

A photograph of a forest fire. In the background, several firefighters in orange protective gear are visible, working to contain the fire. The fire is burning on the forest floor, with smoke rising. The foreground is filled with trees, some of which have yellowing leaves, suggesting an autumn setting. The overall scene is hazy due to the smoke.

Earth Observation and Data Sharing for Disaster Management Forest Fire

Haruo Sawada
The University of Tokyo

Forest Fire is a Worldwide and International Problem

Factors

Social factor, Natural factor

Impacts

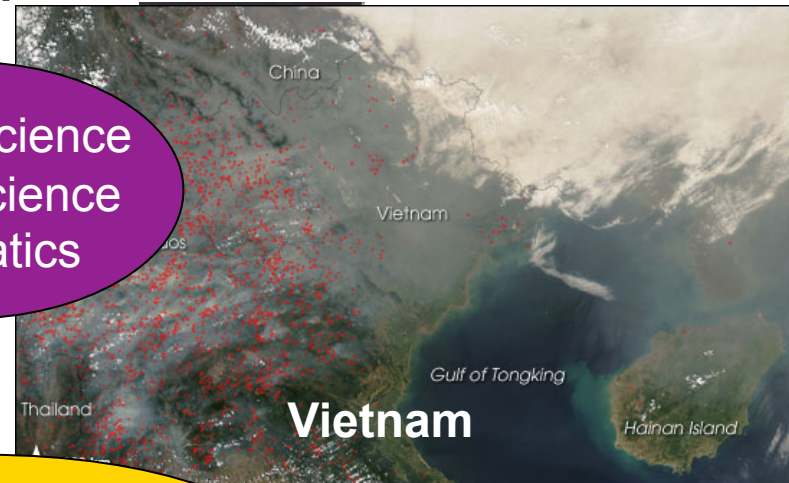
To environment & human health

To forest resources

Countermeasures

Policy, Information, Citizen participation

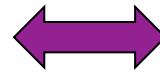
Natural Science
Social Science
Informatics



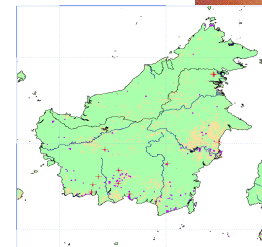
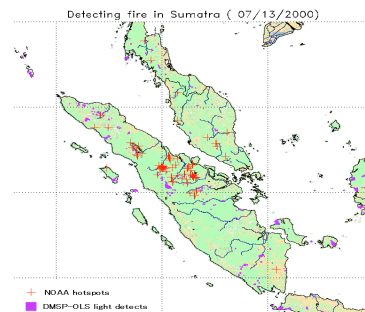
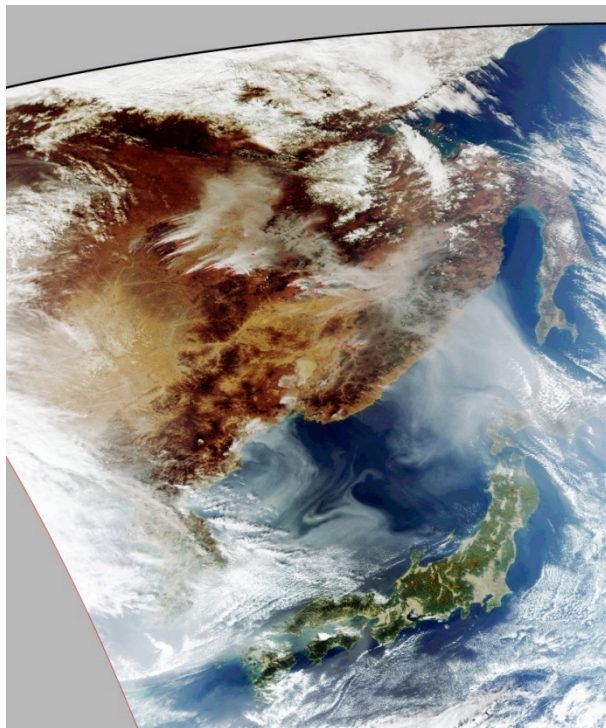
International cooperation
Feedback into policies



Operational
Detection, reporting



Scientific
Information



Automatic Web Information



Activities for Forest Fire Prevention/ Mitigation

1) Fire Event

- Early warning
 - Risk Map
- Early detection
- Fire suppression

Observation
Information
Analysis
Information

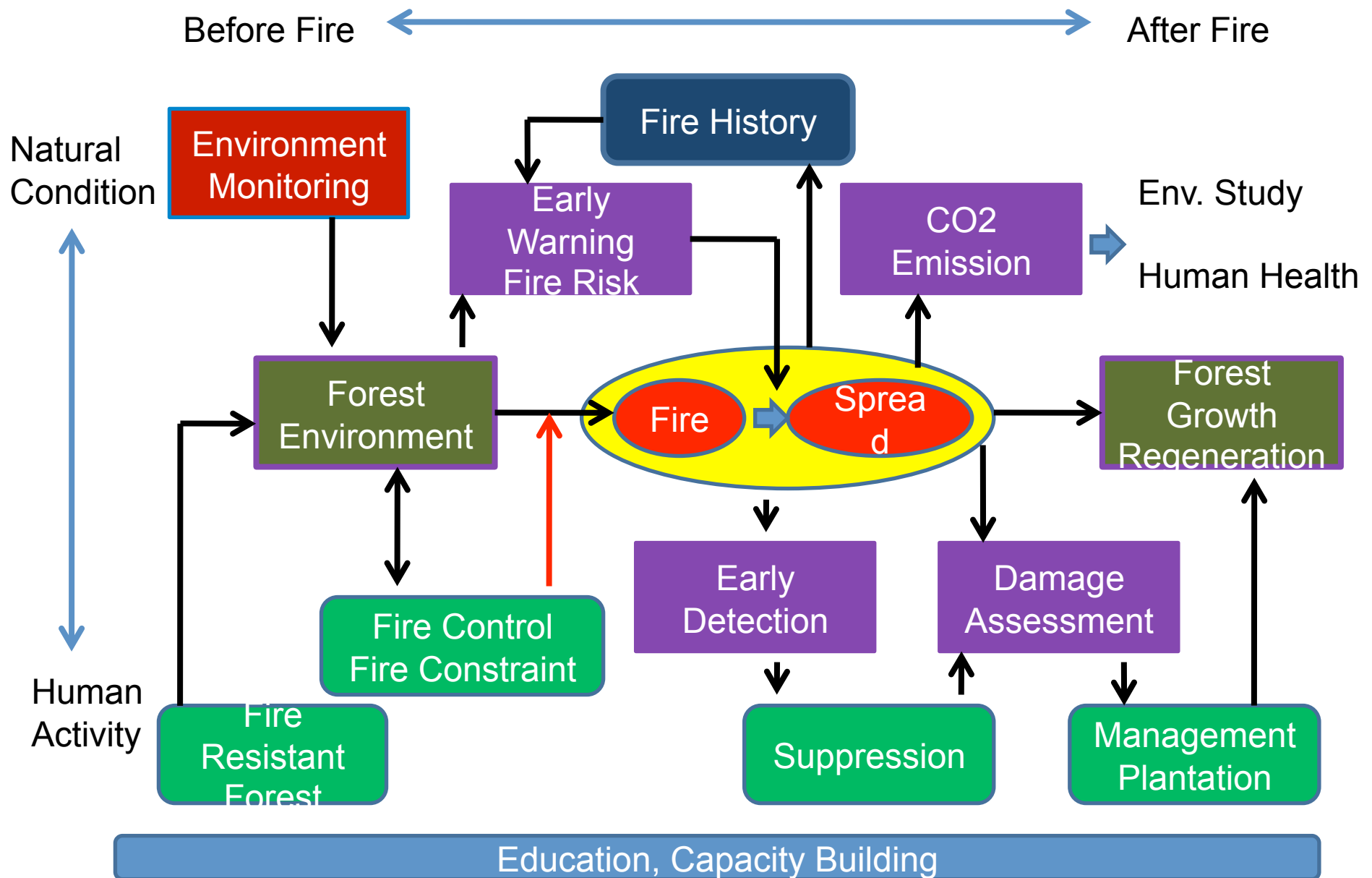
3) Forest Management

- Evaluation of fire damages
 - Gas (CO₂) emission
- Forest regeneration
- Development of Fire Resistant Forest

3) Education

- Curriculum (for children)
- Capacity building: Campaign/
Training

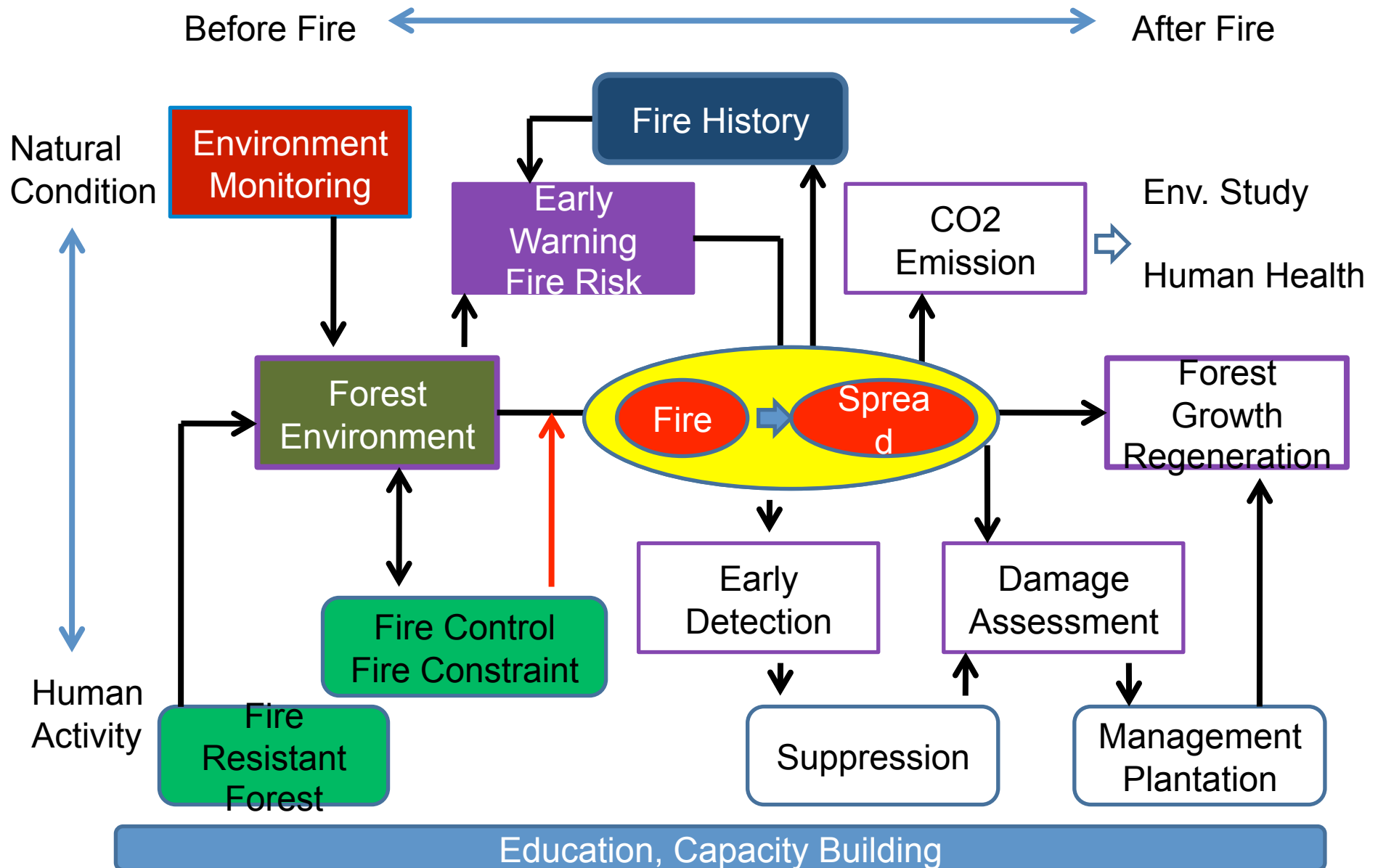
Activities Related to Forest Fire



PROJECTS

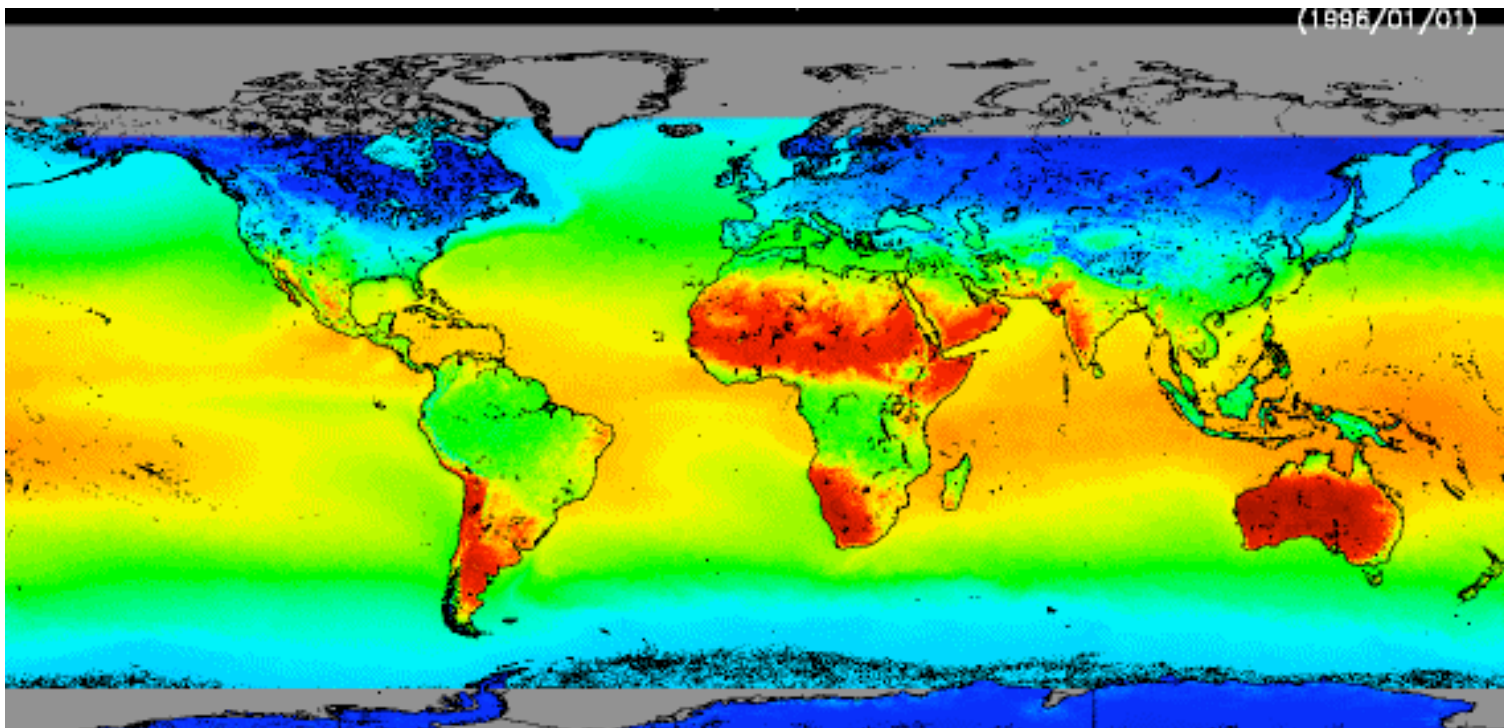
- Scale**
Time Interval
Accuracy
User Friendliness

Before Forest Fire



Early warning

Information of El Nino/La Nina and Dipole mode: Early warning for severe dry season by monitoring sea surface temperature (SST)

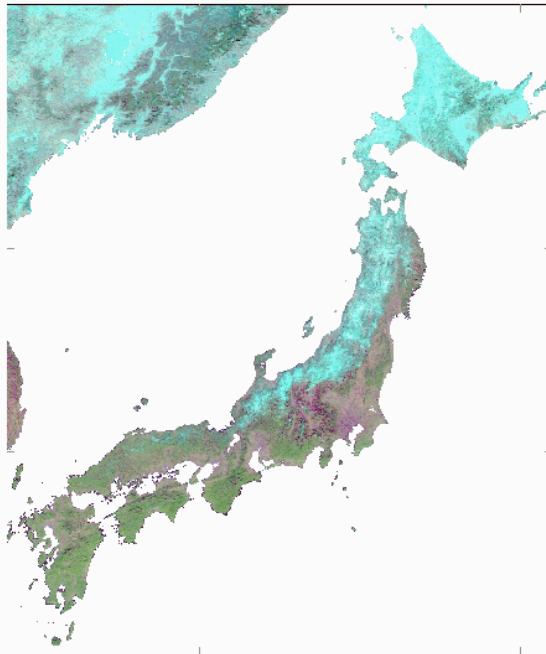
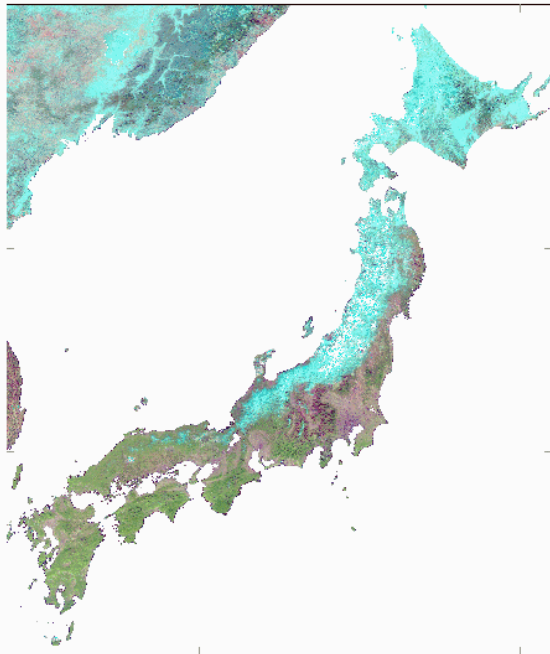


Surface temperature of the world: cloud-free image of every 10 days (Sawada)

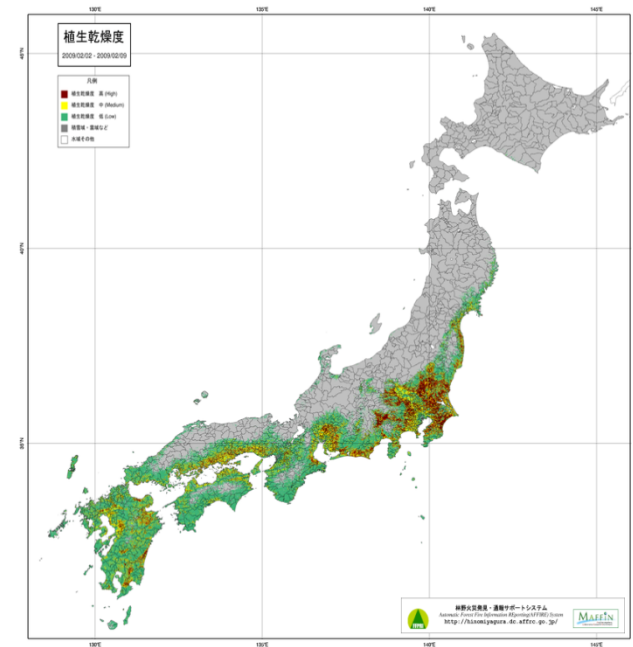
Early warning

Prediction of vegetation dryness for the fire spread risk.

- 1) Cloud-free image is created every 8 days by applying the LMF-KF filtering to MODIS data
- 2) Dryness Index image (VDI) is created and predicted by NDVI and NDII

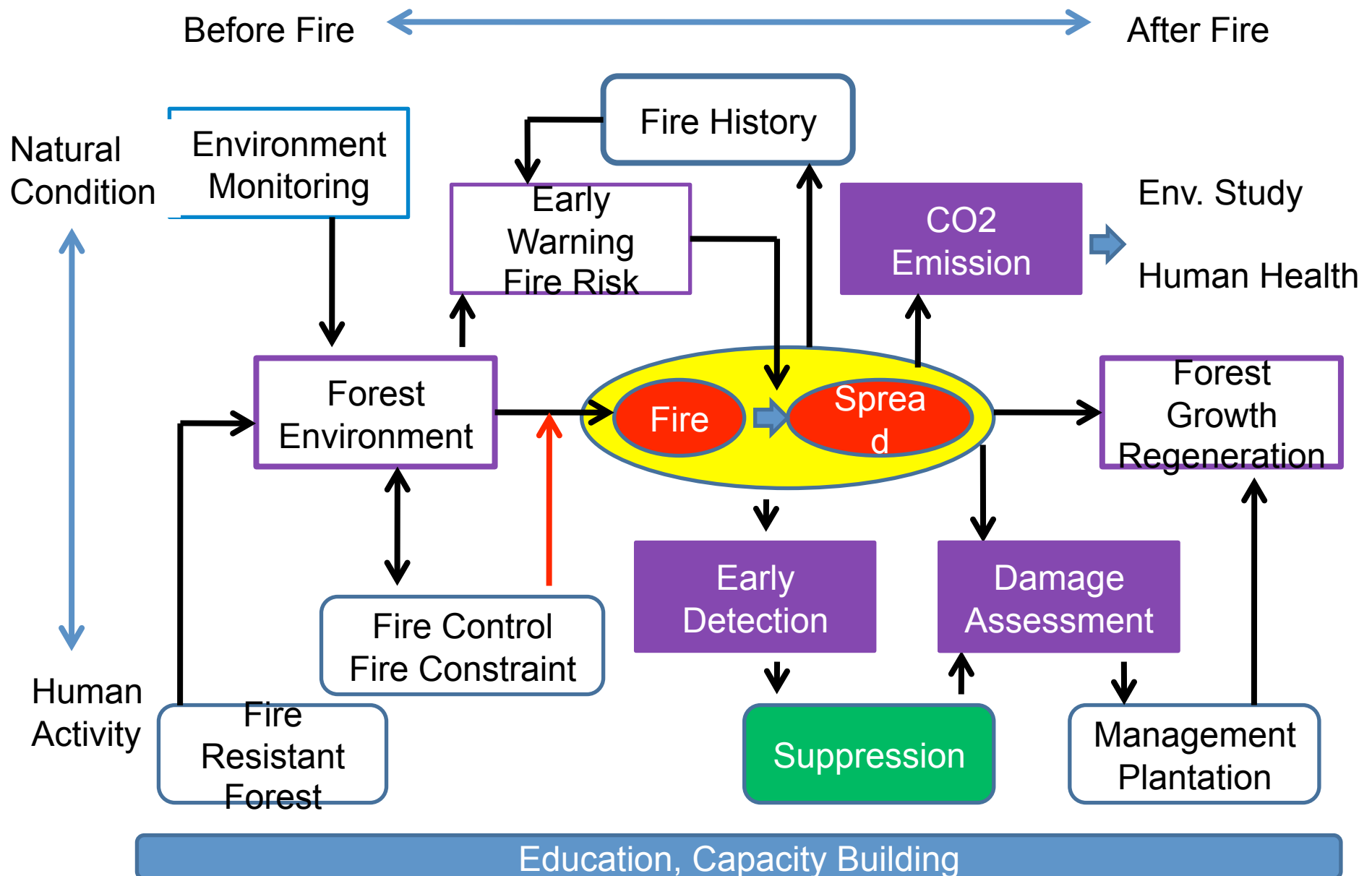


Example of the effect of
LMF Processing



Prediction of dryness
2009.2.2- 2.9

During Forest Fire



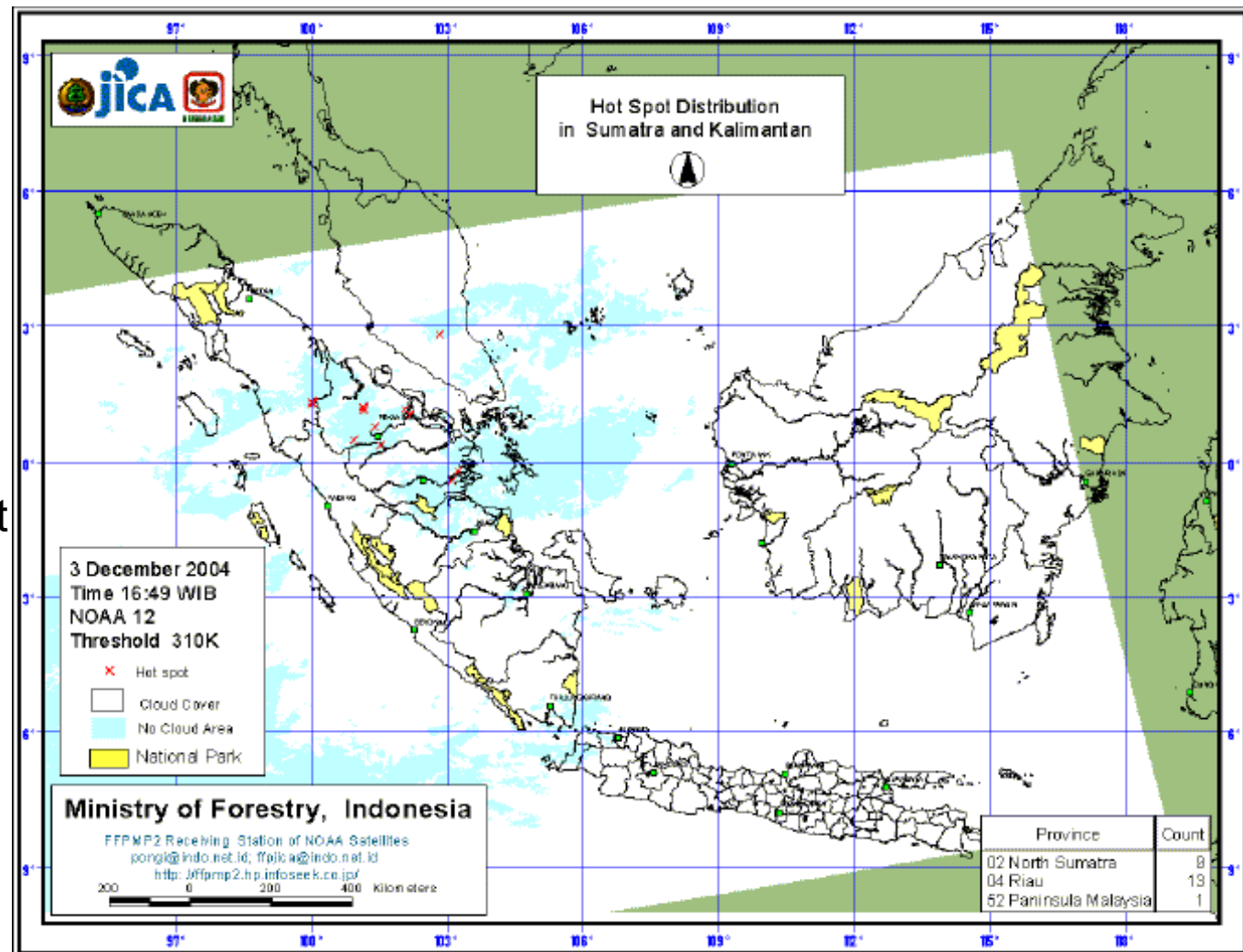
Early Detection of Fires

Forest fire is detected as a “hot spot” on NOAA data.

The coordinates of the hot spot are sent to regional fire management offices in Indonesia.

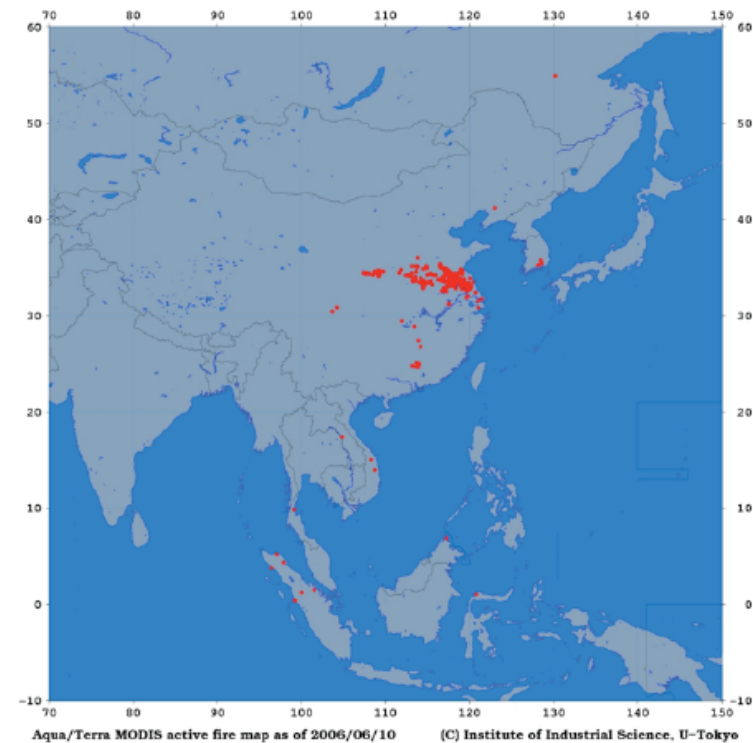
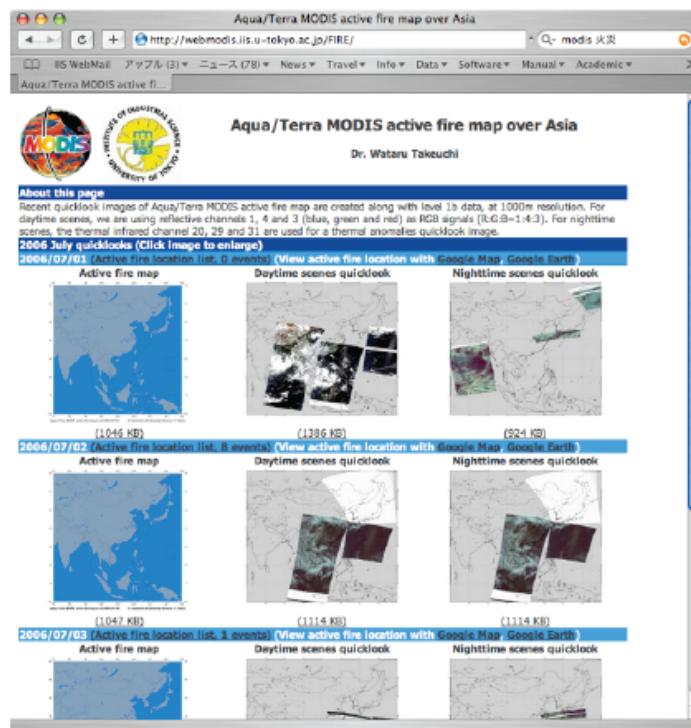
The fire management office checks the hotspot and identify concessioners who use fire. Then, they order the concessioner to suppress the fire.

Fire use for forestry is prohibited by the law.



MODIS fire product at IIS

- Apple The are are mainly two ways to obtain our MODIS fire products;
 - Apple **Anonymous FTP** at WebMODIS
 - Apple Currently fire product in hdf and ascii text format is available online during 2002 Jan - present over IIS and AIT coverage (**22,514 scenes**).



<http://webmodis.iis.u-tokyo.ac.jp/FIRE/>

MTSAT based big fire event monitoring

Active fire mapping database with MTSAT

Wataru Takeuchi, Ph. D. IIS/U-Tokyo/Japan

Introduction

In this page, an extensive burning area is extracted from active fire hot spot database with Aqua/Terra MODIS and a post-fire behavior is monitored with MTSAT imagery for 3 days every 1 hour.

Notice

- Fire events and satellite data acquisition time is represented in UTC (GMT).
- Satellite data is clip out over 1000km x 1000km square size centered in extensive fire location shown above.
- Satellite data is for private or academic use only.

Active fire event database (Currently 681 events and 49032 scenes are registered)

Text based data search:

[1][2][3][4][5][6][7][8][9][10][11][12][13][14][15][16][17][18][19][20][21][22][23][24][25]
[26][27][28][29][30][31][32][33][34][35] [ALL]

ID	Date	Location name	Latitude and longitude	Satellite data
1	2008/04/13	Madhya_Pradesh-India	(17.375000N, 72.125000E)	See satellite image
2	2008/04/13	Hentiy-Mongolia	(44.125000N, 106.541664E)	See satellite image
3	2008/04/13	Chitinskaya_oblast-Russia	(44.291668N, 106.541664E)	See satellite image
4	2008/04/12	Tripura-India	(18.458334N, 86.875000E)	See satellite image
5	2008/04/12	Shan_State-Myanmar	(15.875000N, 93.875000E)	See satellite image
6	2008/04/12	Pegu-Myanmar	(13.458334N, 91.208336E)	See satellite image
7	2008/04/12	Nagaland-India	(20.375000N, 88.375000E)	See satellite image
8	2008/04/12	Kachin_State-Myanmar	(21.541666N, 92.791664E)	See satellite image
9	2008/04/12	Chittagong-Bangladesh	(18.375000N, 87.125000E)	See satellite image
10	2008/04/12	Chin_State-Myanmar	(15.958334N, 87.958336E)	See satellite image
11	2008/04/12	Bokeo-Laos	(15.125000N, 95.541664E)	See satellite image
12	2008/04/12	Assam-India	(20.541666N, 87.875000E)	See satellite image
13	2008/04/12	Arakan_State-Myanmar	(15.958334N, 87.625000E)	See satellite image
14	2008/04/12	Amurskaya_oblast-Russia	(46.541668N, 122.958336E)	See satellite image
15	2008/04/12	Aginskij_Buryatskiy_avtonomnyy_okrug-Russia	(46.125000N, 110.291664E)	See satellite image
16	2008/04/11	Wangchen-Laos	(13.125000N, 97.208336E)	See satellite image
17	2008/04/11	Son_La-Vietnam	(15.708334N, 98.875000E)	See satellite image
18	2008/04/11	Siemreab_Okdar_Meanchey-Cambodia	(9.041667N, 99.208336E)	See satellite image
19	2008/04/11	Shan_State-Myanmar	(15.541666N, 95.125000E)	See satellite image
20	2008/04/11	Pegu-Myanmar	(14.208334N, 91.041664E)	See satellite image

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Last Update: June 13 2007 09:49:02 JST
Corresponding to Dr. W. Takeuchi

Active fire mapping database with MTSAT

Active fire information

- Date (UTC): 2008/04/13
- Location: 22.375000 77.125000 Madhya_Pradesh-India

Animation: [IR1](#) [IR2](#) [IR3](#) [IR4](#) [VIS](#)

61 scenes are found in 3 days from the fire event

Date	IR1 (10.5-11.5)	IR2 (11.5-12.5)	IR3 (6.5-7.0)	IR4 (3.5-4.0)	VIS (0.55-0.90)
2008/04/13 00:30					
2008/04/13 01:30					
2008/04/13 02:30					
2008/04/13 03:30					

ページを開きませんでした (詳細は構成ファイル一覧を参照してください)

Comparison of MODIS and MTSAT hot spot on big fire events

Fire duration time estimation with MTSAT

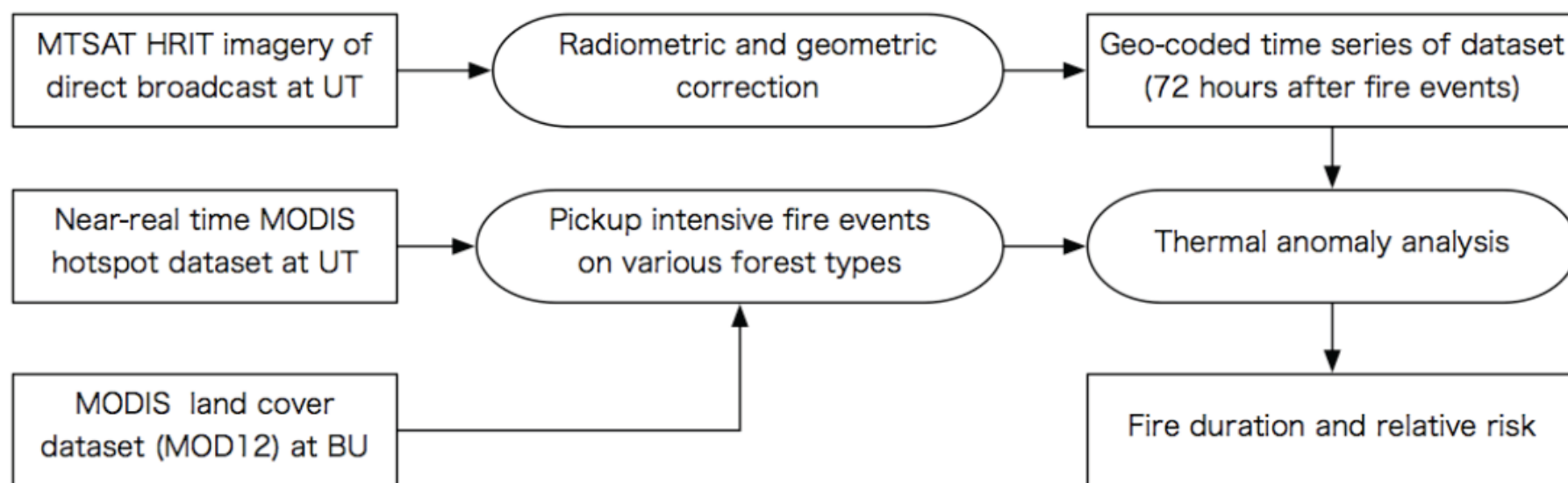
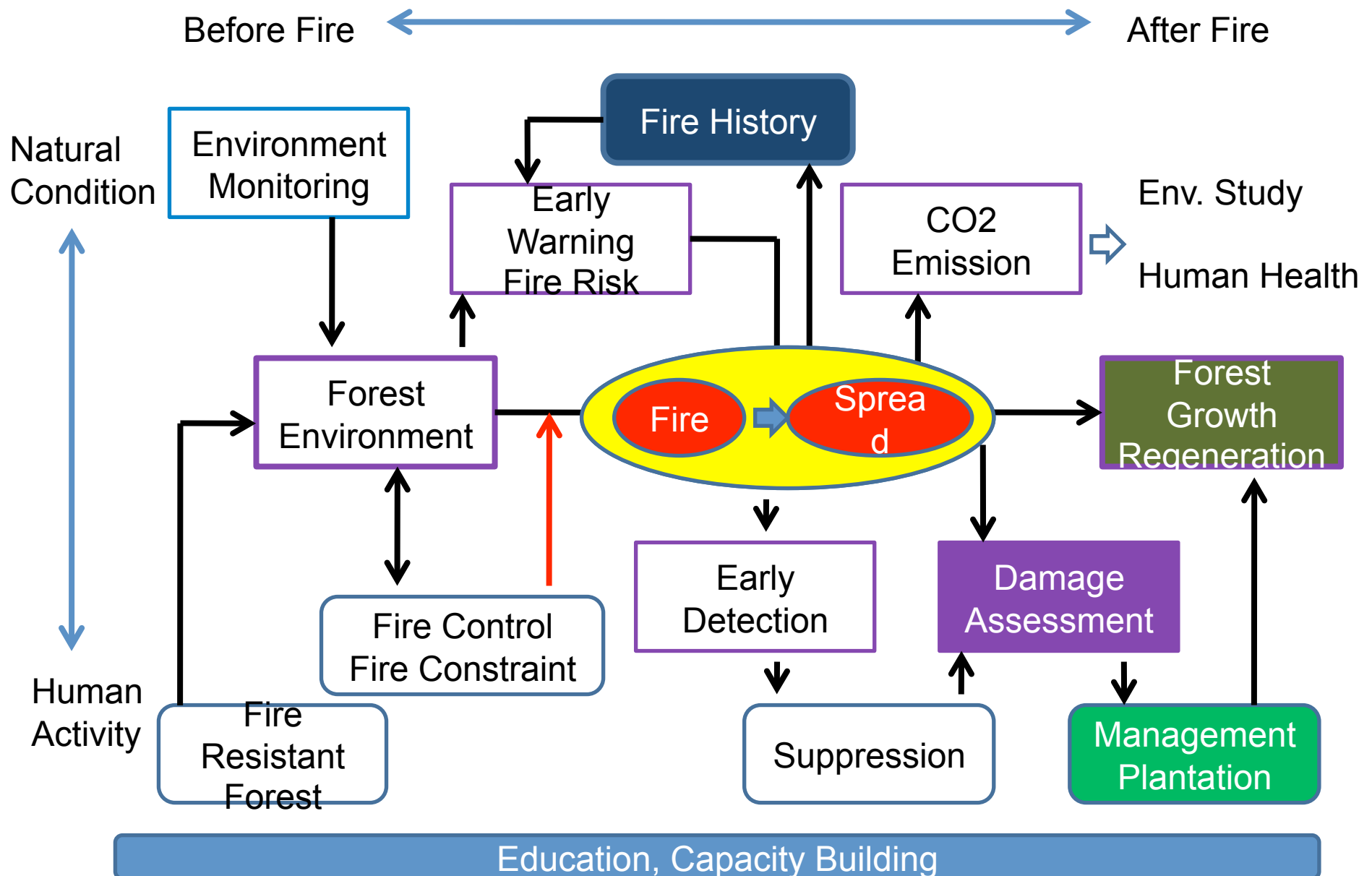


Figure 1. Flowchart of forest fire duration evaluation model based on MTSAT time series supplemented by MODIS hotspot and land cover information.

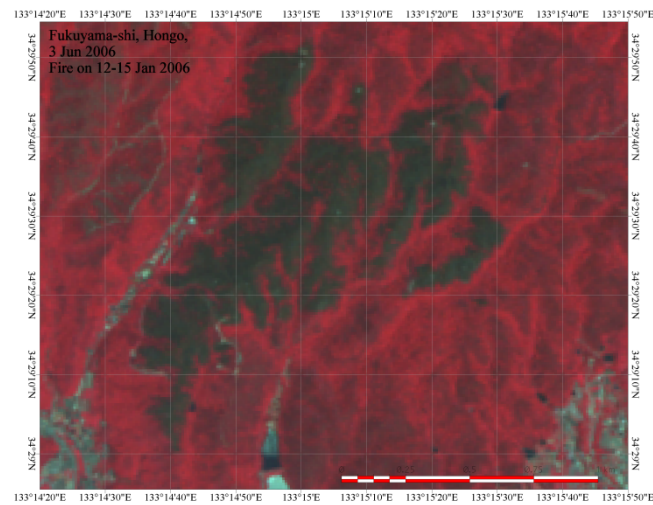
Pick up big fire events with MODIS hot spot information and clip out affected areas with MTSAT for 72 hours after the events.

After Forest Fire

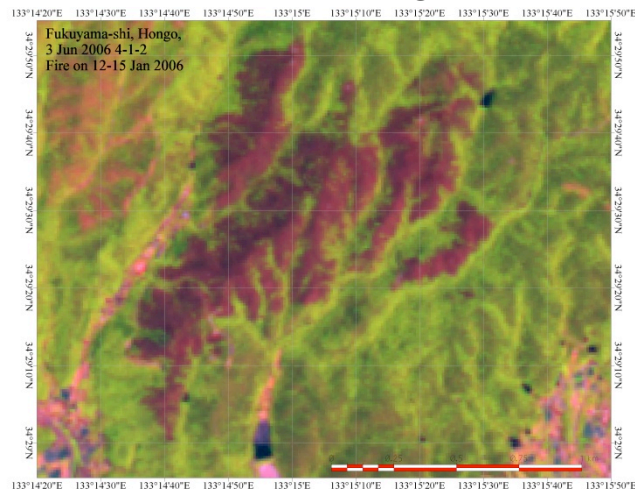


Forest Fire Damage in Hiroshima, Japan

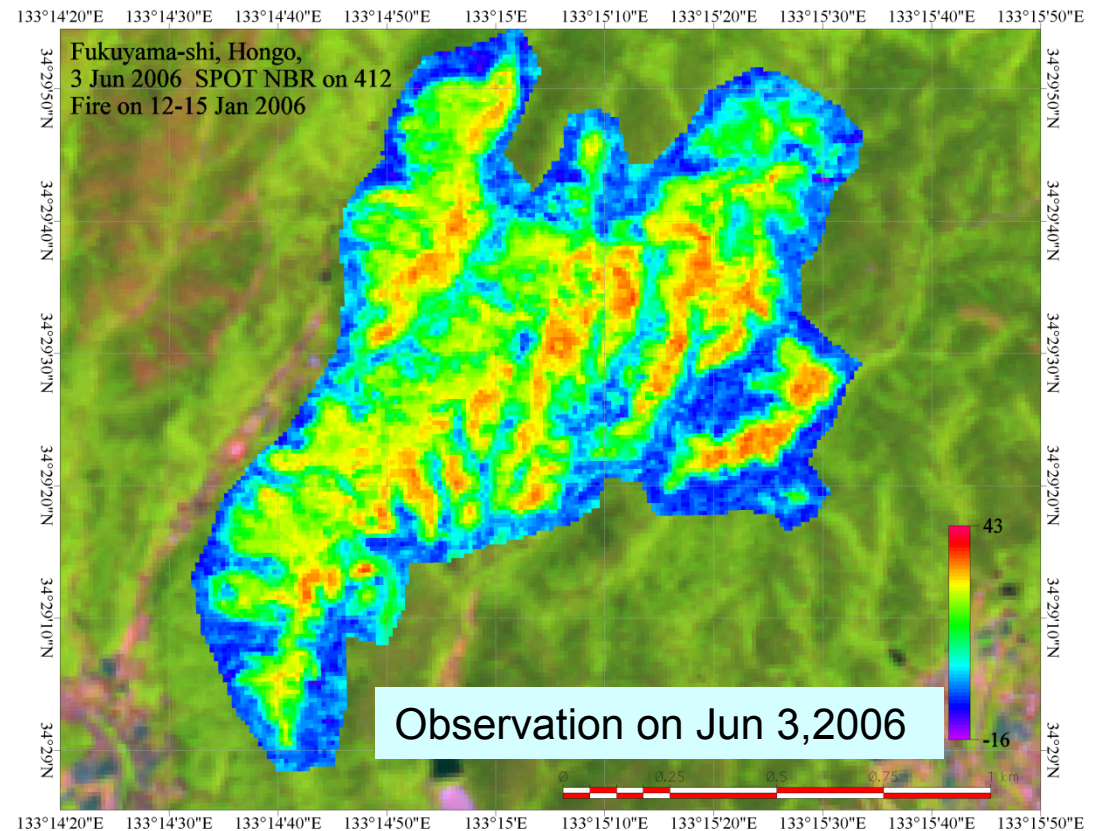
Jan 12-15, 2006



Satellite Image



Satellite Image

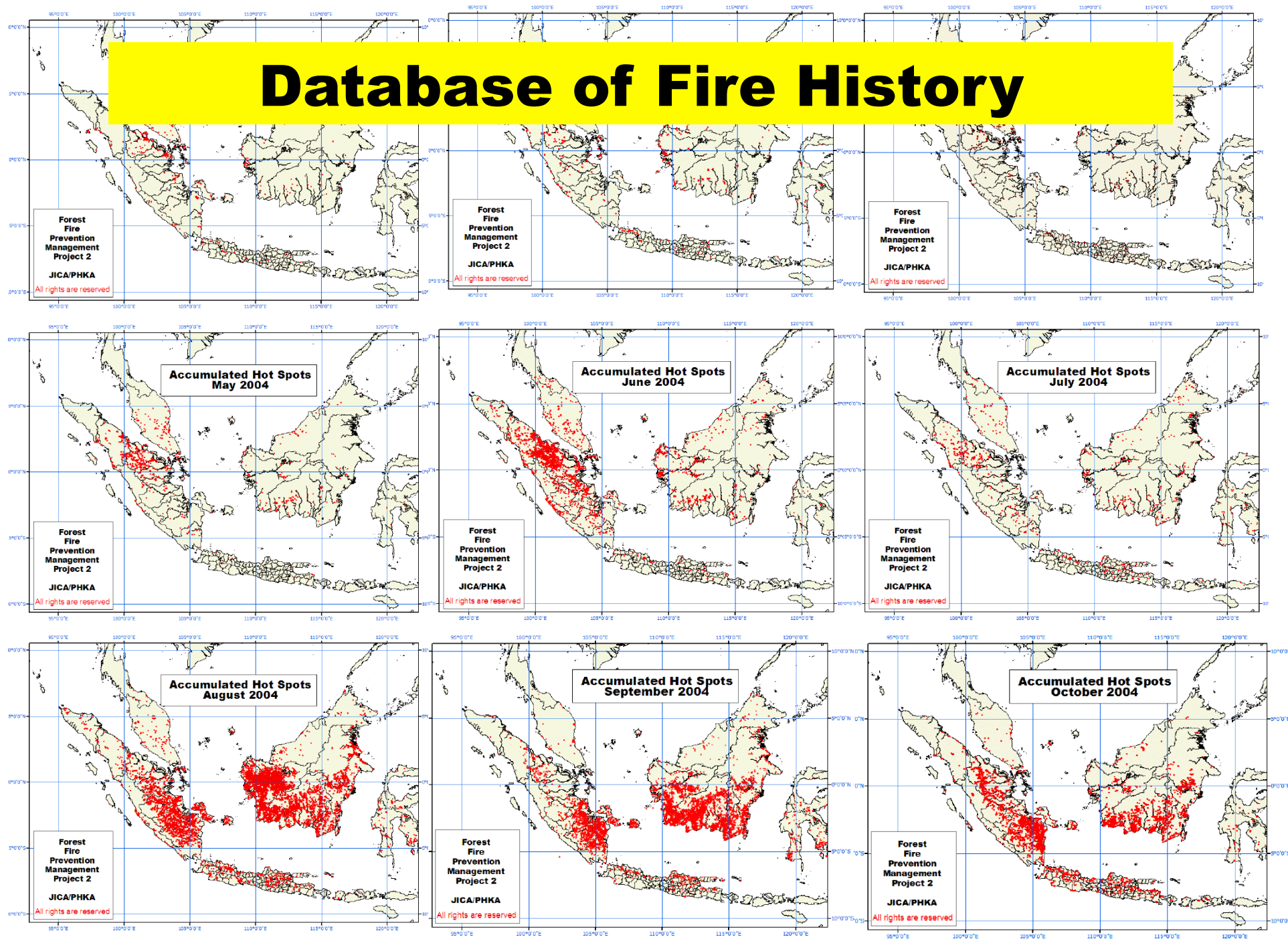


Observation on Jun 3, 2006

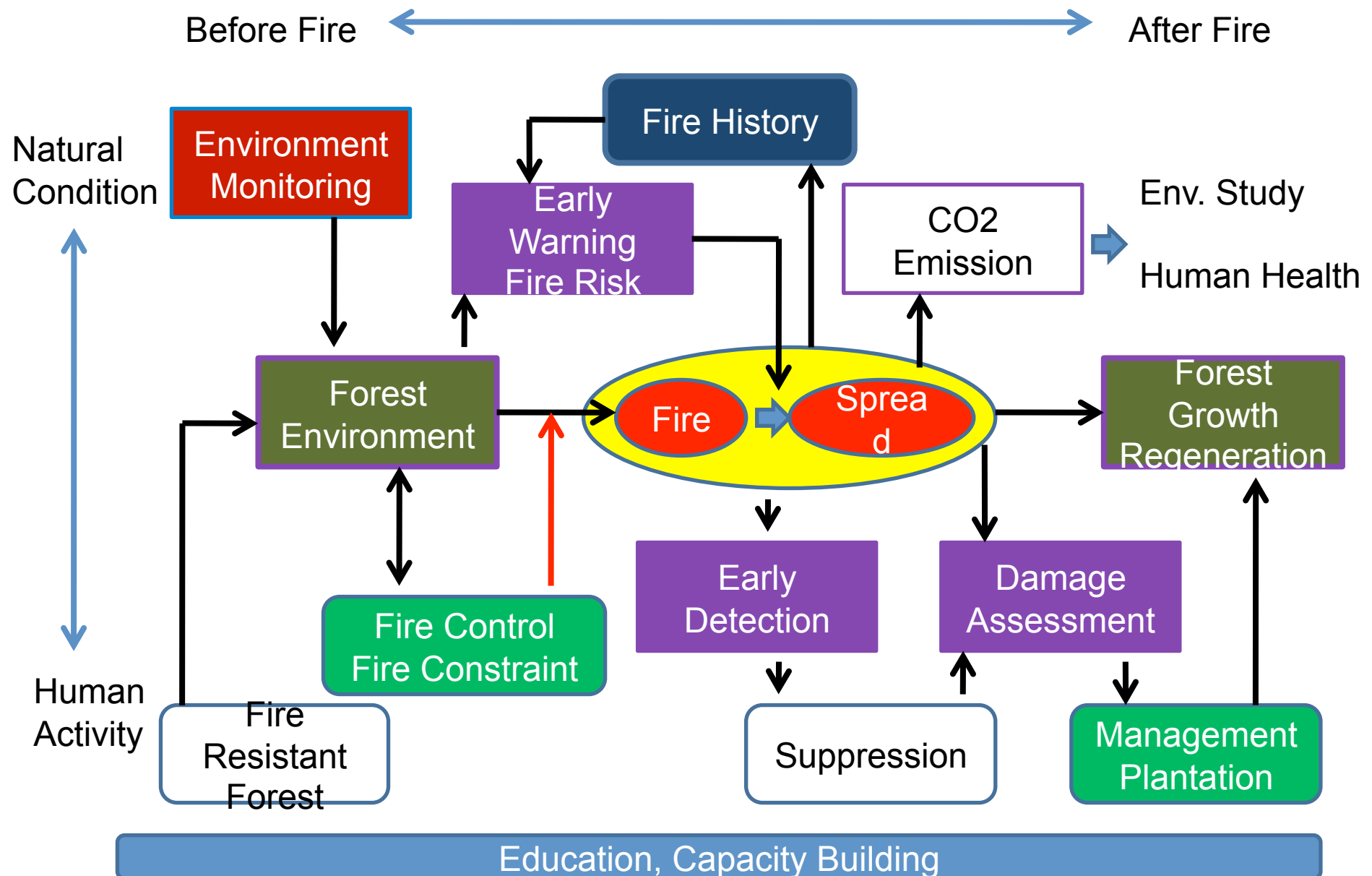
Fire damages estimated by satellite

$$\text{NBR} = (\text{NIR} - \text{SWIR}) / (\text{NIR} + \text{SWIR})$$

Database of Fire History



Development of an appropriate system

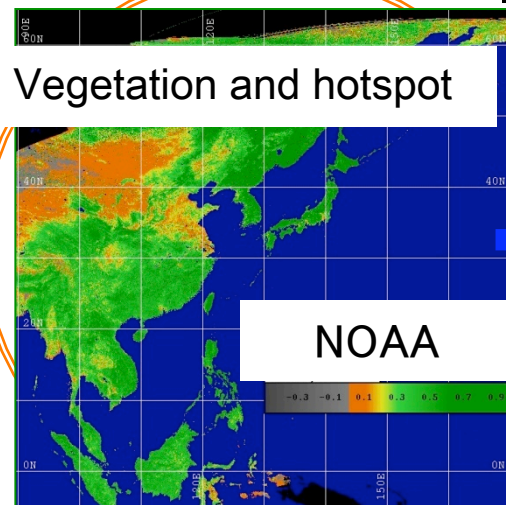


CONTRIBUTORY PROJECTS in AP to GOFC-GOLD

- LAPAN Remote Sensing of Fire Danger Rating System (LAPAN, Indonesia), Indonesia
- ANDES Forest Fire Research Theme (ANDES, Japan), Asia
- CRISP Remote Sensing of LAND/Forest Fires (CRISP/ Singapore), Southeast Asia
- FireWatch Australia (Landgate/ Australia) , Australia

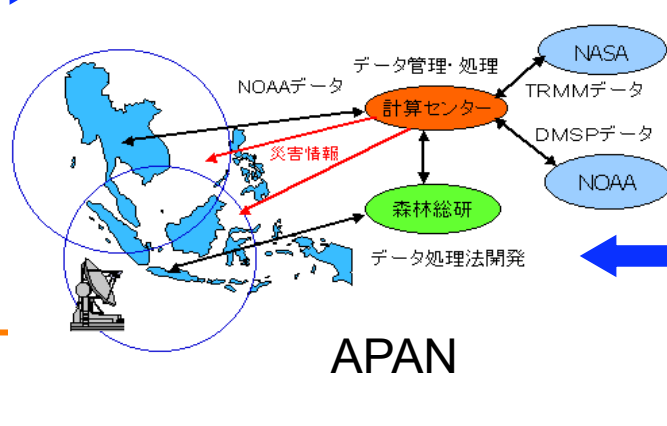
- Sentinel Fire Mapping (CSIRO/DIGO/Australian Geosciences/ Australia), Australia
- North Australian Fire Information (NAFI/ Australia), Australia
- ATSR World Fire Atlas (ESA / Europe), World
- DMSP Fire Monitoring (NOAA/ USA), World
- Fire Locating and Monitoring of Burning Emissions (NRL/NOAA/ USA), World
- Global Burnt Area initiative (SPOT VEGETATION) GBA-2000 (JRC/ Europe), World
- GLOBCARBON (ESA/ Europe), World
- GLOBSCAR: ATSR World Burned Surface Atlas (ESA/ Europe), World
- MODIS Fire and Thermal Anomalies (NASA/UMd / USA), World
- MODIS Land Rapid Response System (NASA/UMd / USA), World
- MODIS Web Fire Mapper (NASA/UMd / USA), World

ANDES: Asia-Pacific Network for Disaster mitigation using Earth observation Satellite since 1999

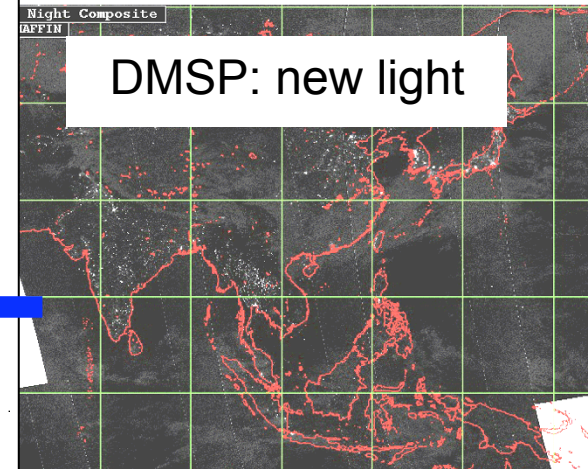


The full automatic forest fire early warning and early detection system was developed to mitigate the disaster in Southeast Asia.

Realtime advanced network



DMSP: new light

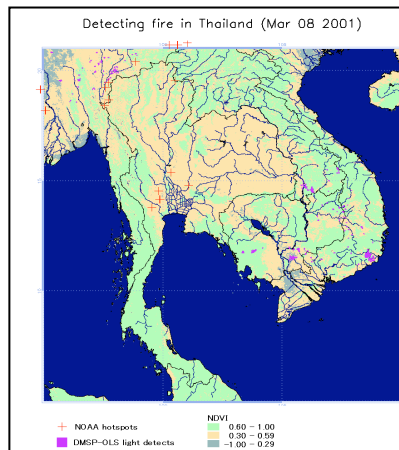


Fire !

Auto E-mail

Fire Risk

at fire offices

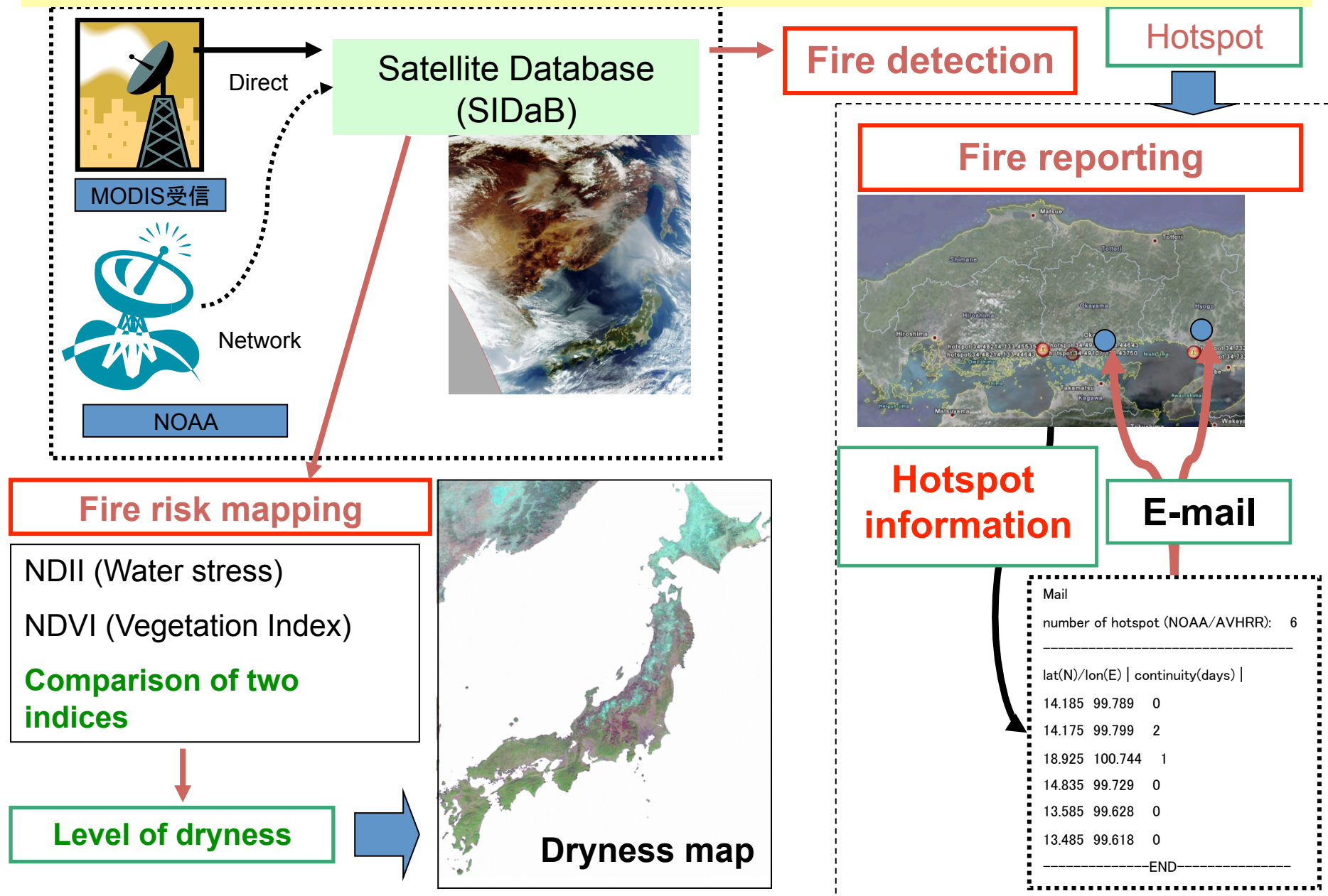


Web site

Fire in the night



AFFIRE: Automatic Forest Fire Reporting System by FFPRI



User Friendly Information System

***How to use**
***User's Guide**
NOTE: This is a prototype system. Please use a Internet Explorer ver 6.0.

View Image

AVHRR
☒ (2001/01/01 – 2004/02/29)
OLS
☐ (2001/01/01 – 2002/03/31)
☐ Non-Forest Area
☐ JERS-SAR
Fire Risk Map
☒ (2001/01/01 – 2002/03/01)
☐ Land Cover [new]

View Go Save

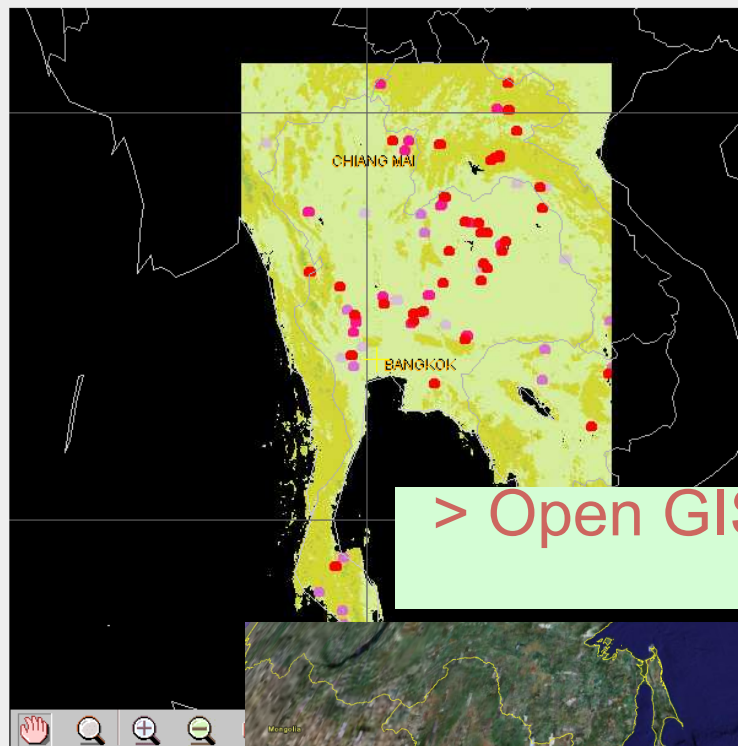
View Feature

☒ City
☒ Border
☒ Coastline
☒ Prefecture
☐ Lake,River
☐ Road

0 455.468 km

Date

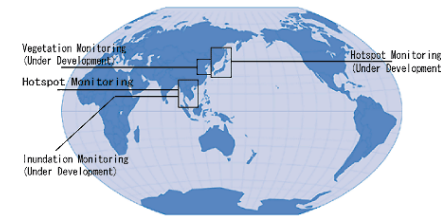
Start
2002 March 10
End
2002 March 15
OK



Developed By

Japanese Page(T.B.D.)
IE6.0 Only

Interoperable Prototype System
to utilize Earth observation satellite data

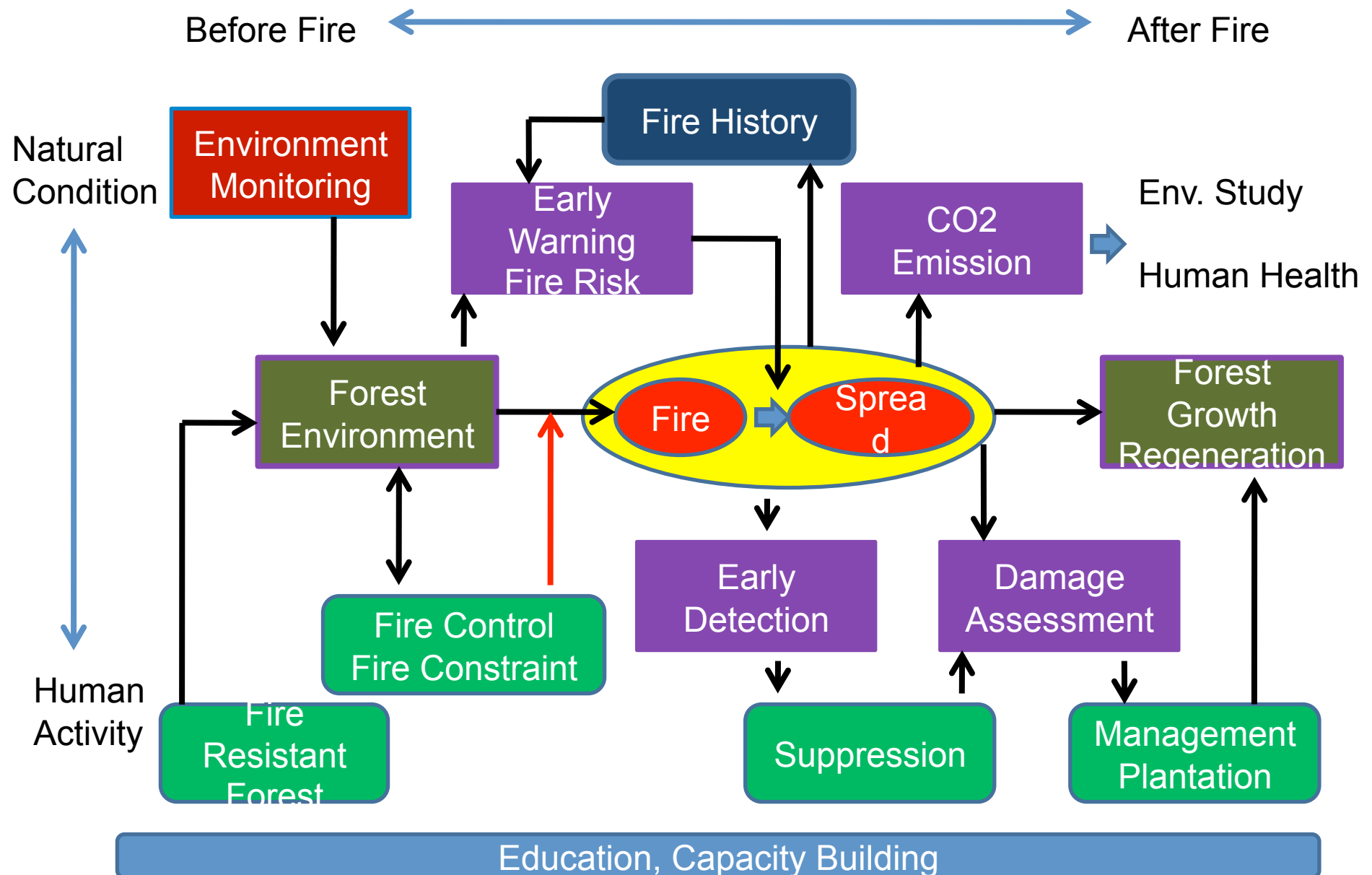


> Open GIS System of MAFFIN and JAXA



> Combination with the Google Earth

Information Sharing for Forest Fire Problem



Information necessity

	Forest Environment	Early warning/ Fire Risk			Early detection	Damage assessment	CO2 emission
		Ignition	Spread	Suppression difficulty			
Forest							
Type	●		●			●	●
Density[●		●			●	●
Temp.			●		●		
Dry/Wetness		●	●				
Infrastructure							
Road		●					
Human							
Popolation		●					
Terrain							
elevation/slope				●			
Weather							
Rain		●					
Satellite							
AVHRR/MODIS	●		●		●		●
TM,ASTER,	●			●		●	●
SAR						●	●
MTSAT			●			●	●

Timely and Accurate Information are necessary

Timely and Accurate Information are necessary