber forest products
- Policy implications
- Political economy
- Reconciliation of livelihoods and conservation
- Remote sensing
- Shifting cultivation
- Slash and burn techniques
- Tree regeneration, survival and growth
- Vegetation and fuels

Measurable Action for Haze-Free Sustainable Land Management in Southeast Asia Programme Programme

5 Years
(2019 – 2024)

USD 3,500,000

Supported by

IFAD
Investing in rural people

Implementation by

CIFOR

Global Environment Centre

asean

reduction of transboundary haze pollution and its impacts in Southeast Asia through enhanced regional coordination. investments. knowledge and results management

- **C.1** Enhancement of data. information and results management system and operational capacity
- **C.2** Data. information and results analysis for strategic knowledge product development
- **C.3** Enhancement of regional coordination mechanisms

MAHFSA Knowledge product development

MAHFSA Knowledge Stock Take Analysis

Advancing evidence-based policy dialogue

Reprint and update knowledge products

Based on gaps, develop new knowledge products

Policy guidance notes submitted to AATHP COP and relevant high-level ASEAN meetings

Guideline on burned area identification and mapping

Policy directive for burned area mapping

National annual burned area mapping with consistent and known accuracy

Elaborate and extend the methodology for AMS to identify and map burned areas, which has been underway in Indonesia.

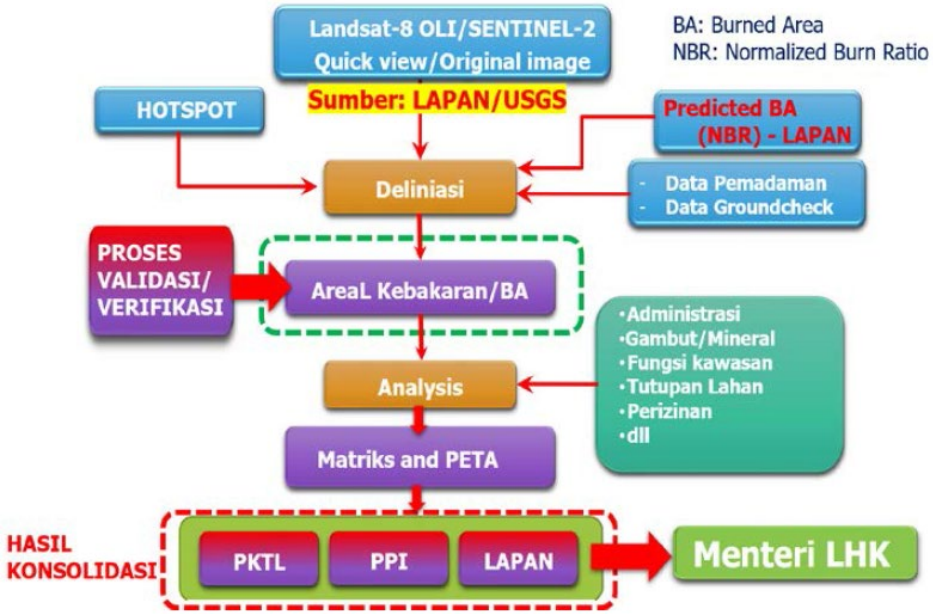
Fire-related information collected by ASEAN and member states

1. Daily weather conditions and seasonal forecasts
2. El Nino and La Nina forecasts (global, regional)
3. Hot spot maps (global, regional, national)
4. Haze maps
5. Fire danger rating (FWI)
6. Fire management statistics (limited)
7. Current national burned area mapping (Indonesia only)

- Few studies present and use clearly described **methodologies** for calculating burned area estimates.
- Few AMS countries **publish** burned area information regularly
- Difficult to make consistent and meaningful **comparisons** among burned area estimates across AMS
- Need to develop a guideline on burned area mapping and estimation with:
  - **best practices** in the international fire community
  - **applicable** to AMS with different capacities and resources

Indonesia national burned area mapping

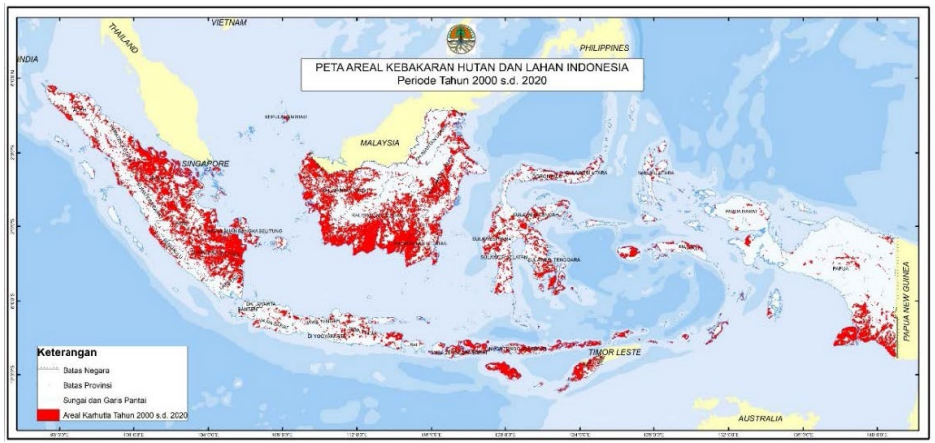
- Current national burned area mapping report, October 2021 (MoEF 2021)
- Reviews approaches and data results from 2000 to 2020



Source: MoEF 2021

Indonesia national burned area mapping

- Indonesia is the only country in ASEAN to map burned area annually, starting in 2016 (https://sipongi.menlhk.go.id/)
- It is the only AMS country to publish national BA statistics.



Tahun	Luas (ha)		Total	Persen (%)		Total
	Mineral	Gambut		Mineral	Gambut	
2000	354.434	32.278	386.712	91,65	8,35	100,00
2001	521.129	98.688	619.818	84,08	15,92	100,00
2002	1.088.678	302.224	1.390.902	78,27	21,73	100,00
2003	1.093.361	103.660	1.197.021	91,34	8,66	100,00
2004	1.033.346	346.604	1.379.950	74,88	25,12	100,00
2005	589.117	390.117	979.234	60,16	39,84	100,00
2006	2.741.181	1.140.811	3.881.992	70,61	29,39	100,00
2007	448.990	144.299	593.289	75,68	24,32	100,00
2008	323.726	73.948	397.674	81,40	18,60	100,00
2009	750.984	366.870	1.117.854	67,18	32,82	100,00
2010	137.714	93.308	231.022	59,61	40,39	100,00
2011	471.462	142.679	614.141	76,77	23,23	100,00
2012	658.532	419.009	1.077.541	61,11	38,89	100,00
2013	297.784	132.002	429.785	69,29	30,71	100,00
2014	1.094.842	682.733	1.777.576	61,59	38,41	100,00
2015	1.736.586	874.825	2.611.411	66,50	33,50	100,00
2016	340.576	97.787	438.363	77,69	22,31	100,00
2017	151.929	13.555	165.484	91,81	8,19	100,00
2018	397.838	131.428	529.267	75,17	24,83	100,00
2019	1.154.807	494.450	1.649.258	70,02	29,98	100,00
2020	276.944	19.998	296.942	93,27	6,73	100,00

Source: MoEF 2021

Burned area mapping methods developed over 20 years

Period 1 (2000 to 2014), using the manual method of interpretation and carried out for an annual period (calculations were carried out in 2018); using **hotspot** data indication

Period 2 (2015), using a semi-automatic method with a combination of point density analyst and manual interpretation; using **hotspot** data indication

Period 3 (2016), using the manual method of interpretation and carried out for an annual period (calculations are carried out at the end of the year); using **hotspot** data indication

Period 4 (2017 to 2019), using the manual method of interpretation and carried out for a monthly period; using **hotspot** data indications and **field reports**

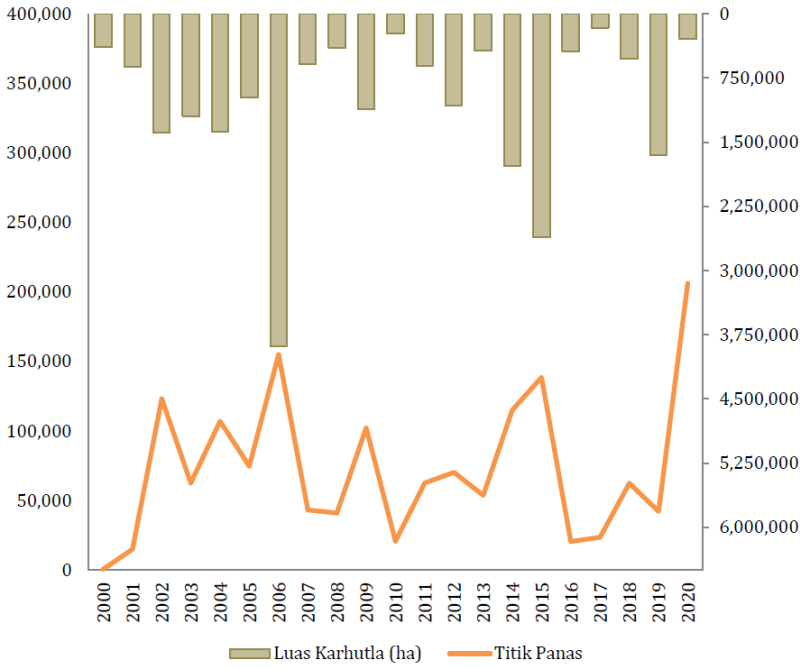
Period 5 (2020 to now), using the manual method of interpretation and carried out for a monthly period; using **indications of hotspot** data, **field reports**, and **digital classification results** conducted by LAPAN

Advancing from hot spots to mapping

Satellite specifications for hotspot detection (LAPAN, 2020)

No	Satelit	Sensor	Kanal (panjang gelombang)	Resolusi Spasial	Tingkat Kepercayaan
1	Terra	MODIS	Kanal 21 dan 22	1000 meter	Rendah: 7
			(3929 -3989 nm)		Medium: 8
					Tinggi: 9
2	Aqua	MODIS	Kanal 21 dan 22	1000 meter	Rendah: 7
			(3929 -3989 nm)		Medium: 8
					Tinggi: 9
3	S-NPP	VIIRS	Kanal 14	375 meter	Rendah: 7
			(3550 - 3930 nm)		Medium: 8
					Tinggi: 9
4	NOAA-20	VIIRS	Kanal 14	375 meter	Rendah: 7
			(3550 - 3930 nm)		Medium: 8
					Tinggi: 9
5	Landsat-8	OLI	Kanal 7	30 meter	Rendah: 7
			(2100 - 2300 nm)		Medium: 8
					Tinggi: 9

Annual hotspot counts versus mapped area burned from 2000-2020



Source: MoEF 2021

Advancing to mapping burned areas in different land cover types

No.	Penutupan Lahan	Luas Karhutla (Ha)		
		Mineral	Gambut	Jumlah
1	*2*	*3*	*4*	*5*
Hutan				
1	Hutan Lahan Kering Primer	2.968		2.968
2	Hutan Lahan Kering Sekunder	17.824	253	18.077
3	Hutan Mangrove Primer	16		16
4	Hutan Mangrove Sekunder	109		109
5	Hutan Rawa Primer	261	295	557
6	Hutan Rawa Sekunder	2.948	577	3.525
7	Hutan Tanaman	7.698	799	8.497
Total		**31.825**	**1.925**	**33.750**
Non Hutan				
1	Semak/Belukar	27.376	436	27.812
2	Perkebunan	7.363	4.737	12.100
3	Permukiman	1.150	7	1.157
4	Tanah Terbuka	8.405	3.059	11.464
5	Savanna	100.564	1.867	102.432
6	Semak/Belukar Rawa	15.995	4.510	20.505
7	Pertanian Lahan Kering	28.857	1.028	29.884
8	Pertanian Lahan Kering Campur Semak	28.185	2.045	30.230
9	Sawah	18.517	86	18.602
10	Tambak	211		211
11	Bandara/Pelabuhan	5		5
12	Transmigrasi	37		37
13	Pertambangan	234		234
14	Rawa	7.894	289	8.183
15	Tubuh Air	328	10	338
Total		**245.119**	**18.073**	**263.192**
Jumlah		**276.944**	**19.998**	**296.942**

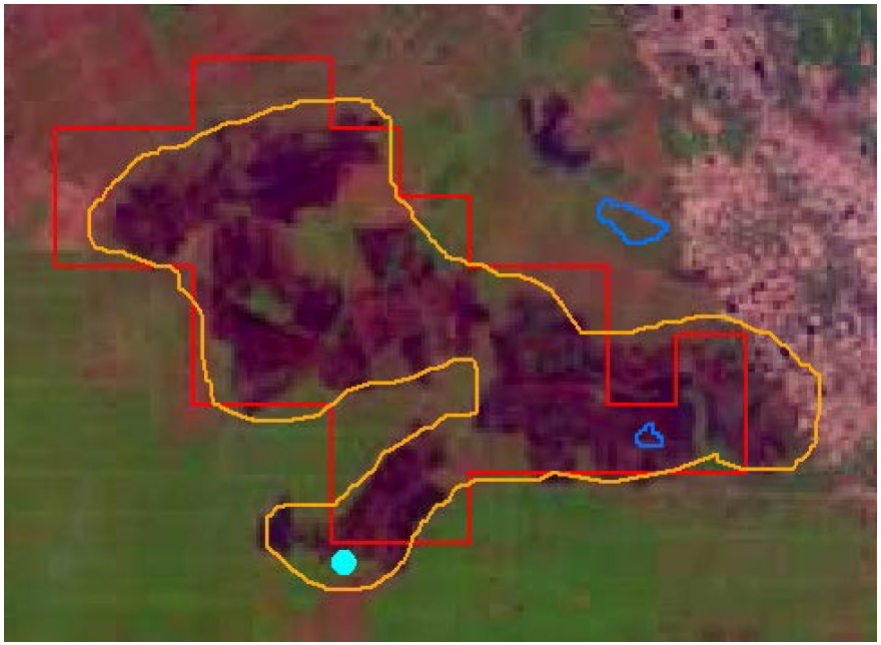
Burned area in 2020 by land cover types

22 forest and non-forest cover types

- 7 forest types
- 15 non-forest cover/land use types

Source: MoEF 2021

Needs for efficient and cost-effective burned area mapping and estimation



Mapping uses Landsat imagery with selective ground truthing to confirm burns and assess mapping accuracy

Source: MoEF 2021

Needs for accurate burned area mapping and estimation

National sensitivities around burned area approaches and results

Earth Syst. Sci. Data, 13, 5353–5368, 2021
https://doi.org/10.5194/essd-13-5353-2021

Open Access Earth System Science Data

Refined burned-area mapping protocol using Sentinel-2 data increases estimate of 2019 Indonesian burning

David L. A. Gaveau[1], Adrià Descals[2], Mohammad A. Salim[1], Douglas Sheil[3], and Sean Sloan[4]

[1]TheTreeMap, Bagadou Bas, 46600 Martel, France
[2]CREAF, Centre de Recerca Ecològica i Aplicacions Forestals, E08193 Bellaterra (Cerdanyola de Vallès), Catalonia, Spain
[3]Forest Ecology and Forest Management Group, Wageningen University and Research, P.O. Box 47, 6700 AA, Wageningen, the Netherlands
[4]Department of Geography, Vancouver Island University, Nanaimo, BC, Canada

Correspondence: David L. A. Gaveau (d.gaveau@thetreemap.com)

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Abstract. Many nations are challenged by landscape fires. A confident knowledge of the area and distribution of burning is crucial to monitor these fires and to assess how they might best be reduced. Given the differences that arise using different detection approaches, and the uncertainties surrounding burned-area estimates, their relative merits require evaluation. Here we propose, illustrate, and examine one promising approach for Indonesia where recurring forest and peatland fires have become an international crisis.

Drawing on Sentinel-2 satellite time-series analysis, we present and validate new 2019 burned-area estimates for Indonesia. The corresponding burned-area map is available at https://doi.org/10.5281/zenodo.4551243 (Gaveau et al., 2021a). We show that > 3.11 million hectares (Mha) burned in 2019. This burned-area extent is double the Landsat-derived official estimate of 1.64 Mha from the Indonesian Ministry of Environment and Forestry and 50 % more that the MODIS MCD64A1 burned-area estimate of 2.03 Mha. Though we observed proportionally less peatland burning (31 % vs. 39 % and 40 % for the official and MCD64A1 products, respectively), in absolute terms we still observed a greater area of peatland affected (0.96 Mha) than the official estimate (0.64 Mha). This new burned-area dataset has greater reliability than these alternatives, attaining a user accuracy of 97.9 % (CI: 97.1 %–98.8 %) compared to 95.1 % (CI: 93.5 %–96.7 %) and 76 % (CI: 73.3 %–78.7 %), respectively. It omits fewer burned areas, particularly smaller- (< 100 ha) to intermediate-sized (100–1000 ha) burns, attaining a producer accuracy of 75.6 % (CI: 68.3 %–83.0 %) compared to 49.5 % (CI: 42.5 %–56.6 %) and 53.1 % (CI: 45.8 %–60.5 %), respectively. The frequency–area distribution of the Sentinel-2 burn scars follows the apparent fractal-like power law or Pareto pattern often reported in other fire studies, suggesting good detection over several magnitudes of scale. Our relatively accurate estimates have important implications for carbon-emission calculations from forest and peatland fires in Indonesia.

Kontroversi Riset Karhutla David Gaveau: Haruskah Manggala Agni Padamkan Gunung Api?

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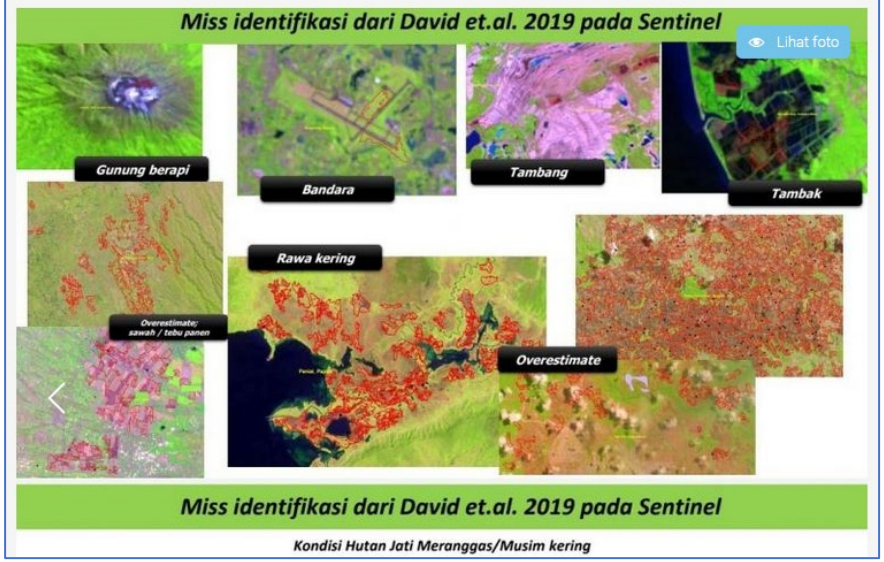
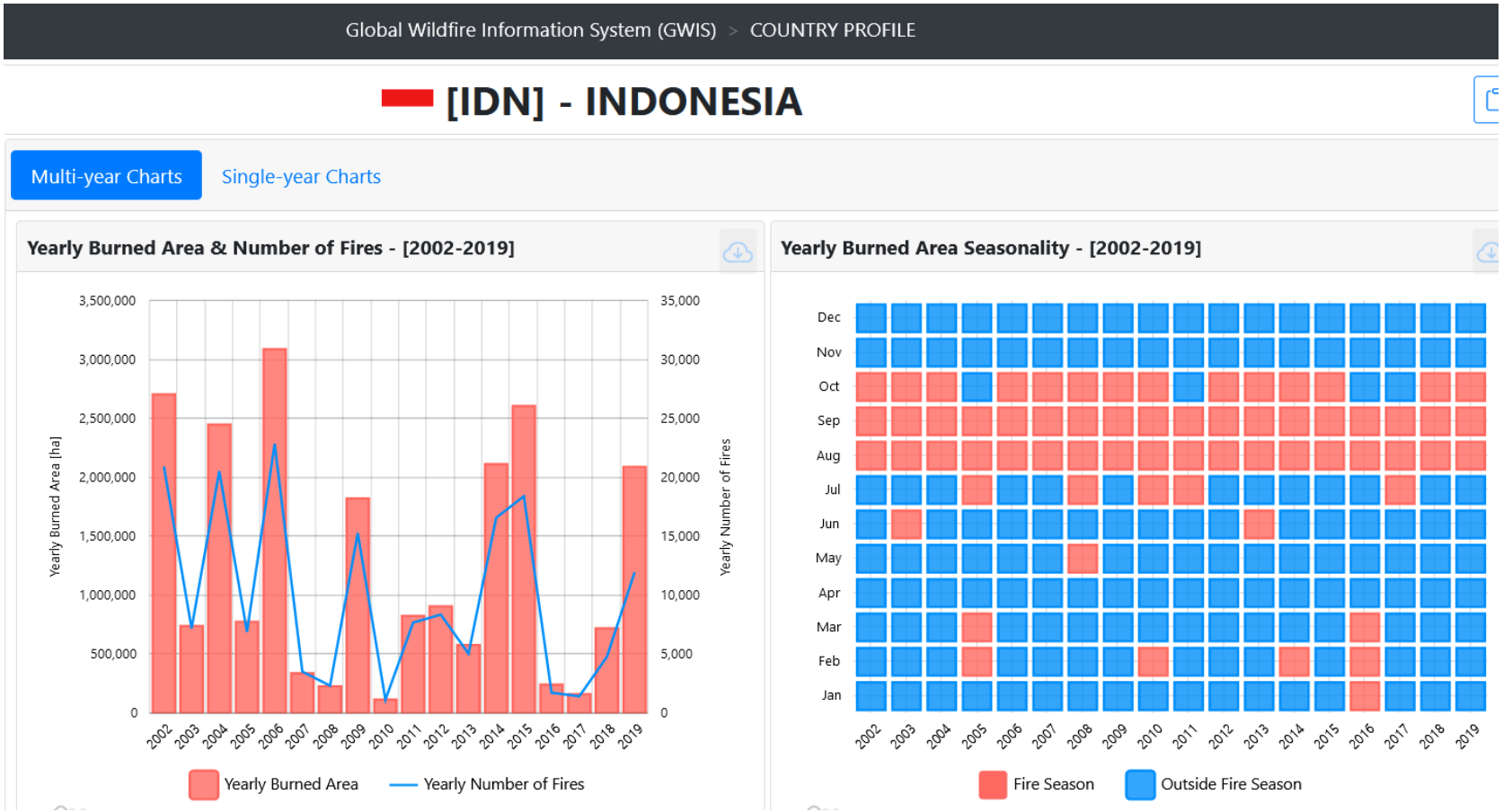


Kondisi Hutan Jati Meranggas/Musim kering

Indonesia 2019 burned area in GWIS



https://gwis.jrc.ec.europa.eu/apps/country.profile/chartsba/IDN

Plans to establish policy and guidance for burned area mapping

1. **Policy dialogue meeting**

- **Current status** of burned area mapping policies and practices in ASEAN and AMS
- Survey **international** policies, programmes and uses of burned area mapping and estimation (e.g., GCOS ECV BA product requirement, GWIS, IPCC T1)
- Collective **endorsement** for national burned area mapping in ASEAN

2. **Workshop to prepare guideline on burned area mapping and estimation**

– Agreed **strategy, plan and identification** of contributors to develop an ASEAN guideline on burned area mapping and estimation.

– Suitable **approach and methods** to burned area mapping and estimation based on AMS context

– Agreed strategy and plan to develop **guideline**

– Identification of guideline development **team** and work plan

Policy and institutional basis for burned area mapping in Indonesia

Institutions:

MoEF: Directorate for Inventory and Monitoring of Forest Resources (IPSDH), Directorate for Forest and Land Fire Control (PKHL), Directorate for Greenhouse Gas Inventory (IGRK)

Decree of the Director General of Climate Change Control Number: SK.1/PPI/PKHL/PPI.4/1/2020 dated January 17, 2020 concerning the **Establishment of a Data and Information Management Team** on the Result of Calculation of the Area of Forest and Land Fires in 2020

LAPAN

Policies:

1. Use in fire management: Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number P.32/MenLHK/Setjen/Kum.1/3/2016 concerning Forest and Land Fire Control
2. Information use: Regulation of the Minister of Environment and Forestry Number P.28/Menlhk/Setjen/KUM.1/2/2016 concerning Geospatial Information Network Scope
3. Methods: Regulation of the Director General of Climate Change Control Number: P.11/PPI/PKHL/KUM.1/12/2018 dated 18 December 2018 concerning Technical Guidelines for Assessing the Area of Forest and Land Fires
4. Mapping: Regulation of the Minister of Environment and Forestry Number 15 of 2021 concerning Organization and Work Procedure of the Ministry of Environment and Forestry
5. Data use: Decree of the Head of the Geospatial Information Agency Number 38 of 2021 concerning Guardians of Thematic Geospatial Information Data

Support from international fire observation community

1. Contribute to survey of international and national **policies, programmes and uses** of burned area mapping and estimation
2. Advise on **suitable approach and methods** to burned area mapping and estimation (e.g., use of global BA products to enhance national mapping, benefits of historical BA mapping, examples of guide developed elsewhere)
3. Advice to development team and **review of work plan** progress

m.brady@cgiar.org

Working to solve global challenges

Our research addresses the following global challenges and offers actionable, game-changing solutions to achieve sustainable transformation.

- Deforestation and biodiversity loss
- A climate in crisis
- Unsustainable supply and value chains
- Transforming food systems
- Extreme inequality

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