

Typology Analysis of Land and Forest Fire in Riau Province, Indonesia



Israr Albar¹²

¹Ministry of Environment and Forestry, Indonesia

²Graduate School, Bogor Agricultural University

*International Workshop on Land Use/Cover Change and Air Pollution
Bogor, 4-7 August 2015*

Outline

- Introduction
- Fire Season in Indonesia & Riau
- IFEWS
- Fire Types
- Canal Blocking
- Burned Area
- Remarks

Facts

- Indonesia experiences the **world's 2nd highest deforestation rate**
- Including one of the **largest emitters of greenhouse gasses emission** due to: forest cover loss and peatland degradation

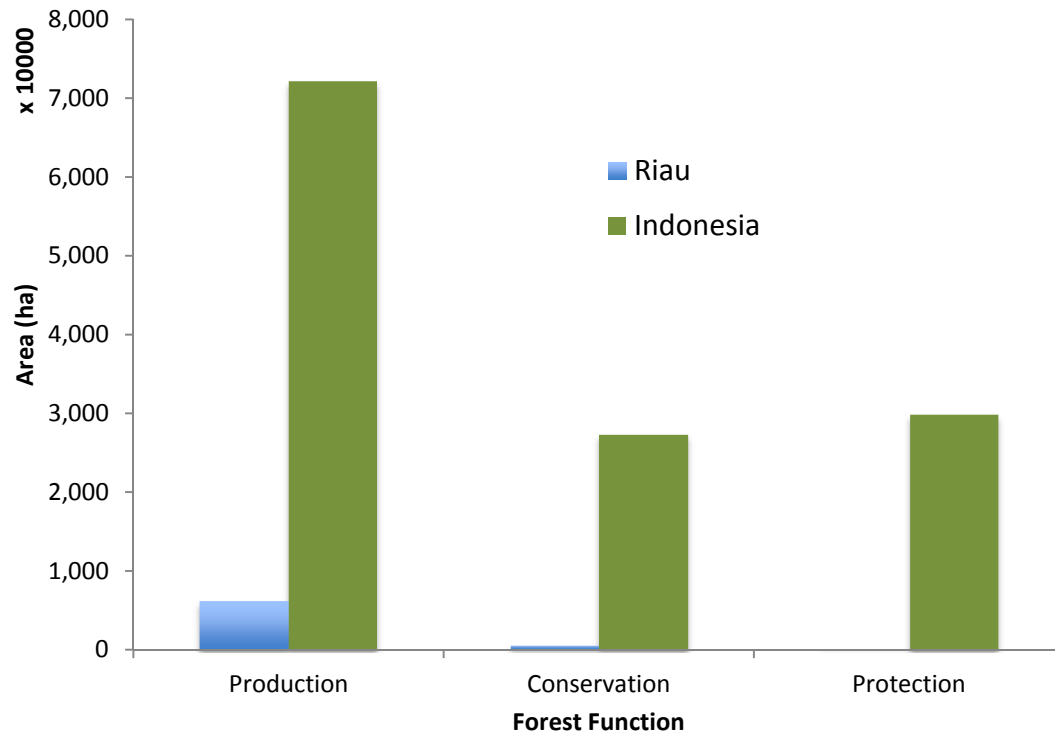
Problems

- Complex and conflicting **definition**
- Lack of adequate **data** sets
- Need a robust **method**
- Insufficient **infrastructure** for the work at national scale

Consequences

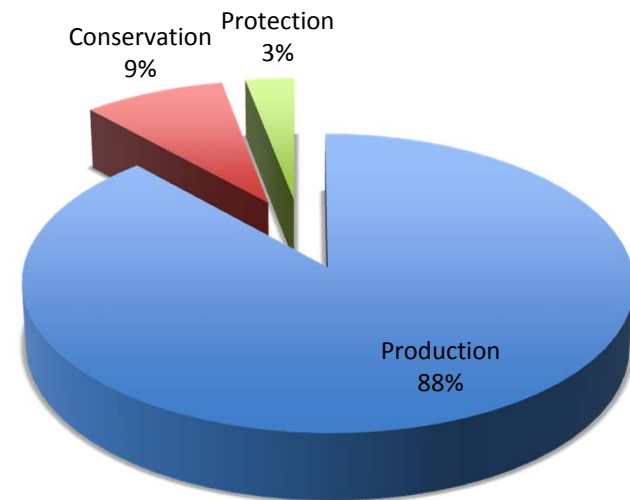
- Cannot provide **near real time** information
- **Lack of consensus** for areal extent and temporal trends of forest cover loss

Forest Area in Indonesia & Riau (MoF 2014)



Riau 7.121.344,00
Indonesia 129.425.443,66

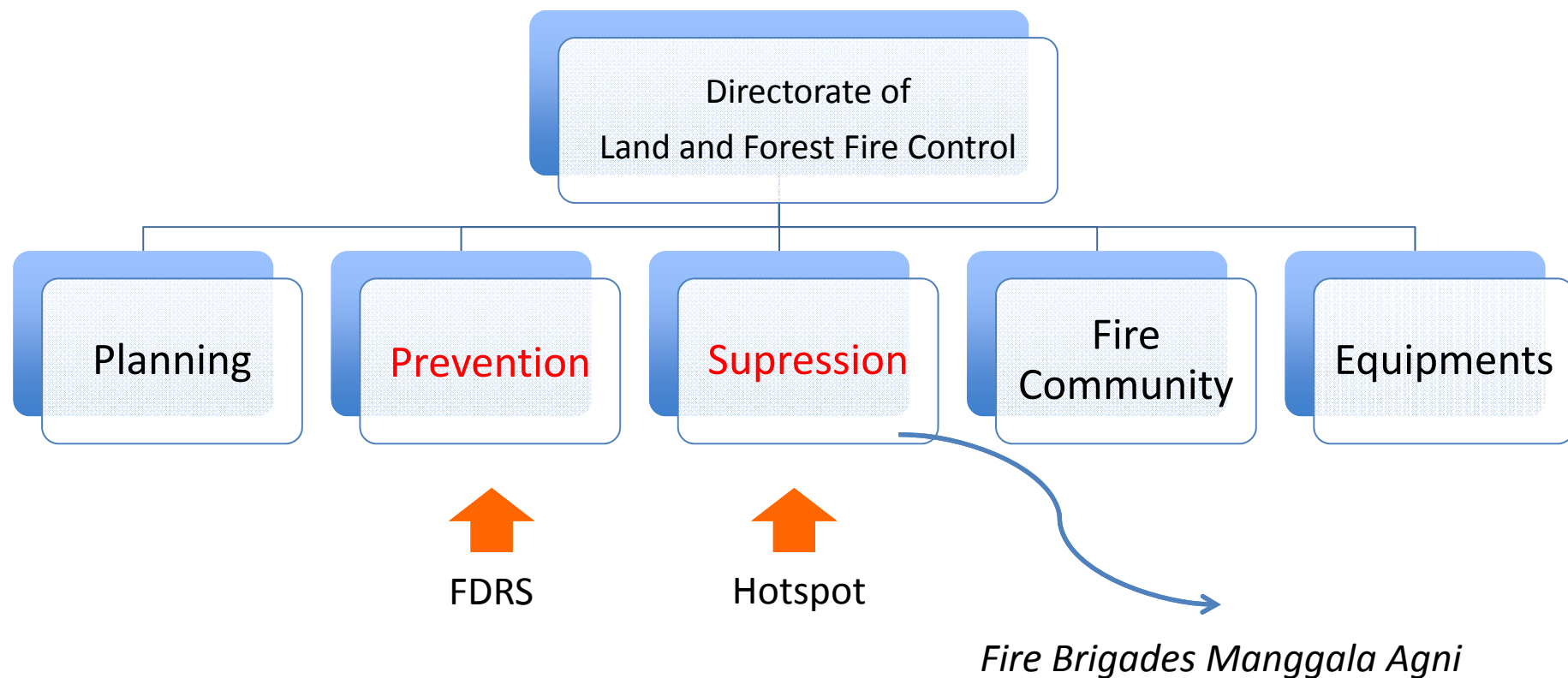
Forest Area in Riau Prov (MoF 2014)



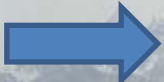


LAND USE/COVER CHANGES AND AIR POLLUTION IN ASIA

AUGUST 4TH-7TH, 2015 - BOGOR, INDONESIA



Fire-Caused Emissions

Combustion  Emissions
Emissions = GHG + Pollution

GHG – A Global Problem

Pollution – National, A Regional & International Problem

INTERNATIONAL WORKSHOP ON

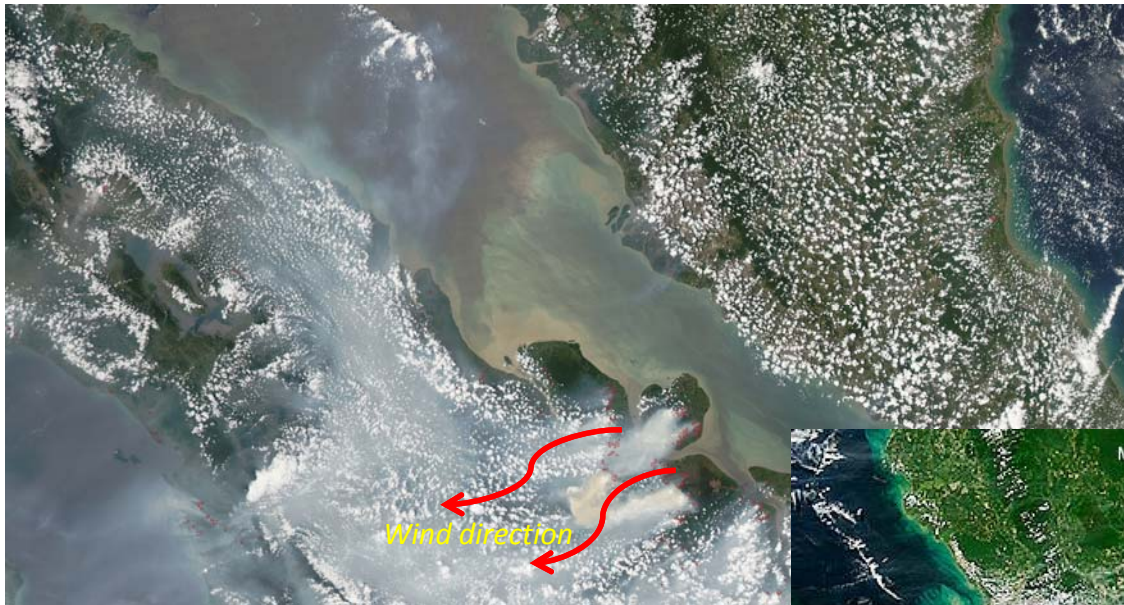
LAND USE/COVER CHANGES

AND AIR POLLUTION IN ASIA

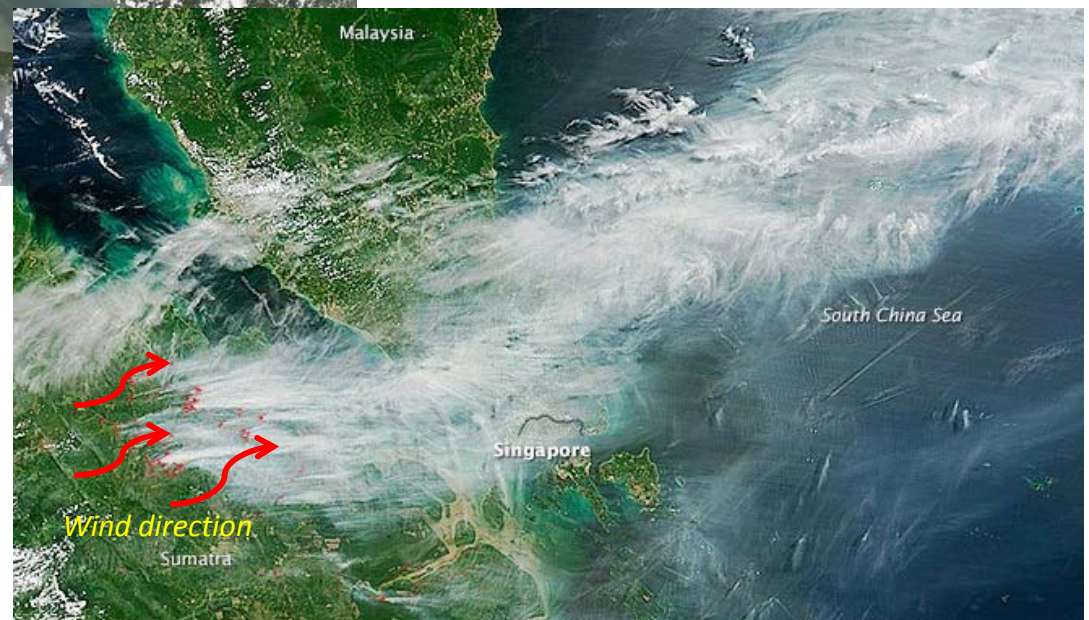
AUGUST 4TH-7TH, 2015 - BOGOR, INDONESIA

Emissions are a National & Regional Problem

Human Health, Commerce, Transportation, Regional Haze, Trans-Boundary Geo-Political Issues

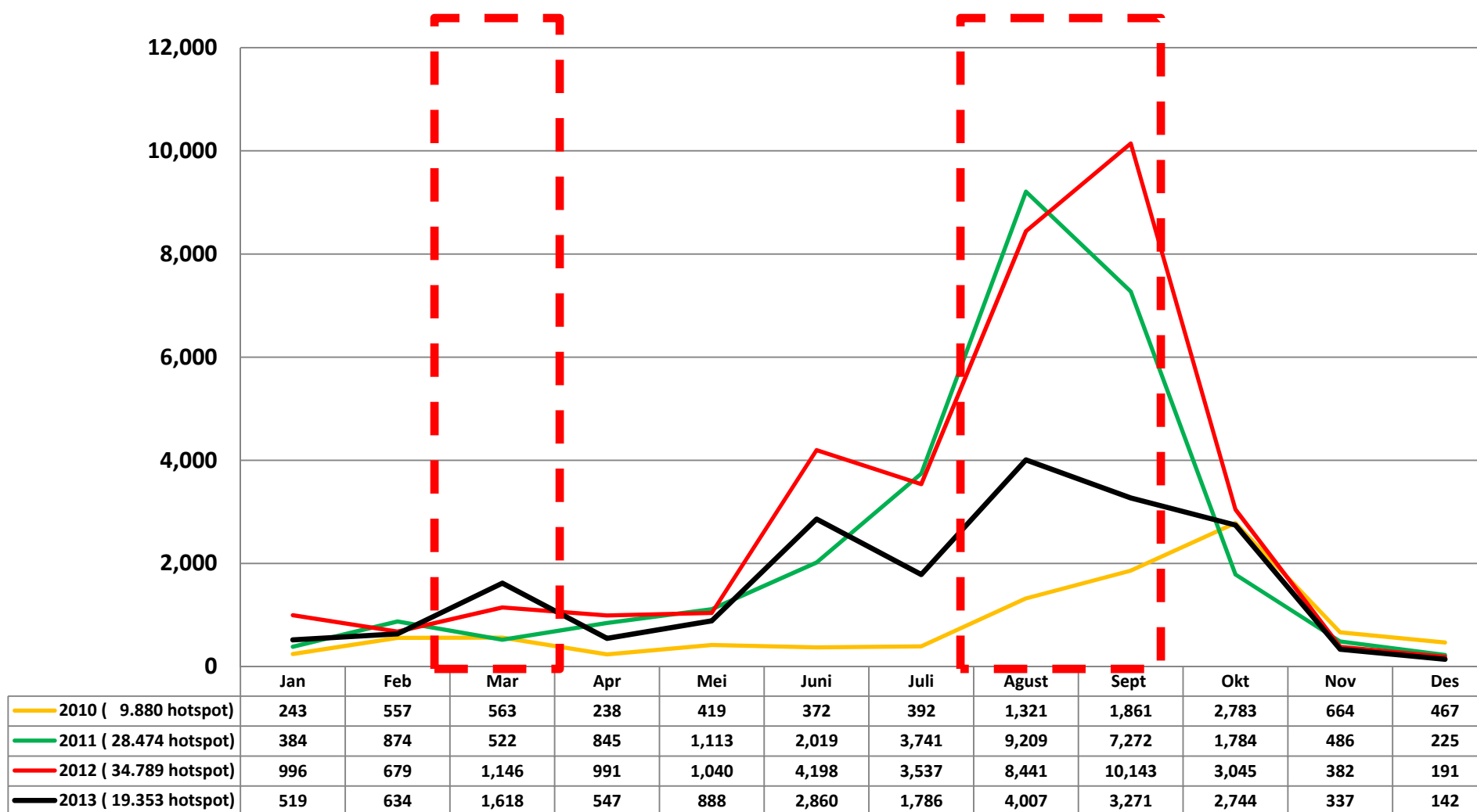


Sumatra, February 28, 2014



Peat Fires, Indonesia, June 2013

Monthly Hotspot Pattern in Indonesia (2010-2013)



INTERNATIONAL WORKSHOP ON

LAND USE/COVER CHANGES

AND AIR POLLUTION IN ASIA

AUGUST 4TH-7TH, 2015 - BOGOR, INDONESIA



Fire & Haze Season in Indonesia



First Season: February – March
(North/South Sumatra, Riau, Jambi)

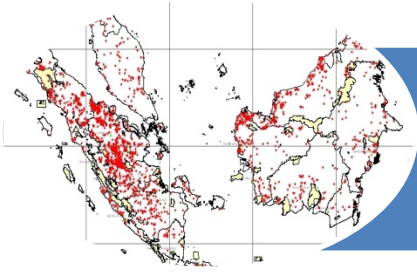
Second Season: June - September
(Whole of Sumatra and Kalimantan)

INTERNATIONAL WORKSHOP ON

LAND USE/COVER CHANGES

AND AIR POLLUTION IN ASIA

AUGUST 4TH-7TH, 2015 - BOGOR, INDONESIA



Fire Pattern in Indonesia



**Peat land Fire Region –
Open Burning Practices**

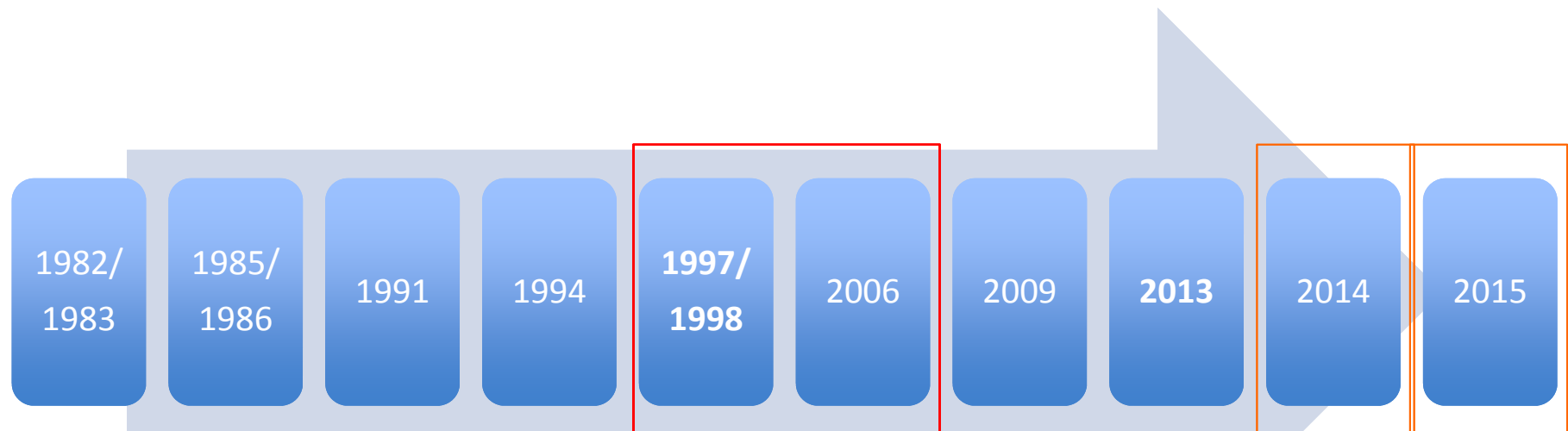
Ground Wildfire Region

INTERNATIONAL WORKSHOP ON

LAND USE/COVER CHANGES

AND AIR POLLUTION IN ASIA

AUGUST 4TH-7TH, 2015 - BOGOR, INDONESIA



Big fire episode in Indonesia

Fire in Riau : short period, high intensity



Fire in Riau Province, 26 July 2013
credit photo : Agus Wibowo-BNPB

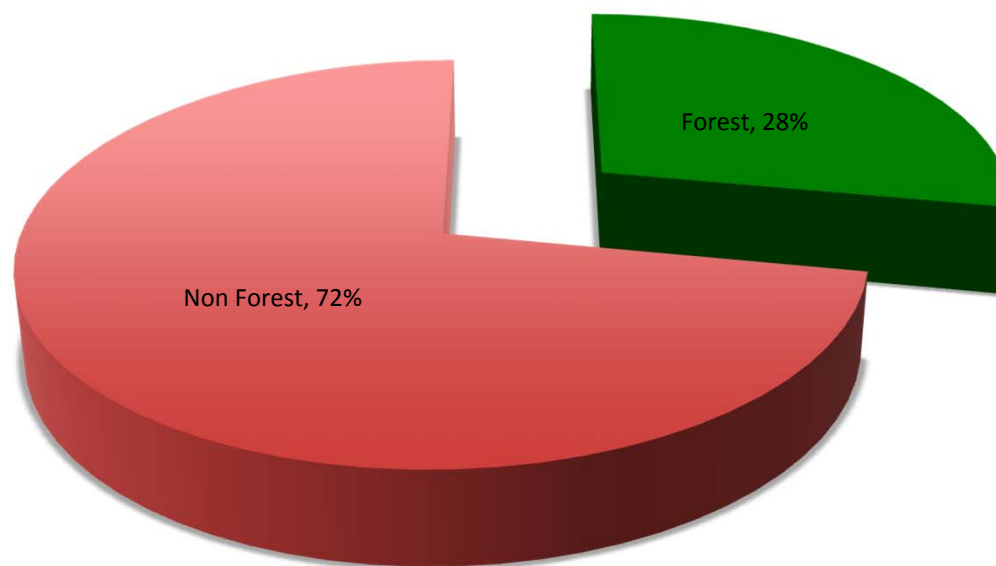
Burnt area



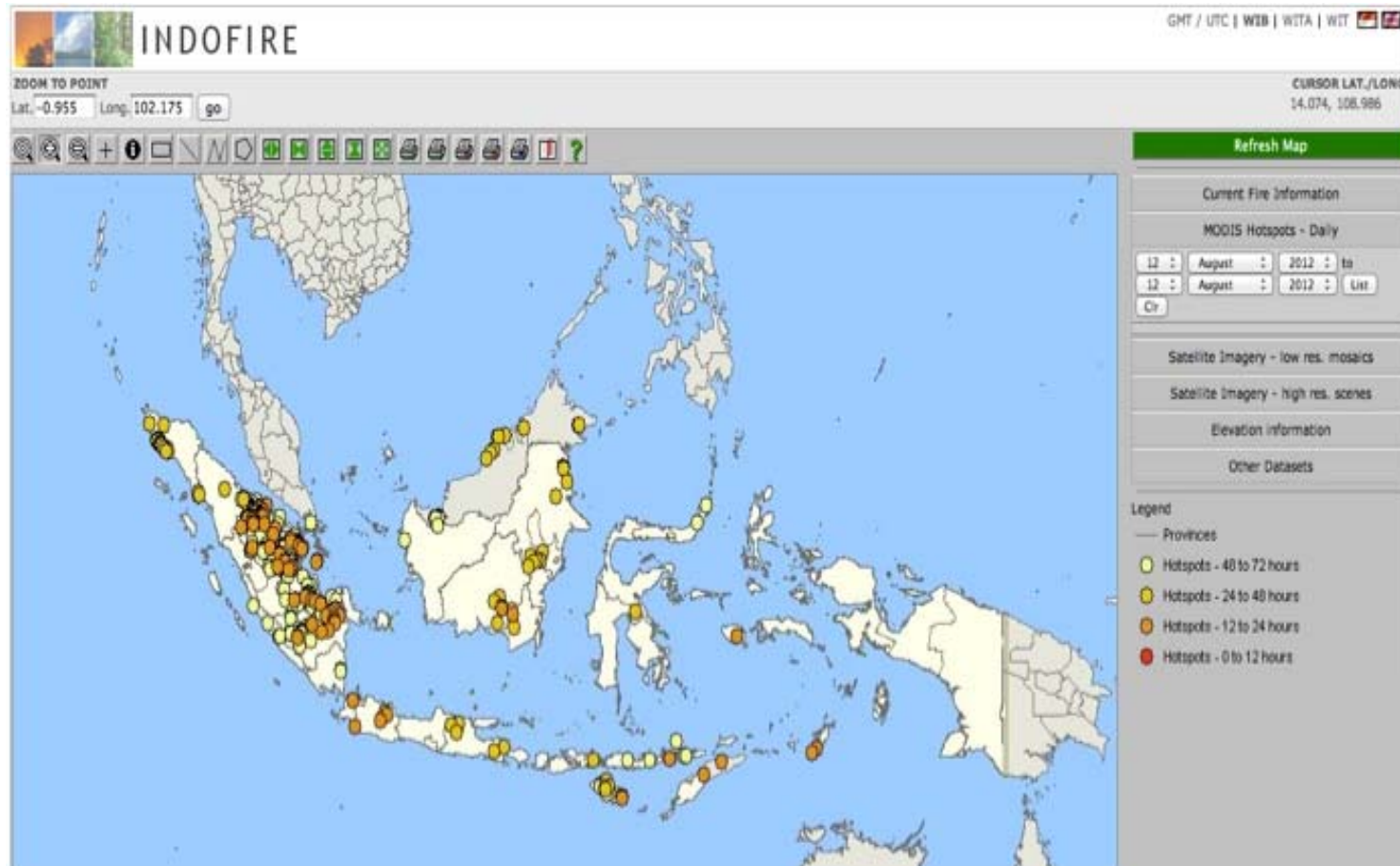
Fire Hotspots on Forest & Non Forest

2006		2007		2008		2009		2010		2011		2012		2013	
Forest	Non Forest	Forest	Non Forest	Forest	Non Forest	Forest	Non Forest	Forest	Non Forest	Forest	Non Forest	Forest	Non Forest	Forest	Non Forest
48.574	97.690	10.083	27.826	5.631	24.985	8.654	30.809	2.270	7.610	6.652	21.822	8.684	22.487	11.735	46.59

Fire Hotspots 2006-2013



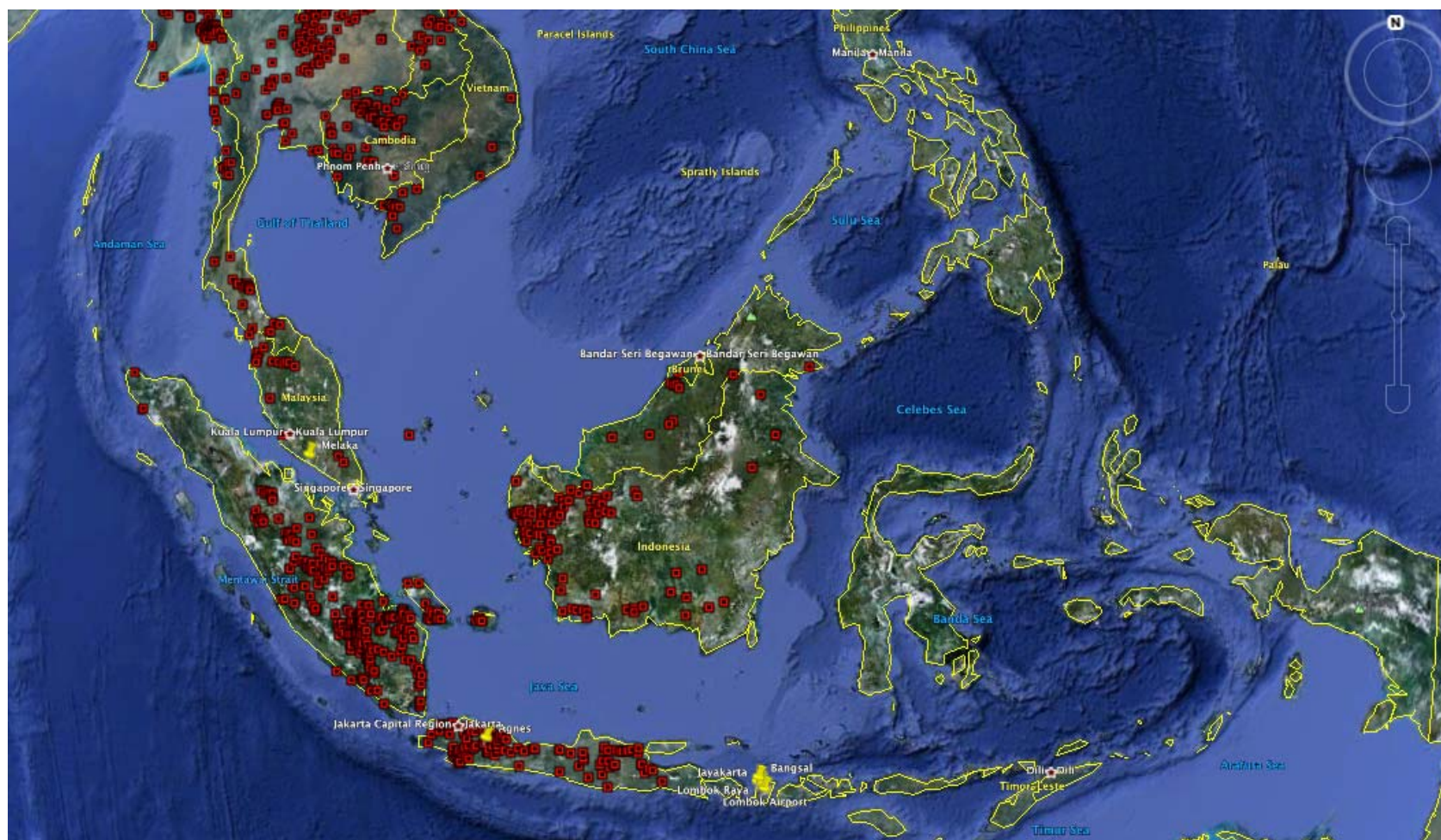
Indonesia Fire Early Warning System (IFEWS)



MODIS-FHS
Dissemination

MoFr-
LAPAN-
MoNatEd –
Inherent
(Indonesian
Higher
Education
Network)

<http://indofire.landgate.wa.gov.au/indofire.asp>.



www.indofire.org/www.dephut.go.id

NOAA-FHS
dissemination



SiPongi



Posko Kebakaran Hutan
+62 8131 0035 000



SMS Center
+62 8129 7185 000



Facebook
SiPongi



Twitter
@HotspotSiPongi

Home

Hotspot

Manggala Agni

Berita & Publikasi

Peraturan Perundangan

Tentang

Kontak

↓ MENU

0

SATELIT

NOAA18 (ASMC)



TERRA / AQUA (NASA)

OPSI

PERGERAKAN ANGIN

Selasa, 09 Juni 2015

Google

Data peta ©2015 AutoNavi, GBRMPA, Google, SK planet, ZENRIN | Syarat Penggunaan



KemLhHut



Lapan



BMKG



Ditjen PKHA



BNPB

Kontak

Gedung Pusat Kehutanan Manggala Wanabakti
Blok VII Lt. 13
Jl. Jend. Gatot Subroto Jakarta 10270
Tel/Fax : 021-5704618

Manggala Agni

Profile
Daerah Operasional
Sarana dan Prasarana

Data

Sebaran Hotspot
Luas Kebakaran
Peraturan
Perundangan

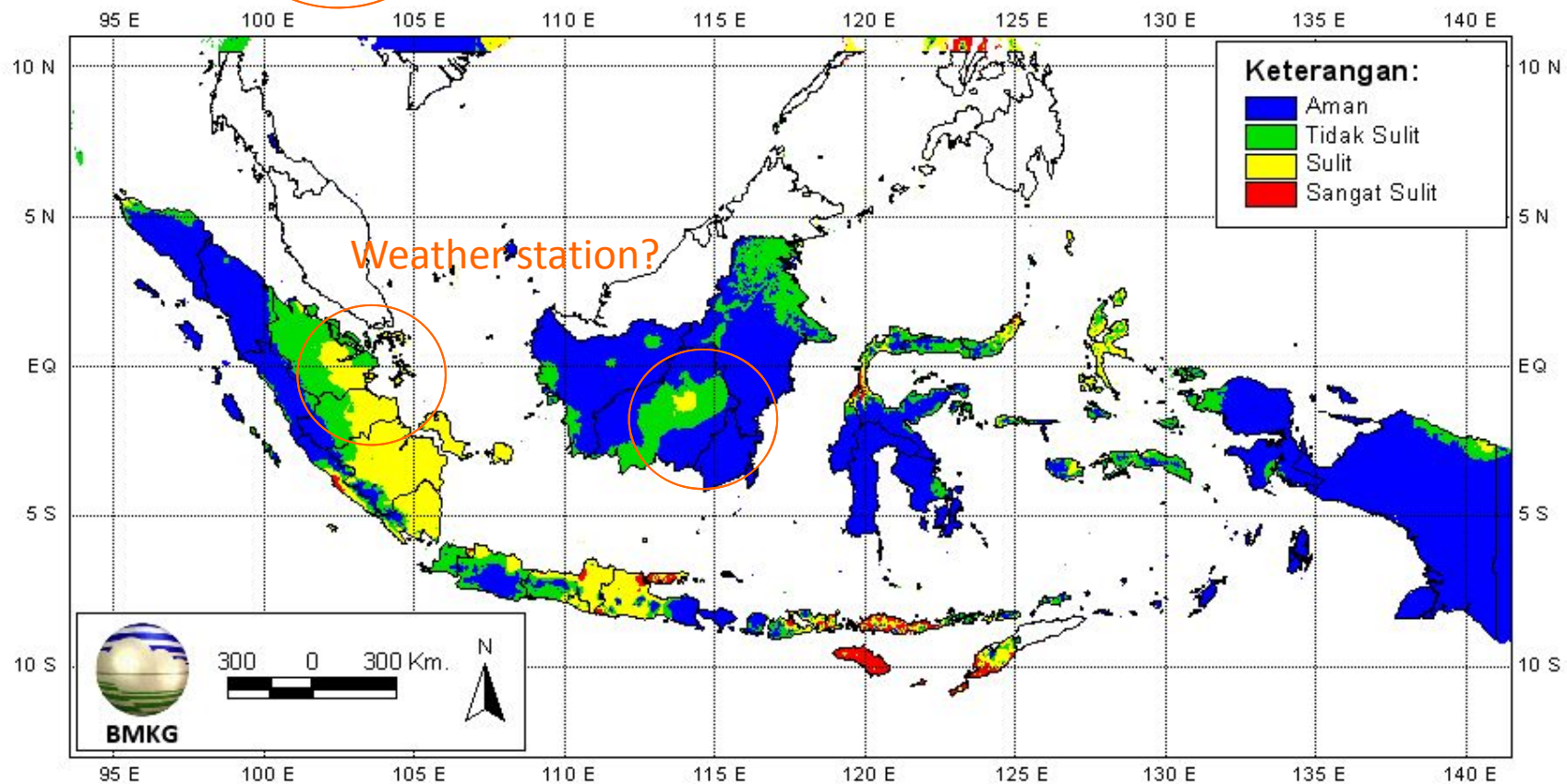
Tentang

Direktorat
Pengendalian
Kebakaran Hutan
Struktur Organisasi
Hubungi Kami

POTENSI TINGKAT KESULITAN PENGENDALIAN APABILA TERJADI KEBAKARAN HUTAN DAN LAHAN

Fire Weather Index

Berlaku untuk 06 Juni 2015 ----- Wilayah Indonesia



Subid Cuaca Ekstrem Bidang Peringatan Dini BMKG

Sumber Data : Data Realtime Pengamatan Sinoptik BMKG

INTERNATIONAL WORKSHOP ON

LAND USE/COVER CHANGES

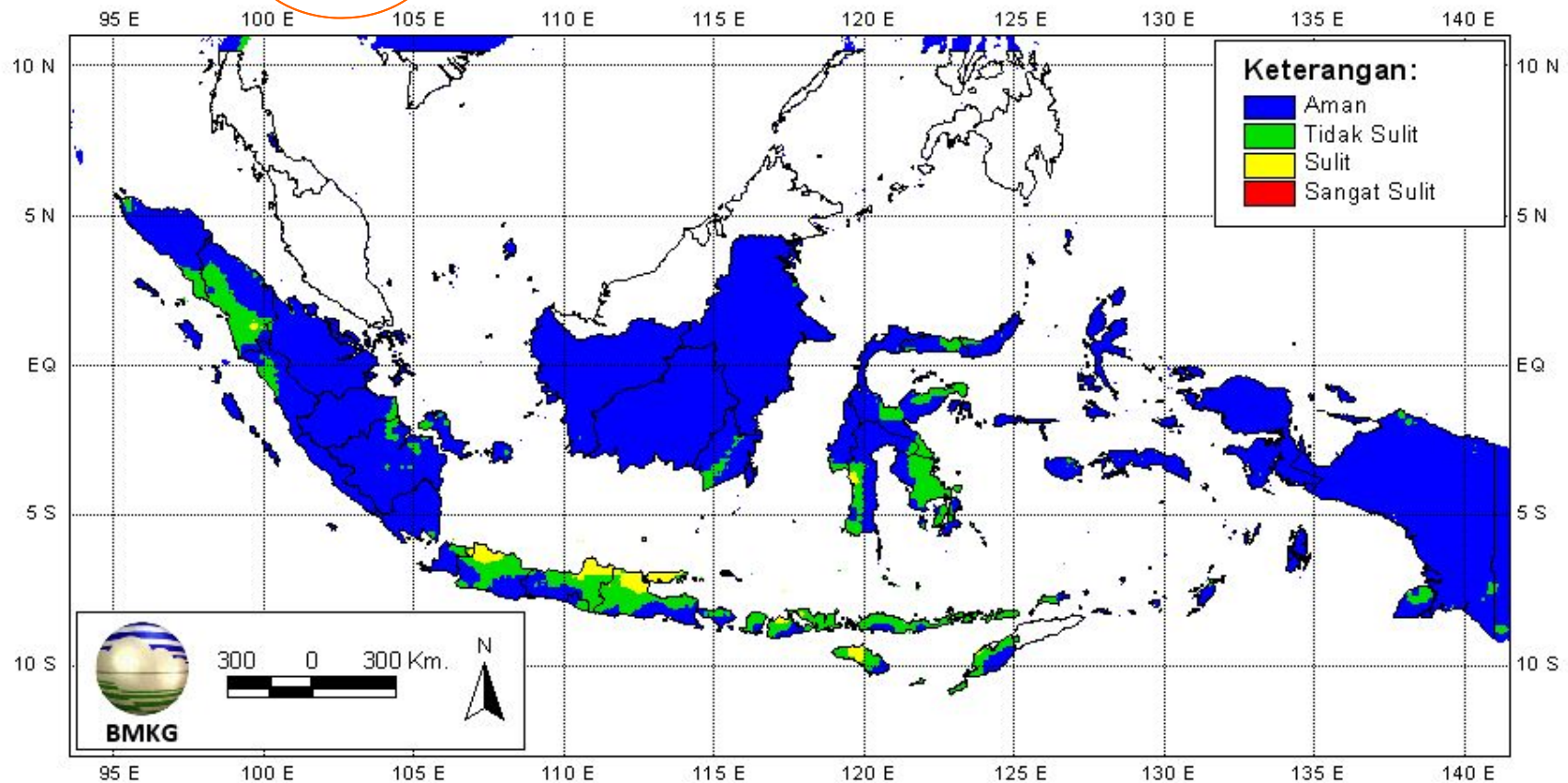
AND AIR POLLUTION IN ASIA

AUGUST 4TH-7TH, 2015 - BOGOR, INDONESIA

POTENSI TINGKAT KESULITAN PENGENDALIAN APABILA TERJADI KEBAKARAN HUTAN DAN LAHAN

Fire Weather Index

Berlaku untuk 15 Juni 2015 ----- Wilayah Indonesia



Subid Cuaca Ekstrim Bidang Peringatan Dini BMKG

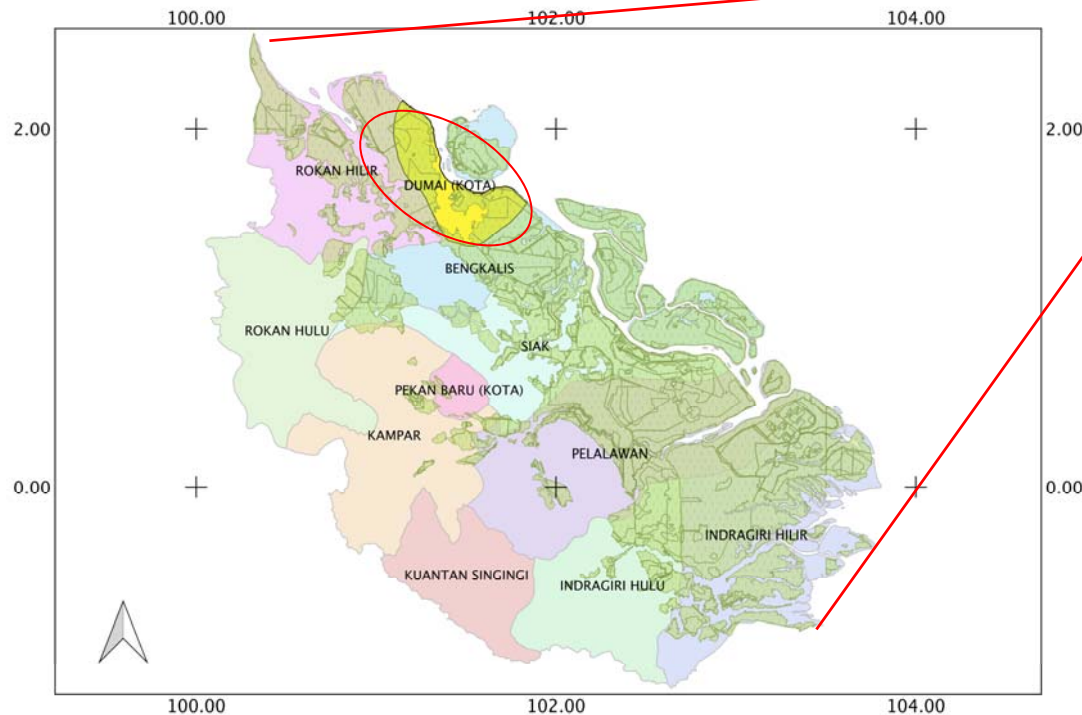
Sumber Data : Data Prakiraan (MODEL WRF)

FDSR application at
Siak Fire Brigades
Office, Riau



FDSR application at
Minas Fire Brigades
Office, Riau

Study Area



- Riau province as the highest number of hotspot
- Highest land and forest fire occurrences
- Fire prone area designated
- Source of transboundary haze pollution
- Peatland (3.8 mio ha/ 43% Riau area)

Fire in Riau

2:59 pm August 4, 2015 | No Comment

Lack of Water Sources in Riau Hampers Firefighting on Peat Soil



2:37 pm August 4, 2015 | No Comment

Indonesia Will Head SEA Smoke Haze Coordination Center



2:34 pm August 4, 2015 | No Comment

Fires Pushing More Smoke Across Cities in Sumatra



5:55 pm July 28, 2015 | No Comment

APRIL Enlists Villages to Fight Forest Fires

After years spending millions of dollars on equipment and personnel to combat forest fire with little result, pulp and paper giant Asia Pacific Resources International Holdings sees that there's no substitute for good neighbors.



4:45 pm April 21, 2014 | No Comment

As Many as 23 Companies Said to Be Involved in Riau Fires This Year

Indonesian Environment Minister Balthasar Kambuaya said on Monday that as many as 23 companies were allegedly responsible for fires and haze that struck Riau earlier this year, although police so far have named only one of them a suspect.



3:11 pm April 1, 2014 | 7 Comments

TNI Plans for Return Home as Riau Haze Under Control: BNPB

The number of hotspots detected in the troubled Indonesian province of Riau fell to zero over the weekend after forest fires burned intermittently for some two months, Indonesian officials said on Tuesday as they announced plans to recall some 1,000 military personnel sent to combat local haze-causing fires.



2:05 pm March 28, 2014 | 2 Comments

After a Moment of Calm, Riau Is Burning Once Again

The haze has returned to Indonesia's troubled Riau province as the region's forests once again burned.



6:07 pm March 16, 2014 | No Comment

Police Warn Riau Fire Starters as SBY Lands in Province

The chief of the National Police has sent a strong warning to anyone caught illegally slashing and burning land in Riau: stop immediately or risk being shot for resisting arrest.



7:33 pm March 2, 2014 | No Comment

Govt Turns to Water Bombers as Riau Fires Continue

The National Disaster Mitigation Agency (BNPB) on Sunday began using aerial firefighting methods in an effort to quell blazes that continued to burn in 12 Riau subdistricts and municipalities.



6:14 pm February 25, 2014 | 1 Comment

More Riau Haze Arrests as Singapore Drafts Legislation

Another 24 suspects were charged with setting brushfires in Riau on Tuesday in the latest police crackdown on illegal land clearing as the fires raging across the Sumatran province for more than three weeks showed signs of subsiding.



4:30 pm February 24, 2014 | 1 Comment

Respiratory Illness and Flight Disruptions as Riau Haze Worsens

Some 20,000 people have reported respiratory illnesses in Riau as forest fires and the resulting haze continued to worsen on Monday, the local health agency reported.



7:38 pm February 21, 2014 | 3 Comments

Riau Peatland Fires Continue to Burn as Police Seek Perpetrators

A raging forest fire in the Giam Siak Kecil-Bukit Batu biosphere reserve in Riau continued to expand on Friday, charring more than 1,000 hectares of Sumatran peatland.



9:45 am November 19, 2013 | No Comment

Indonesia Still at High Risk of Catastrophic Fires

In June, Singapore, Malaysia and Indonesia were enveloped in haze as hundreds of forest fires burned across the island of Sumatra, in the worst pollution crisis to hit Southeast Asia in more than a decade. An analysis by the U.S.-based World Resources Institute (WRI) determined that 150,000 square kilometers

INTERNATIONAL WORKSHOP

LAND USE/COVER CHANGES AND AIR POLLUTION IN ASIA

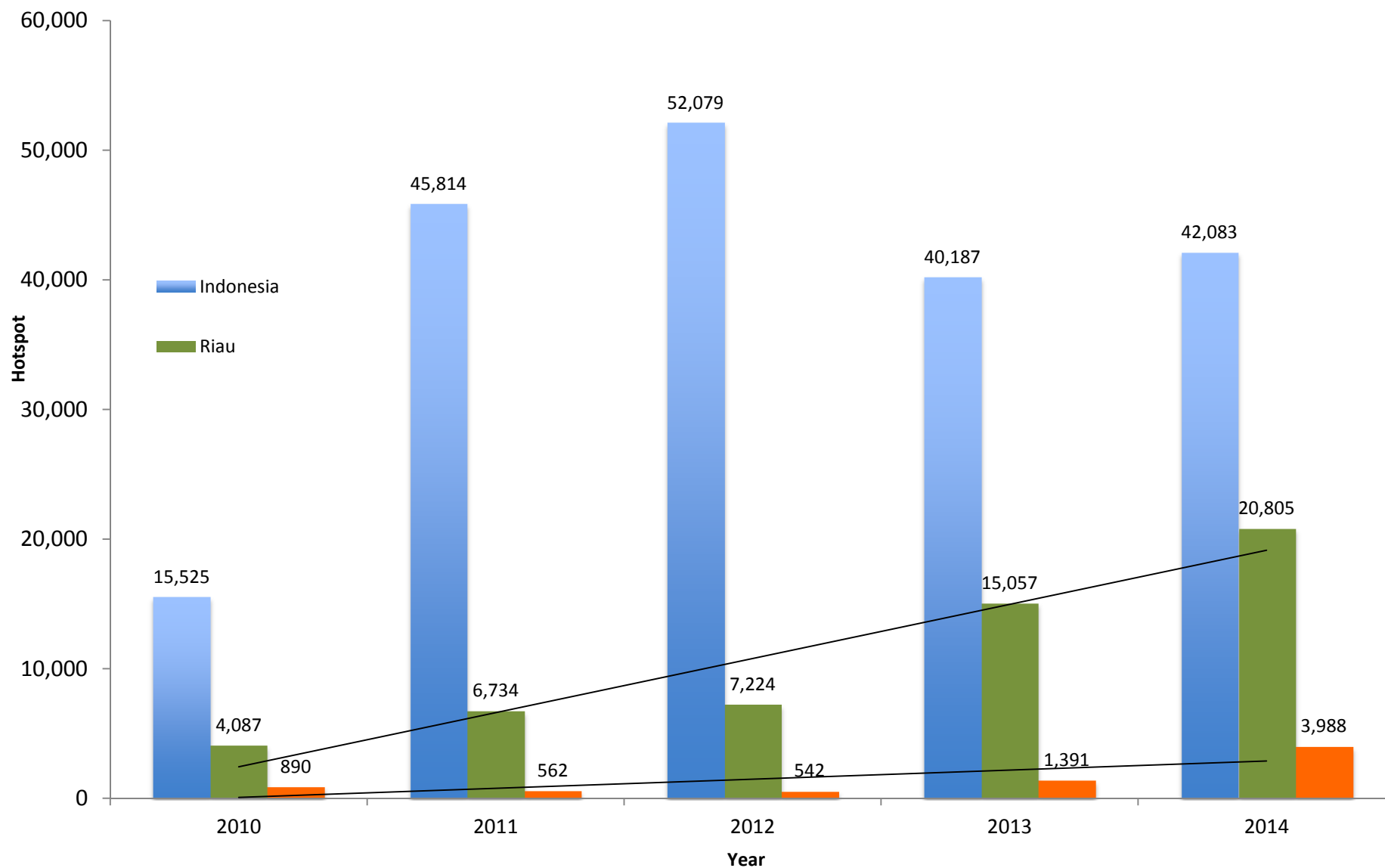
AUGUST 4TH-7TH, 2015 - BOGOR, INDONESIA

Hotspot in Riau based on Land Use

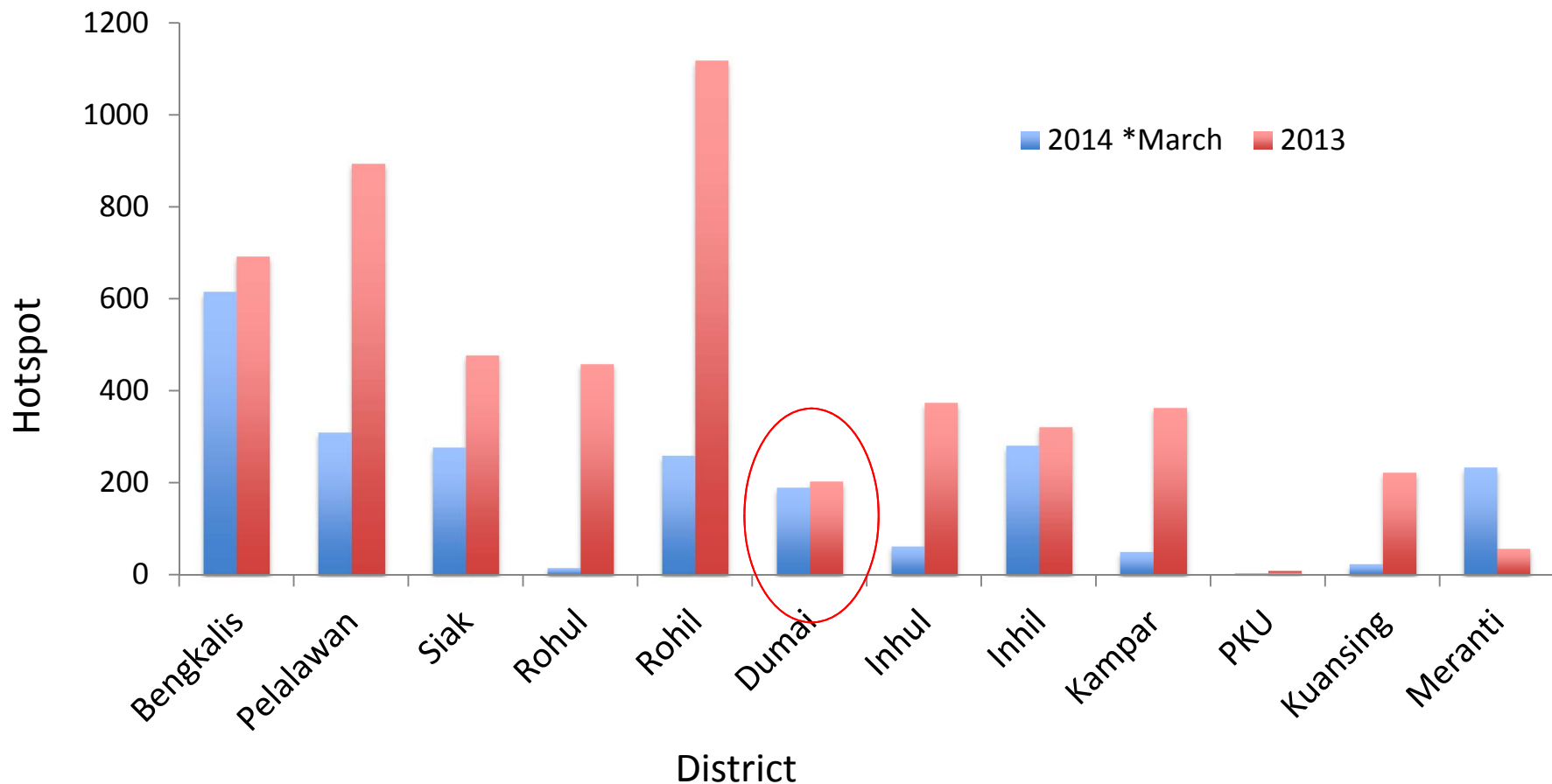
Land Use	Year			
	2010	2011	2012	2013
Conservation Area	49	50	232	262
Natural Forest	90	181	294	244
Planted Forest	395	819	1.059	1.077
Protected Forest	47	126	271	234
Plantation	121	263	337	417
Land/Others use	1.005	2.097	2.493	2.948
Total	1.707	3.536	4.686	5.182

Source: MoF

Fire Hotspot in Indonesia, Riau Prov & Dumai District



Hotspot in Riau based on Districts



Peatland in Riau Province Total Riau : 8.915.015,09 HA

No	District	Area (Ha)
1	Indragiri Hilir	982.526
2	Indragiri Hulu	222.396
3	Bengkalis	856.386
4	Pelalawan	679.371
5	Siak	503.669
6	Rokan Hilir	453.874
7	Rokan Hulu	50.481
8	Dumai	159.595
9	Kampar	119.775
10	Pekanbaru	5.231
Total		4.033.304

Peat Fire Characteristics

- Peat fires in Riau mostly surface fires : spread fast and consumes surface fuel in short time.
- Deep peat fire (smoldering fires) spread slowly.
- Peat fires may occur after the peat has been drained and under ground water level more than 40 cm.

Peatland Fire vs. Peat Fire

Peatland Fire = Fire on a peat dominated site

Peat Fire = Ground Fire burning in Peat Soil

surface fires on peatlands lead to peat fires when peat soil is dry.

Fire Types

1. Small scale land fire owned by community for a particular planting eg pineapple.
2. Area extention by burning the shrub
3. Encroachment using fire at plantation area
4. Open a new land for plantation
5. Fire at natural forest (conservation area and core zone of biosphete reserves)

Sources of the fires

- Land Conversion
- Drought
- (Illegal) Shifting Cultivators
- Land preparation using fire for forestry and oil palm activities
- Logging



Fire in Riau Province, 26 July 2013
credit photo : Agus Wibowo-BNPB

← Burnt area

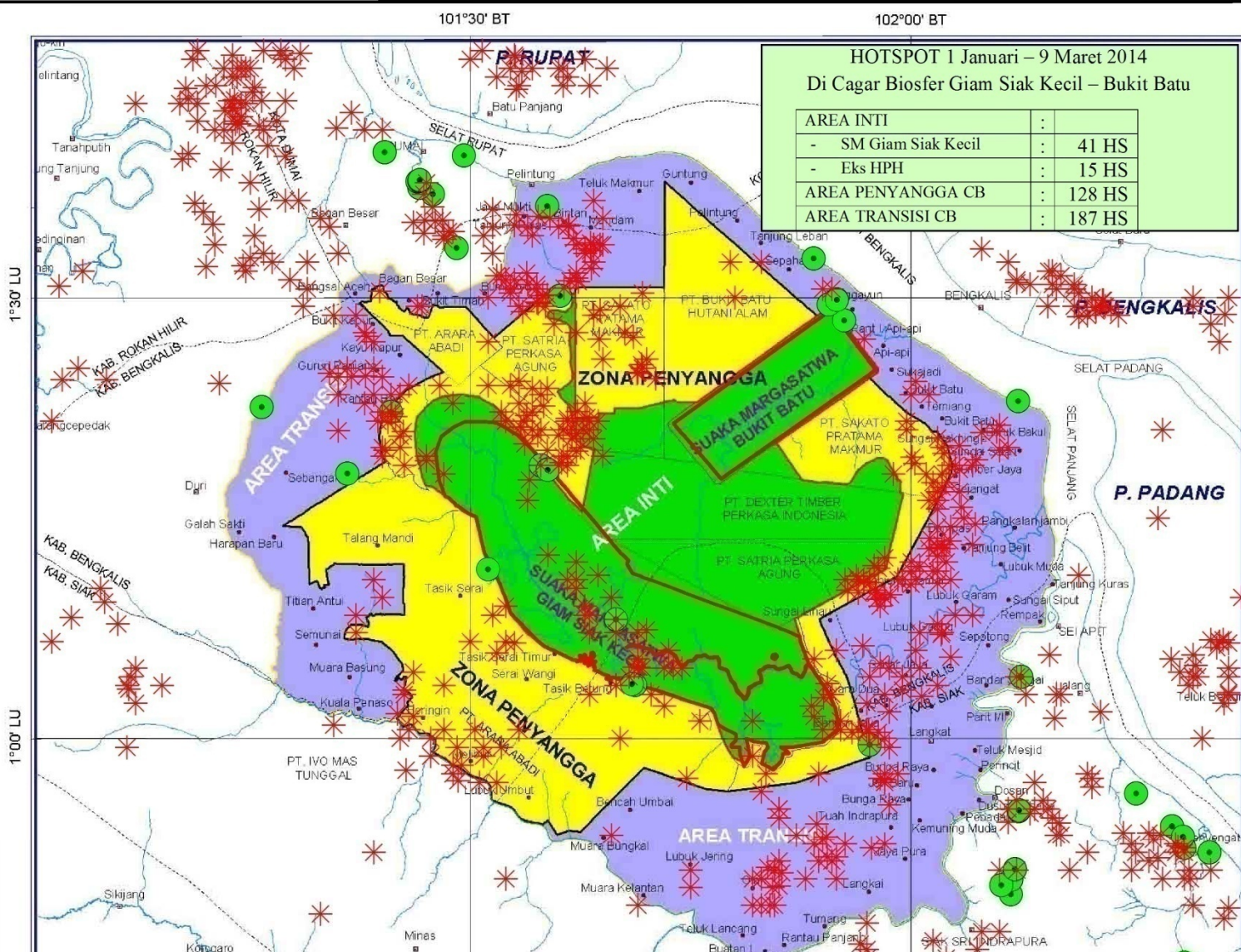


INT

LAND USE/COVER CHANGES

AND AIR POLLUTION IN ASIA

AUGUST 4TH-7TH, 2015 - BOGOR, INDONESIA



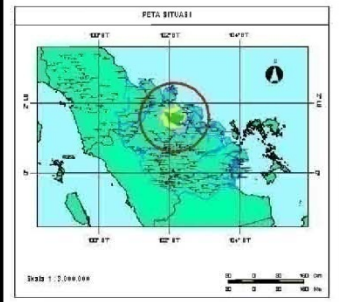
Core Area
± 178,722 Ha
(KK 106,467, HTI 72,255)

Buffer Zone HTI
± 222,500 Ha

Transition Area (Pemukiman)
± 304,123 Ha

Legenda

- Kota
- Desa
- Jalan
- Sungai
- Batas Kabupaten/Kota
- Area Inti
- Zona Penyangga
- Area Transisi
- Lokasi Pemadaman Kebakaran Oleh Manggala Agni
- Hotspot 1 Jan s.d 2 Maret 2014



Datum Vertikal : WGS 1984
Datum Horizontal : Permukaan Laut Provinsi Riau
Zona UTM : NUTM 47
Proyeksi Grid : Geodetik

*Peta ini tidak dapat dijadikan acuan batas-batas negara

Declared by UNESCO-MAB programme as biosphere reserve at Jeju, South Korea 25 – 29 Mei 2009
Minister of Forestry as of 1 July 2009 (705.271 ha)



Fire at Giam Siak Kecil Biosphere Reserve

INTERNATIONAL WORKSHOP ON

LAND USE/COVER CHANGES

AND AIR POLLUTION IN ASIA

AUGUST 4TH-7TH, 2015 - BOGOR, INDONESIA



Fire at Giam Siak Kecil Biosphere Reserve

INTERNATIONAL WORKSHOP ON

LAND USE/COVER CHANGES

AND AIR POLLUTION IN ASIA

AUGUST 4TH-7TH, 2015 - BOGOR, INDONESIA



Land fire at Sepahat sub-district, February 2014

INTERNATIONAL WORKSHOP ON

LAND USE/COVER CHANGES

AND AIR POLLUTION IN ASIA

AUGUST 4TH-7TH, 2015 - BOGOR, INDONESIA



Surface fire in wild *Acacia* forest in Siak District, Riau (March, 2014)



Peatland fire at Siak District, Riau 2014



Land fire at Dumai District, Riau, February 2014



Land preparation using fire near Riau airport (July, 2015)



Burned at Sepahat, Dumai district, Riau



Burned area at Pelintung, (along left-side the road),
Dumai district, Riau



Land for sale...

Canal Blocking

There has been a big program call blocking canals in Riau as part of prevention activities. Actually the Government plan to set up 1000 blocking canals in order to re-wetting the peatland. But, the latest proposal is to set up 629 canal blocking in Riau itself.

125 locations already verified to build the canal. But the progress is too slow due to administration procedure.

Under the Ministry of Environment and Forestry, 25 blocking canals in Kepulauan Meranti have just established. Since last March 2015, Riau province stated as 'fire emergency status' till the end of August.

UNDP is also interested in establishing the blocking canal for other location in Riau as well as Jambi province, and July 2015 they start to verify the locations.



Shallow water level at Siak Giam Kecil, Riau, prevented the fire from establishing a deep peat fire. Fires here thus categorized as surface fires on peat. The fires spread quickly and brought high damage severity to the area. The areas were burned at February, 2014.

The development of an appropriate canal will reduce the negative effect of using the peat land. In the reality many of the development of canals did not follow the rules, so the negative effects were occurred, i.e. flooding, disappearance of flora and fauna, increased forest fires, sedimentation and reducing the quality of river (Anwar, 2006)



Canal in Giam Siak Kecil Biosphere Reserve

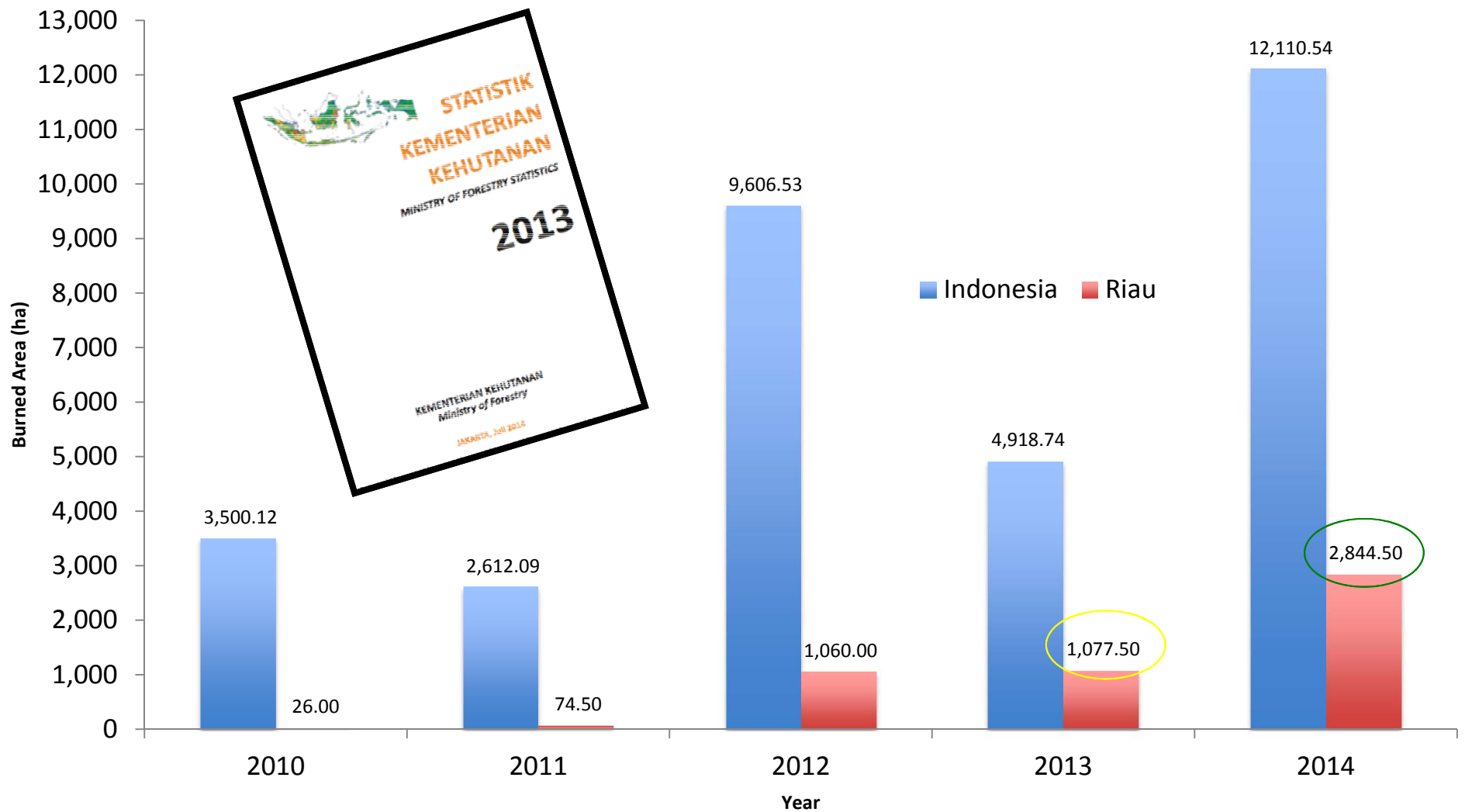


Canal in four years old oil palm plantation



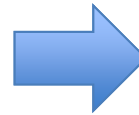
Canal constructed by community in Pelintung, Duma, Riau for oil palm land preparation

Burned Area : Indonesia vs Riau Prov



Burned Area in 2013 (official report from Regional Offices)

Provinces	Burnt Area (ha)
North Sumatra	175.00
Riau	1,077.50
Jambi	199.10
South Sumatra	188.76
West Kalimantan	22.70
South Kalimantan	417.50
Central Kalimantan	0.05
West Java	257.78
Central java	31.20
East Java	1,352.14
Yogyakarta	6.00
Bali	60.50
West Nusa Tenggara	12.00
East Nusa Tenggara	624.11
North Sulawesi	0.25
SE Sulawesi	13.00
South Sulawesi	36.50
Total	4,469.09



MoFr received FBA data from the regional office.

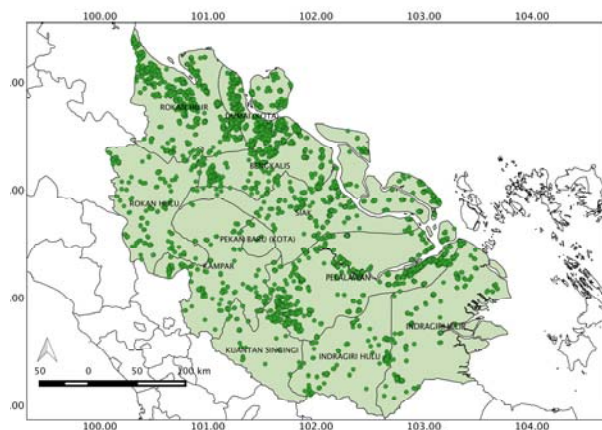
Landsat 8 as source of burned area estimation



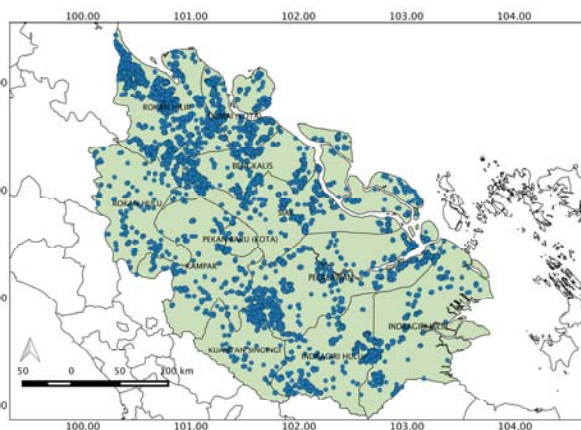
2013



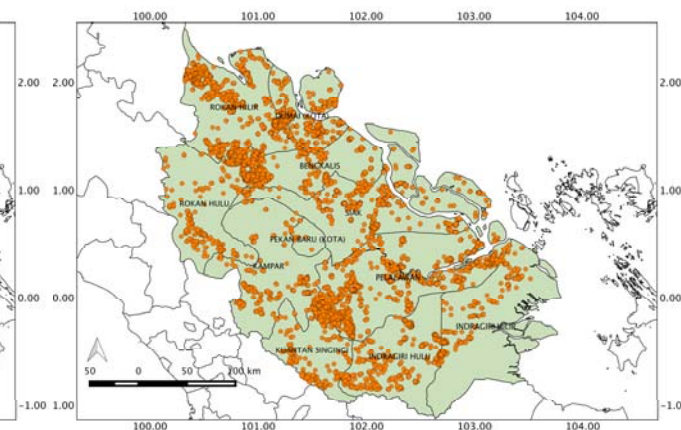
2014



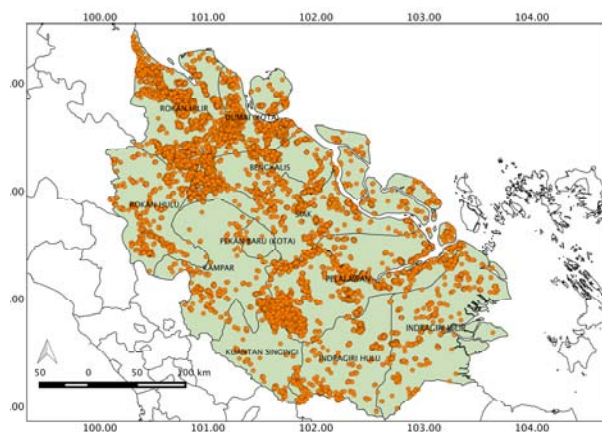
FHS 2010



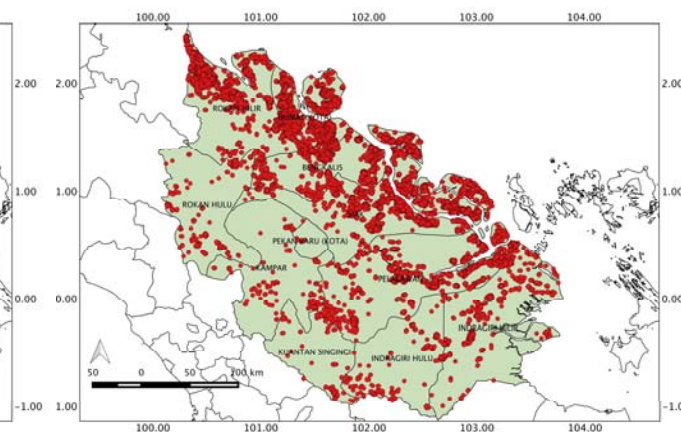
FHS 2011



FHS 2012



FHS 2013



FHS 2014

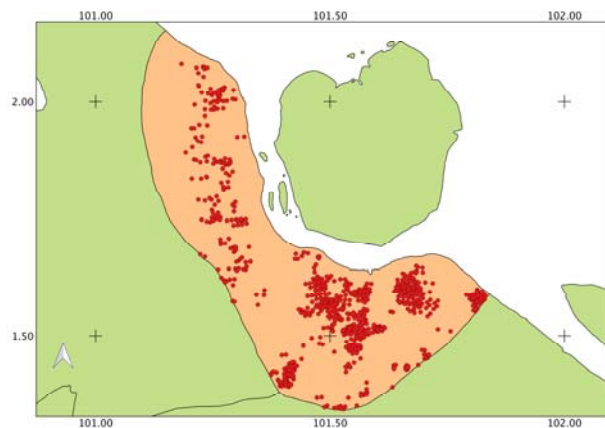
Fire Hot Spot in Riau Province

INTERNATIONAL WORKSHOP ON

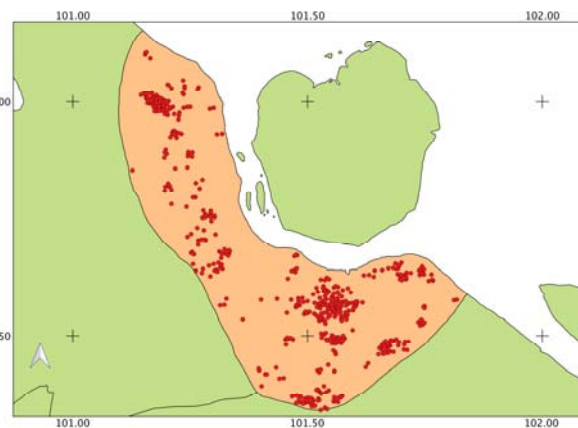
LAND USE/COVER CHANGES

AND AIR POLLUTION IN ASIA

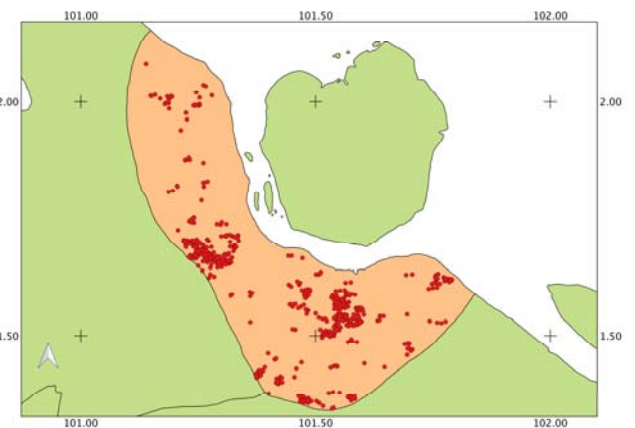
AUGUST 4TH-7TH, 2015 - BOGOR, INDONESIA



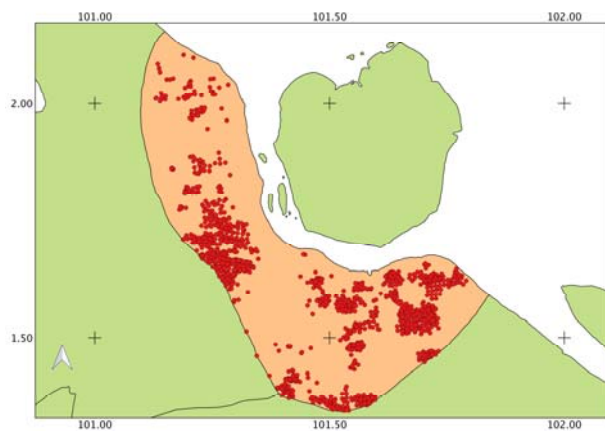
FHS 2010



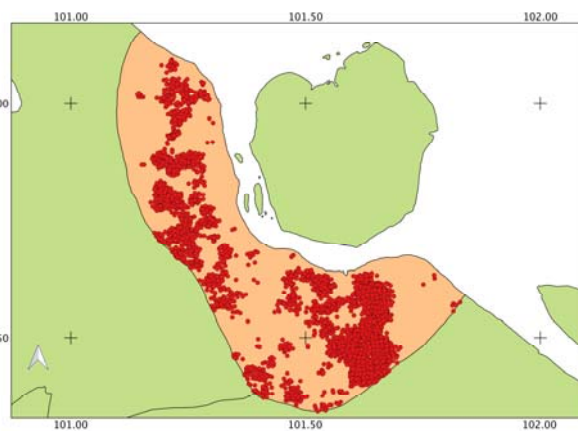
FHS 2011



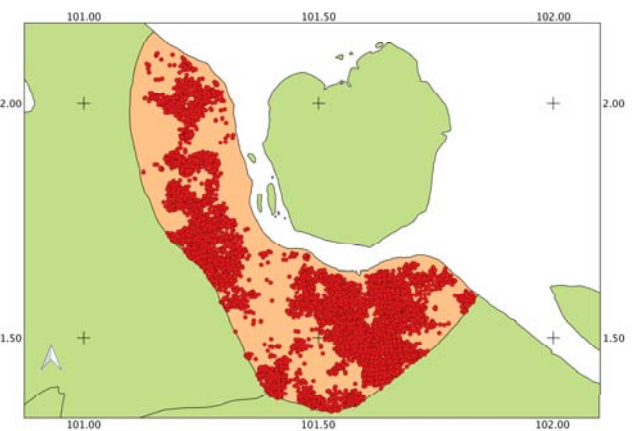
FHS 2012



FHS 2013



FHS 2014



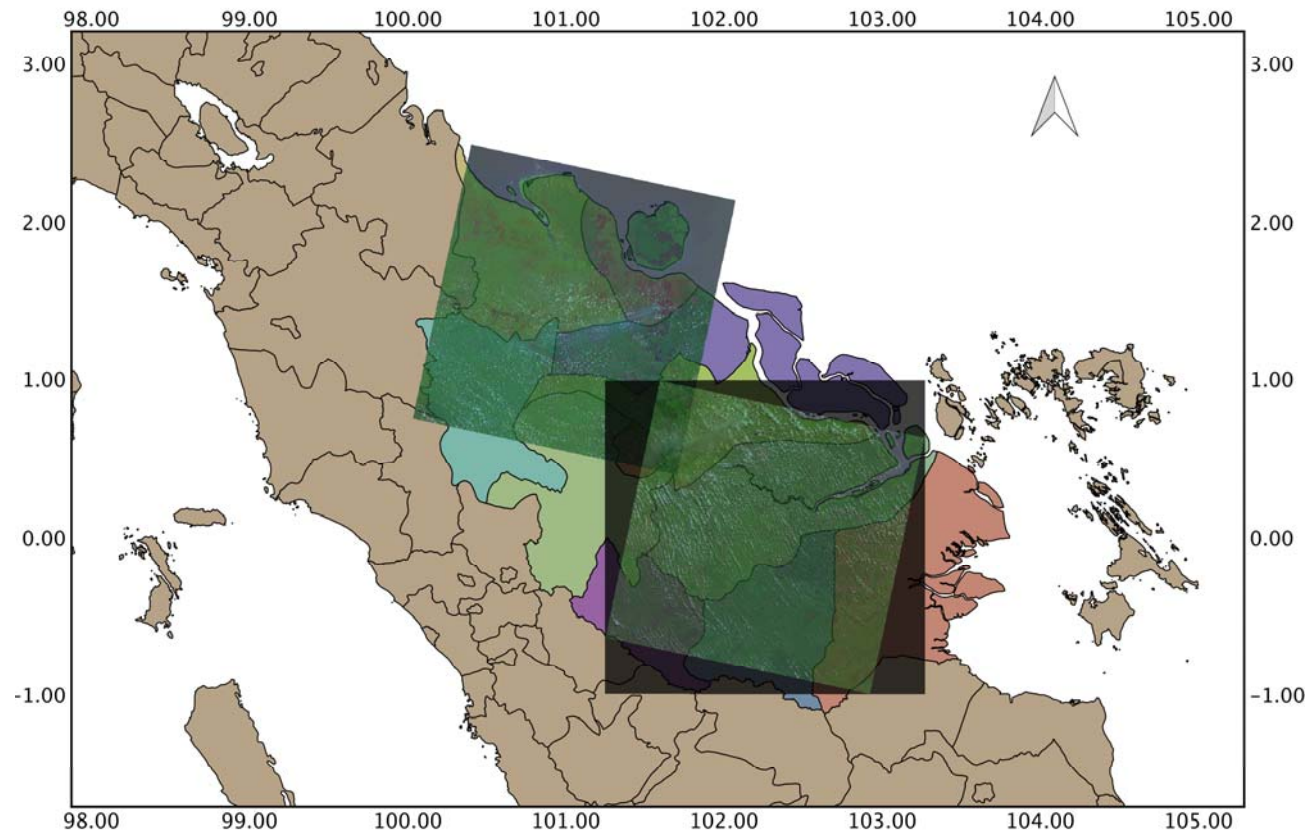
FHS 2010-2014

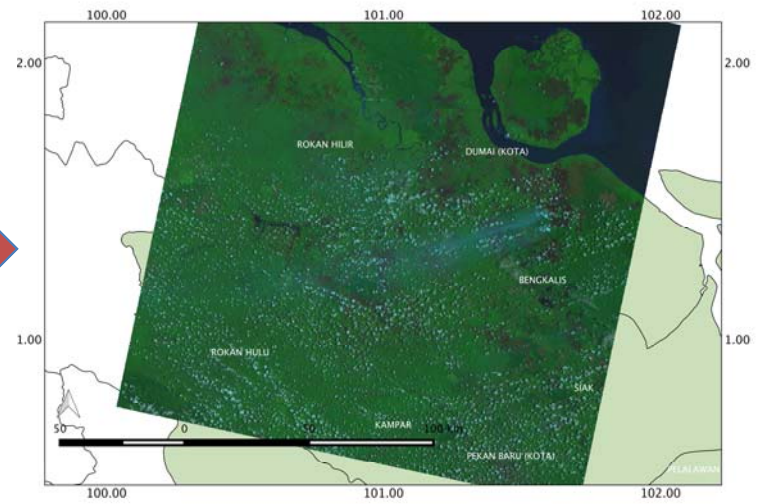
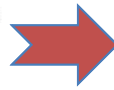
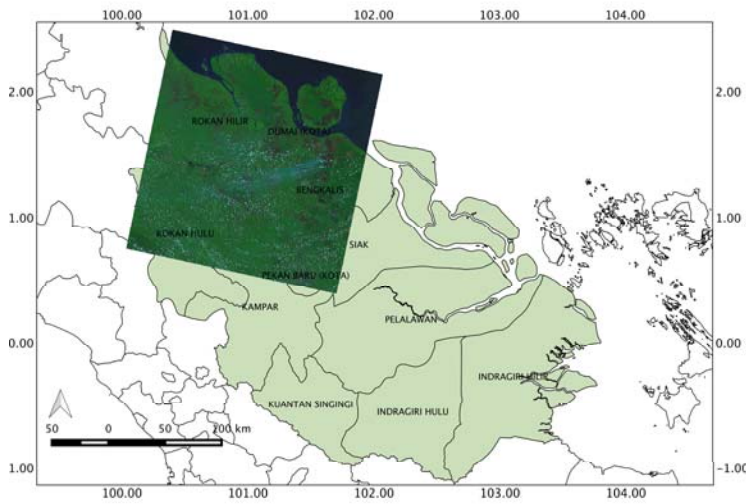
Fire Hot Spot in Dumai City, Riau Province

Burned Area Estimation : Semi-Auto Classification

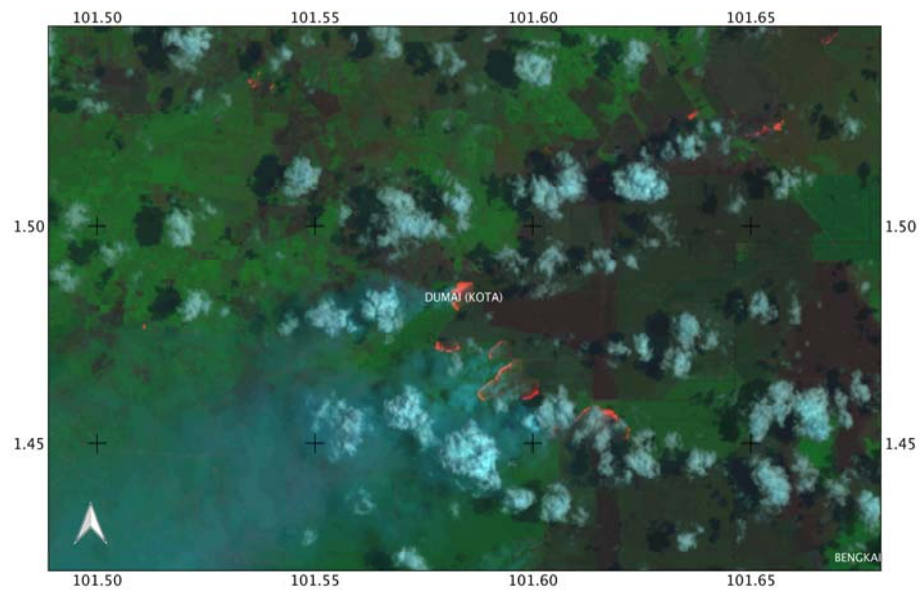
Landsat Image Riau 2010-2015 CC 20%

- 2010 : 7
- 2011 : 2
- 2012 : 7
- 2013 : 9
- 2014 : 10

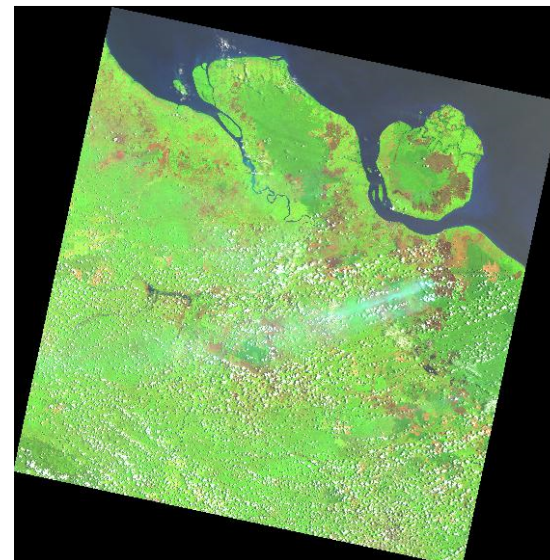
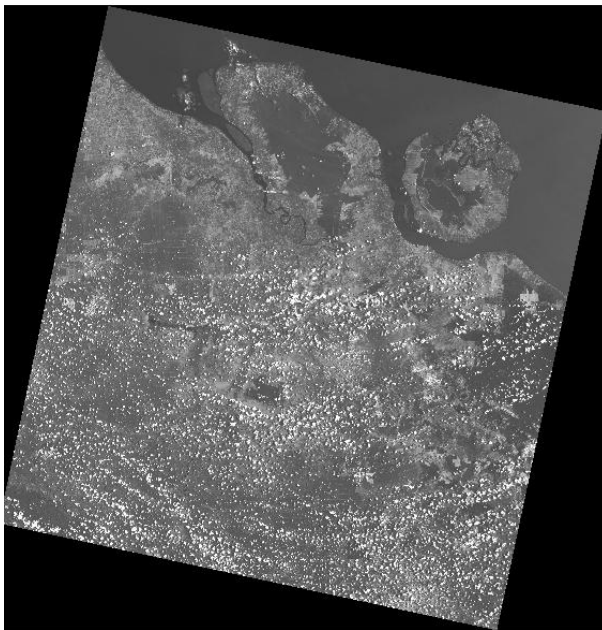




LC81270592014083_Comp754



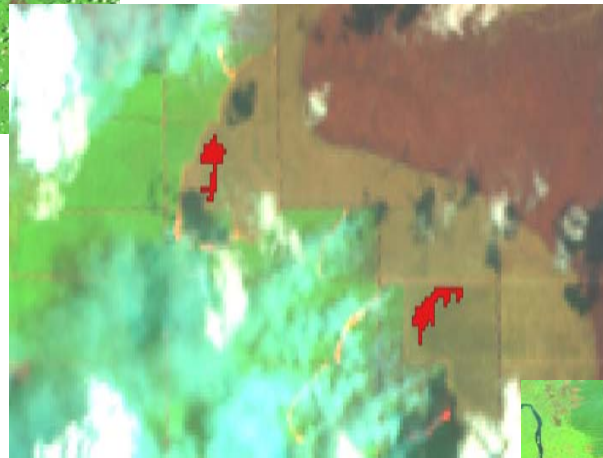
Landsat8 127/59, 24.03.2014
Band 2-7 (Blue-Green-Red-Nir-SWIR1-SWIR2)
RGB 543 (Color Infrared – Vegetation)



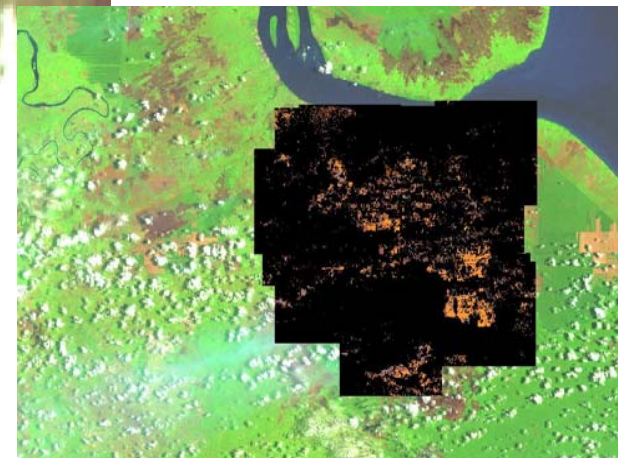
DN to Reflectance



Fire Detection



ROIs

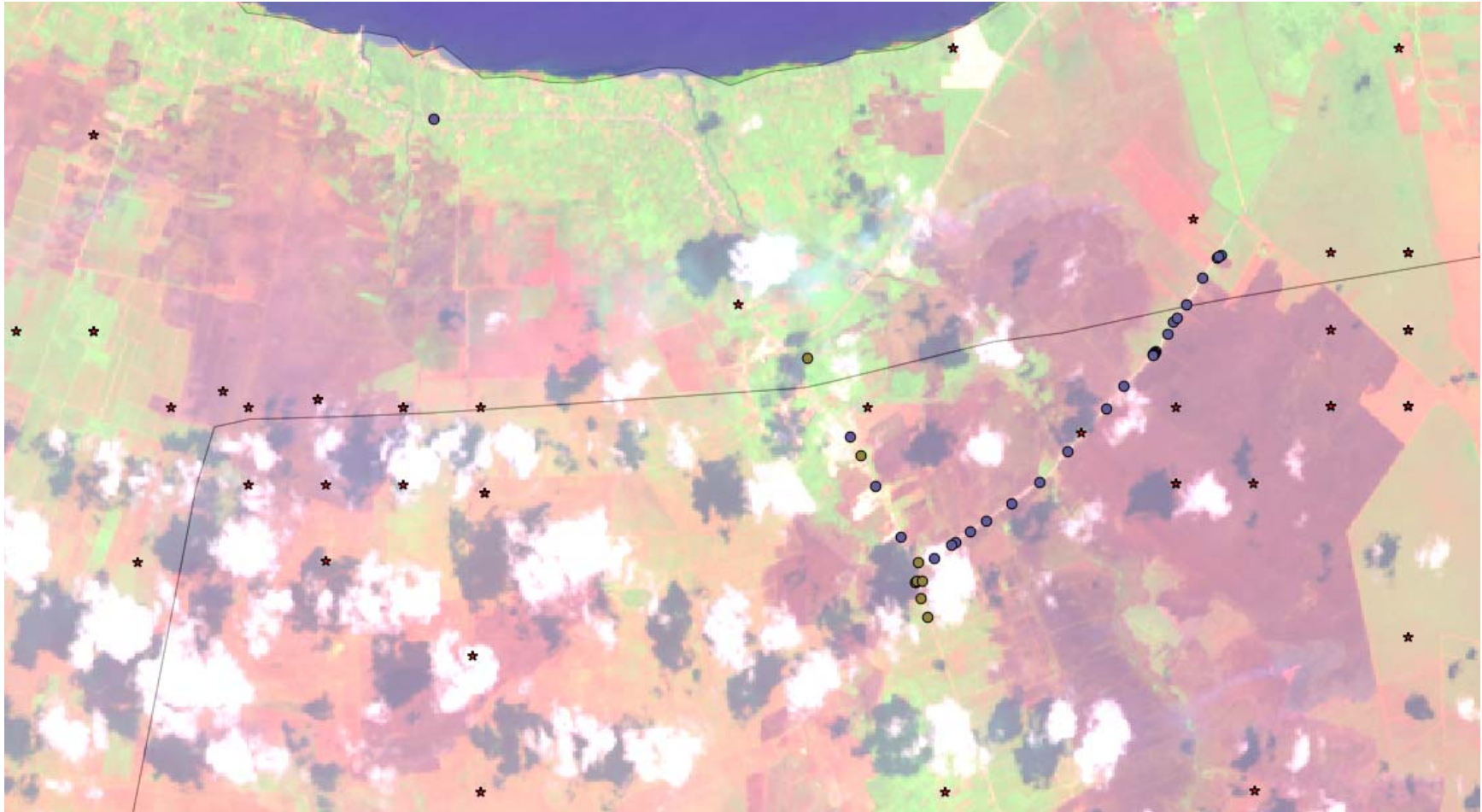


Burned Area Classification

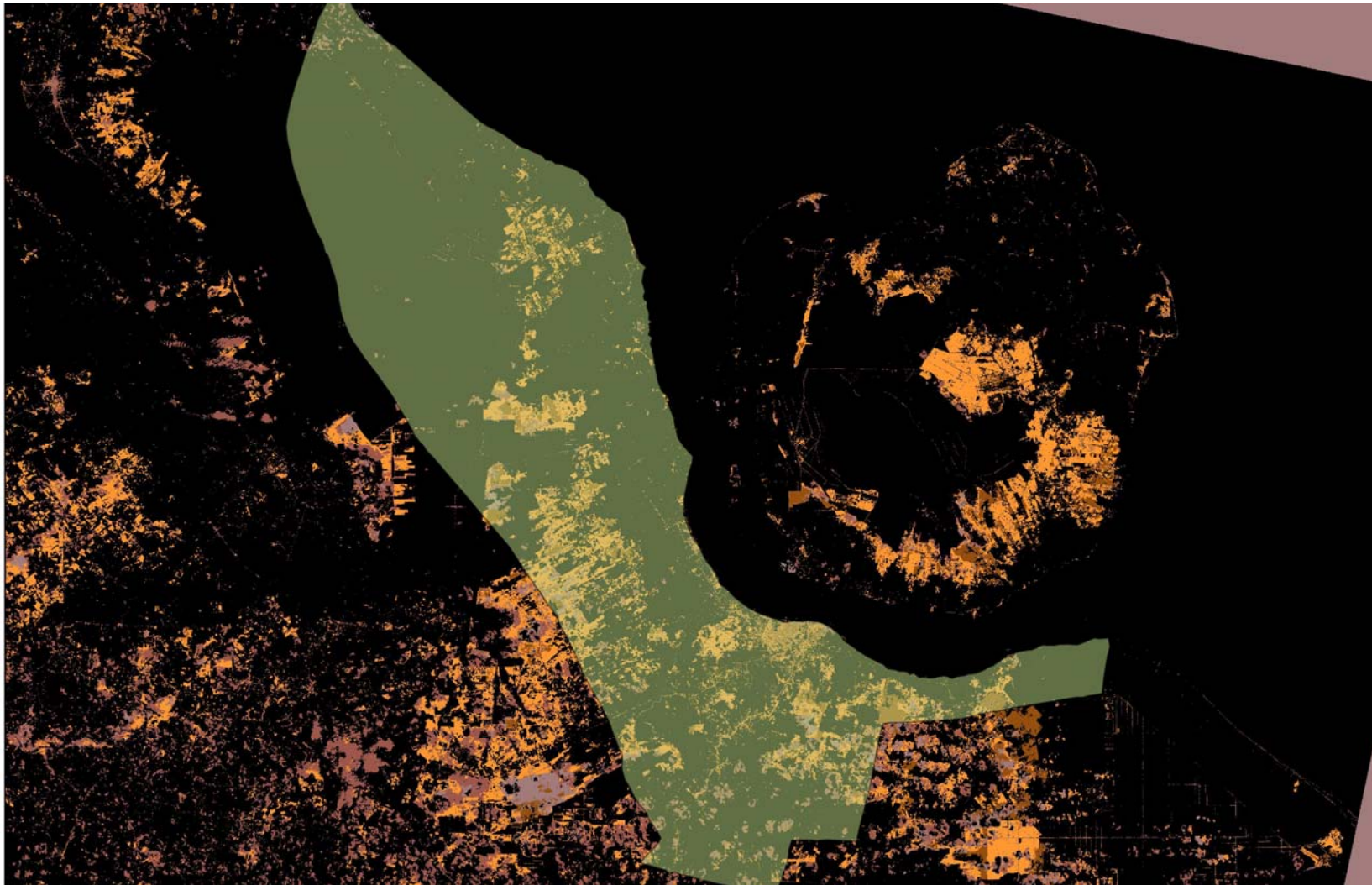
FHS MODIS Validation



Ground truth validation



Burned Area Estimation



20-30 cm



Depth of fire on peat, Riau 2014

Community Development



FDRS sign board at Siak Fire Brigades Office



INTERNATIONAL WORKSHOP

LAND USE/COVER CHANGES

AND AIR POLLUTION IN ASIA

AUGUST 4TH-7TH, 2015 - BOGOR, INDONESIA

Fire Controlling

- Prevention
- Suppression
- Handling of Impact



Manggala Agni : 2.800
Community Fire : 7.308



INTERNATIONAL WORKSHOP ON

LAND USE/COVER CHANGES

AND AIR POLLUTION IN ASIA

AUGUST 4TH-7TH, 2015 - BOGOR, INDONESIA

Remarks

- Peatland fire will be repeatedly occur in Riau. Need a proper policy based on scientific knowledge.
- Surface fires on peatland lead to peat fires when peat soil is dry.
- Development an applicable methodology to measure the burned area (and depth) of peatland fire is very important (eg. for MRV).
- Applicable methods needed to estimate BA regularly

Outlook

- Ground truth at study area (validation)
- Study with BAMS (Burned Area Mapping Software, 2014)
- Compare Landsat Reflectance

Remote Sens. **2014**, *6*, 12360–12380; doi:10.3390/rs61212360

OPEN ACCESS

remote sensing

ISSN 2072-4292

www.mdpi.com/journal/remotesensing

Article

BAMS: A Tool for Supervised Burned Area Mapping Using Landsat Data

Aitor Bastarrika ^{1,*}, Maite Alvarado ^{2,†}, Karmele Artano ^{1,†}, Maria Pilar Martinez ^{1,†},
Amaia Mesanza ^{1,†}, Leyre Torre ^{1,†}, Rubén Ramo ^{3,†}, and Emilio Chuvieco ^{3,†}

An aerial photograph of a mangrove forest. The image shows a large, dark blue body of water interspersed with numerous green, tree-covered islands of varying sizes. The vegetation is dense and vibrant green. The water reflects the sky and the surrounding greenery. The overall scene is a lush, natural landscape.

Thank you