



# **FOREST MONITORING USING REMOTE SENSING**

**by:**

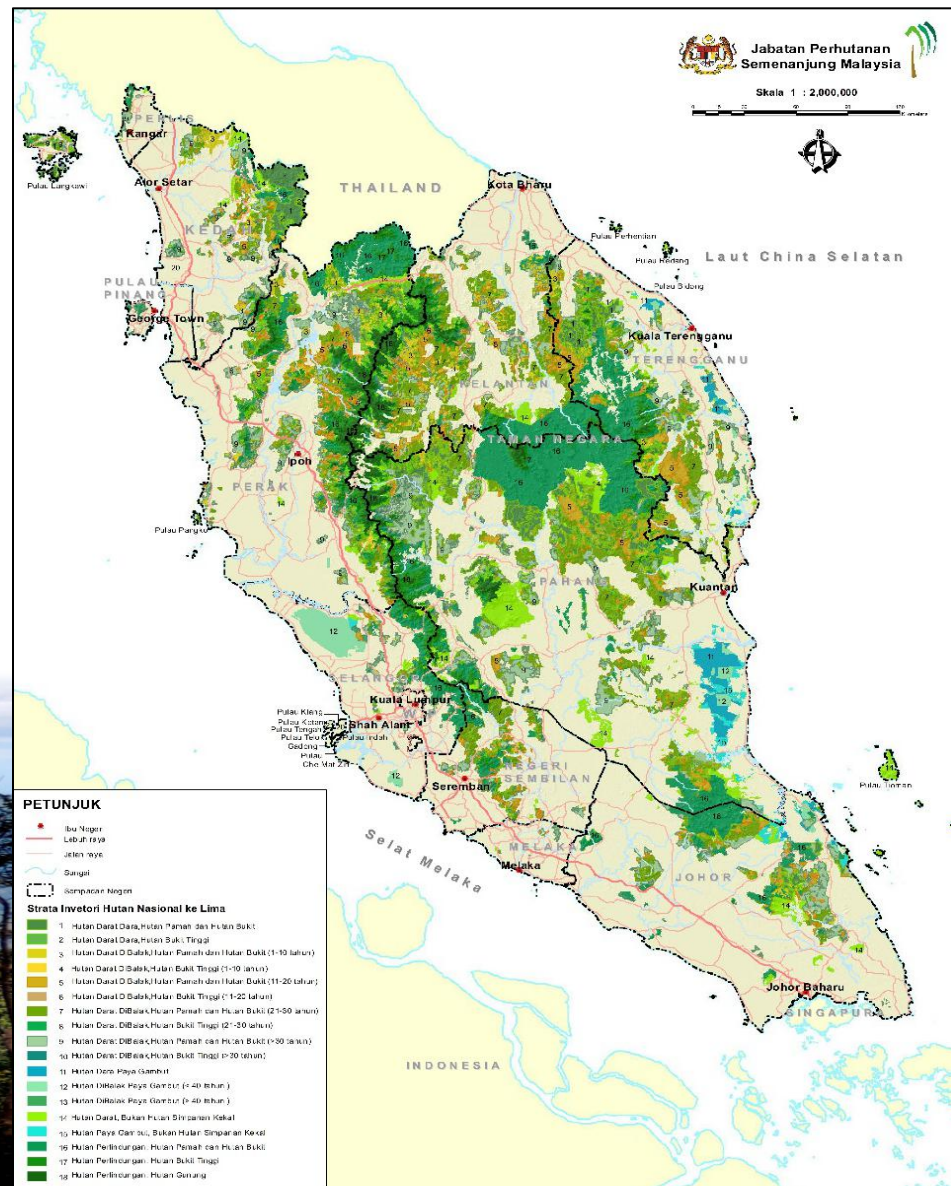
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# FOREST PROFILE IN PENINSULAR MALAYSIA



Hutan Gunung Tinggi (*Upper Montane*)

1,500 m

Hutan Gunung (*Montane*)

1,200 m

Dipterokarpa Bukit Tinggi (*Upper Hill Dipterocarp*)

750 m

Dipterokarpa Bukit (*Hill Dipterocarp*)

300 m

Dipterokarpa Pawah (*Lowland Dipterocarp*)

Paya Gambut (*Peat Swamp*)

0 m

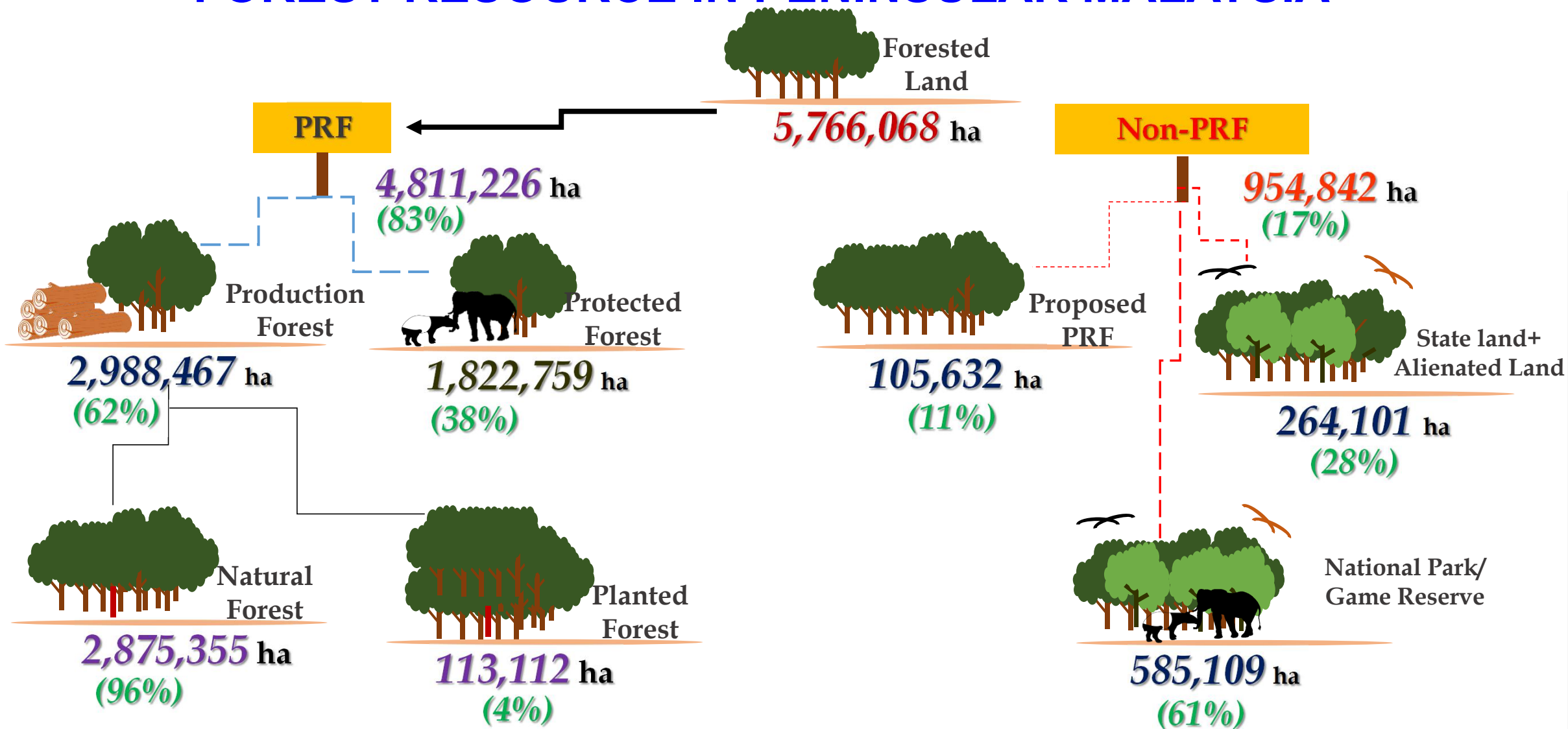
Paya Laut (*Mangrove*)

Hutan Darat  
(*Inland Forest*)

Hutan Paya Gambut (*Peat Swamp Forest*)

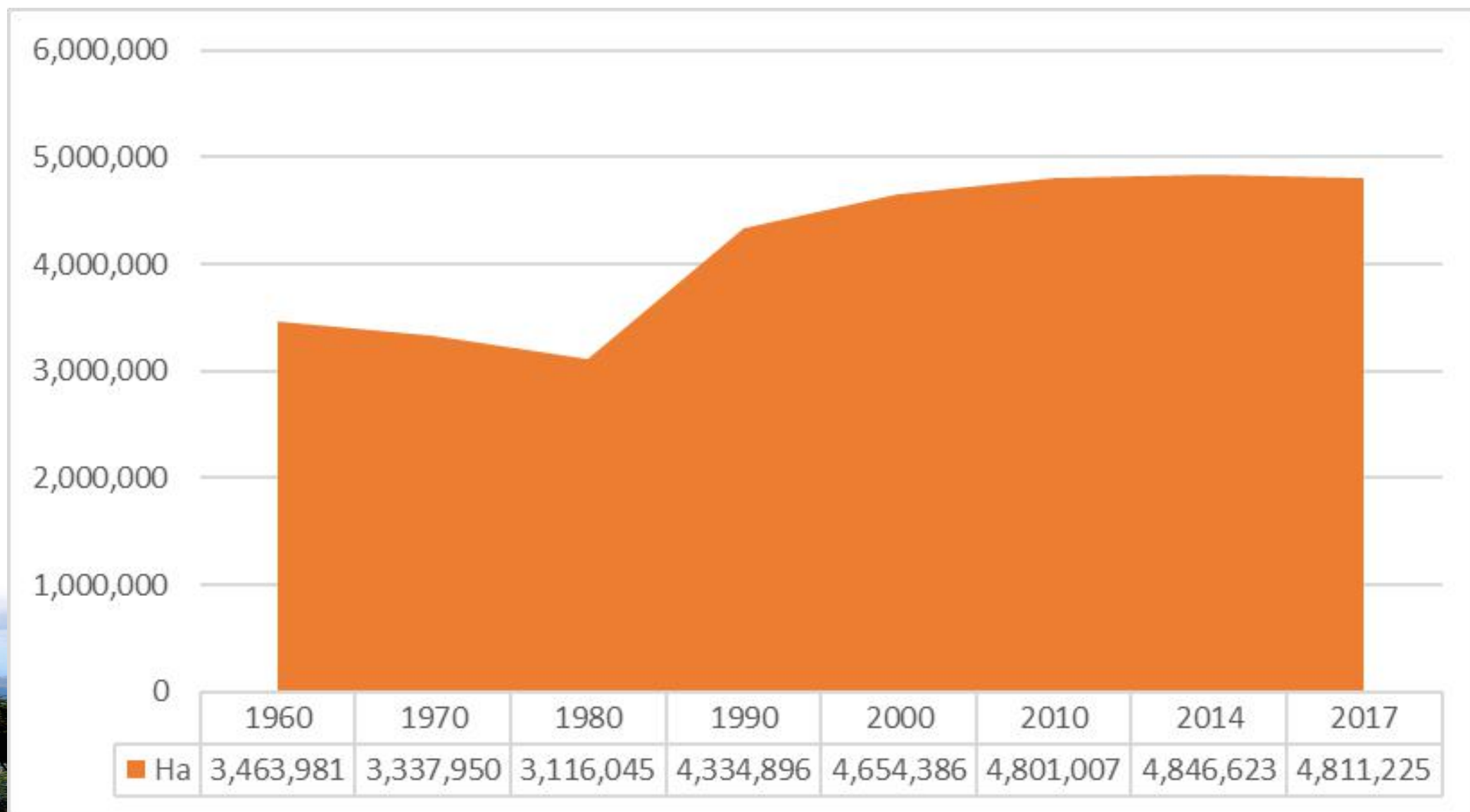
Hutan Paya Laut Mangrove/Coastal Forest

# FOREST RESOURCE IN PENINSULAR MALAYSIA



\* PRF - Permanent Reserved Forest

## PRF SIZE TREND (1960-2017)



# SELECTIVE MANAGEMENT SYSTEM - SMS

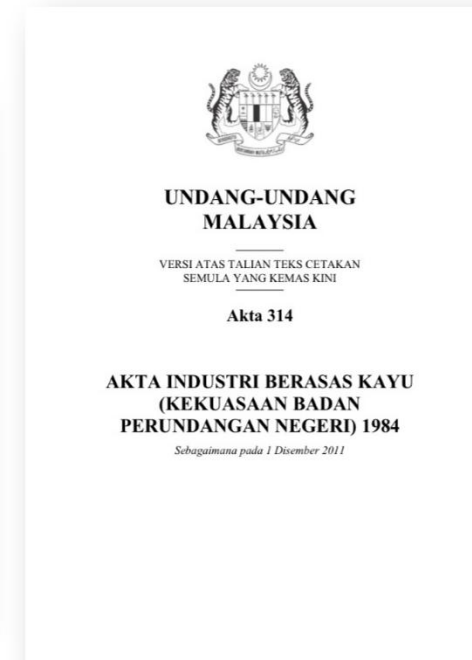
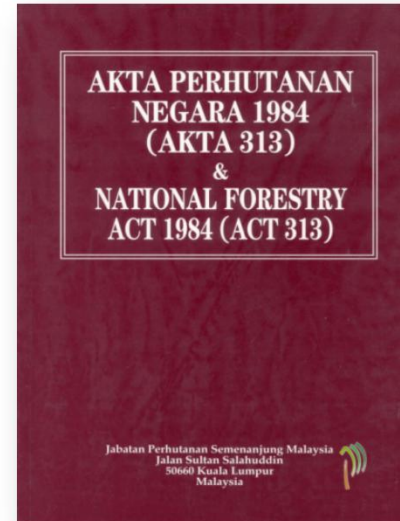


## FOR PRODUCTION FORESTS WITHIN PRFS



# FOREST LEGISLATION

- **NATIONAL FOREST POLICY 1978 (AMENDED 1992)**
- **NATIONAL FORESTRY ACT 1984 (AMENDED 1993)**
- **WOOD-BASED INDUSTRIES ACT 1984 (AMENDED 2009)**



# Introduction to FMRS Plus

- FMRS Plus is an initiative by the Forestry Department Peninsular Malaysia (FDPM) to monitor forest resources of Peninsular Malaysia particularly the Permanent Reserved Forests (PRF) using geospatial technology
- In 2005 FDPM collaborated with the Malaysian Remote Sensing Agency (MRSA) to develop the Forest Monitoring using Remote Sensing (FMRS)
- FDPM as provider of forestry GIS layers and user while MRSA as developer and satellite image provider
- Initially using web-based on-line open source software but upgraded (Plus) in 2013 using commercial software for technical stability and support

# Objective

to monitor and detect :-

- (i) forest area changes (forest land use to other land use conversion)
- (ii) clearings/openings (logging camp, log landings, forest road construction, illegal agriculture/encroachment) within PRFs
- (iii) illegal logging outside legal permits (logging/use)
- (iv) breach of harvesting guidelines and other related specifications imposed on legal permits (reduced impact/road specs)

# Features

- Mechanized by GIS software (ArcGIS Server), on-line and 24/7
- Accessibility through ID and password for registered FDPM HQ and State Forest Offices (SFO) and District Forest Offices (DFO) staffs
- <http://hutan.remotesensing.gov.my/fmrs/index.html>
- Application administrator at FDPM HQ
- Assurance in terms of system security and data integrity
- Centralized system for data and reporting consistency
- Access level :-
  - (i) FDPM HQ – all states
  - (ii) SFO – respective states



# Features

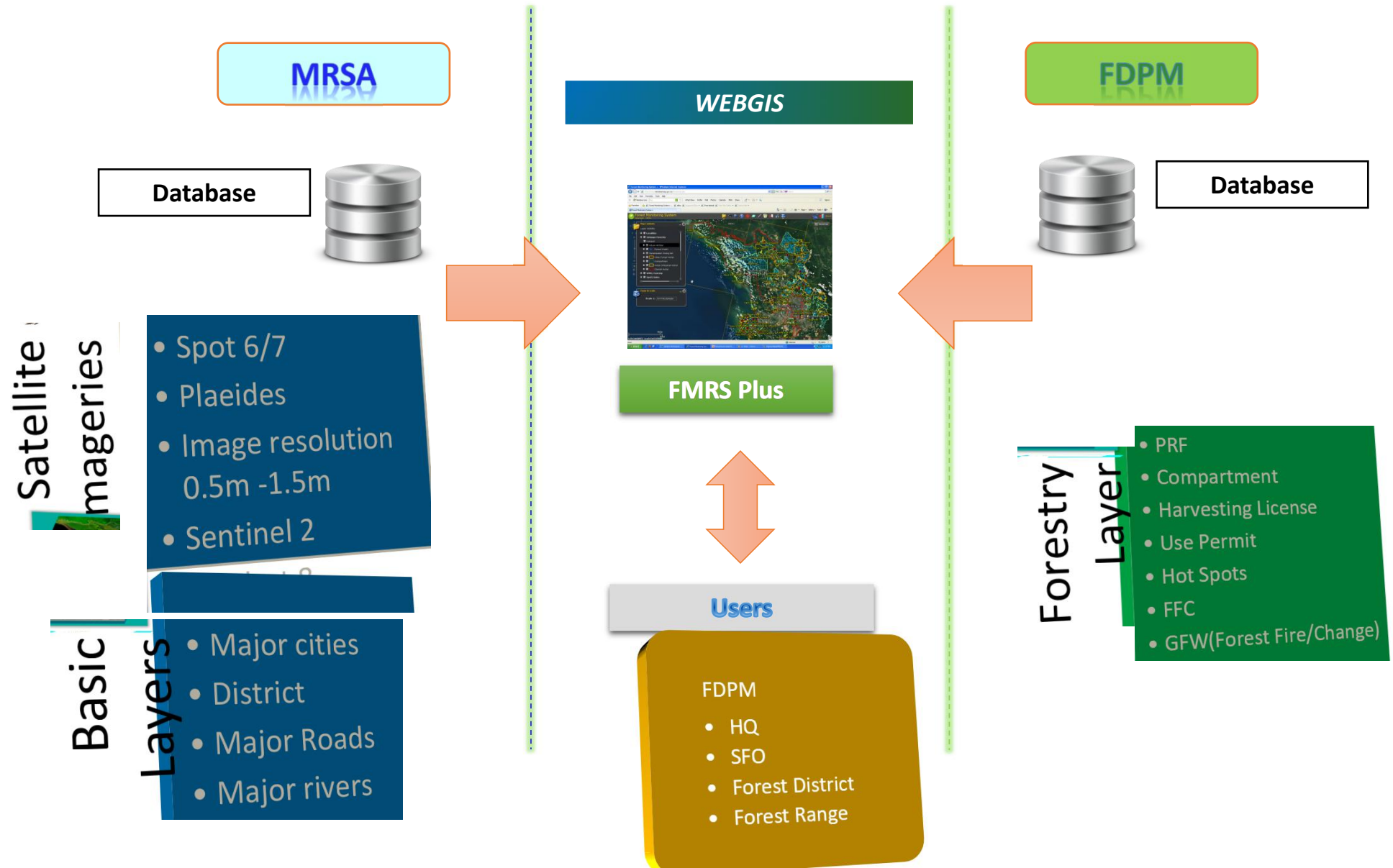
- Display forestry GIS vector layers from FDPM accessed from FDPM's server while raster layers (satellite imageries) from MRSA server.
- FDPM GIS layers – State, Forest District, PRF, national parks/game reserves, Compartments, Forest Functional Classes, Harvesting License & other use permits, Orang Asli (native area), Illegal Logging Hotspots, Global Forest Watch ( subscribed Forest Fires and Forest Change x,y data)
- MRSA raster satellite images – Landsat8, Sentinel 2, SPOT 6/7 and Plaeides
- Image replacement by MRSA depending on availability from MRSA Data Receiver Station and request from registered users while forestry layers updated in system by FDPM HQ (depending on updates from SFO).

# Functionalities

- **Search to locate area of interest including through report/complaints by entering coordinate or name of location**
- **Analysis of area of interest (AOI) (zoom in ) and its surroundings**
- **Measure and calculate distance**
- **Measure and calculate area**
- **Generate buffer for analysis**
- **Swipe analysis of change detection between two imageries of different dates (before and after)**
- **Capable of uploading external layers for better/new analysis**
- **Map production for reporting**
- **Users able to give feedback to further improve the system**



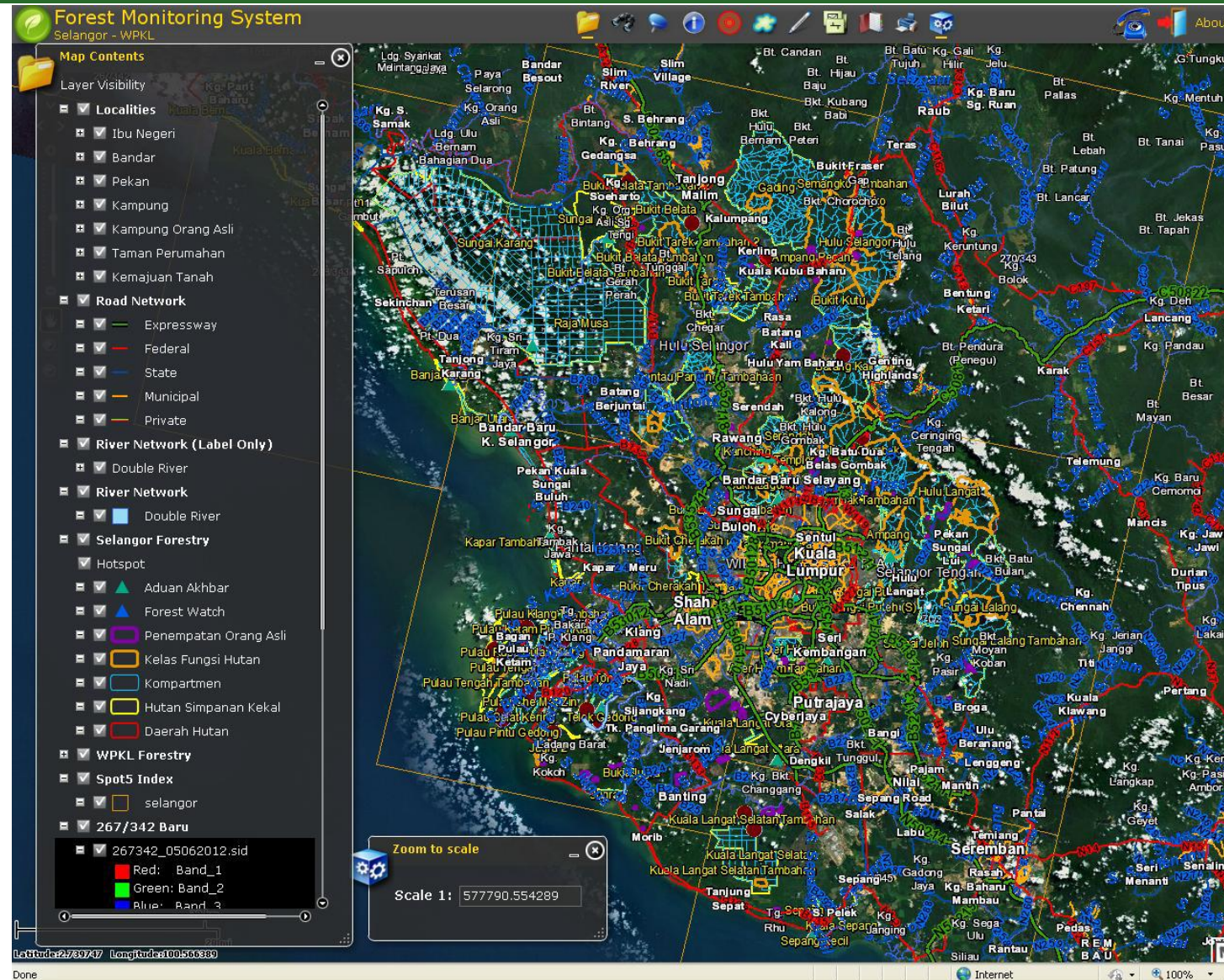
# Data Storage Concept of Data Storage and Operation of FMRS Plus





# Main Interface of FMRS Plus

## Display of Layers



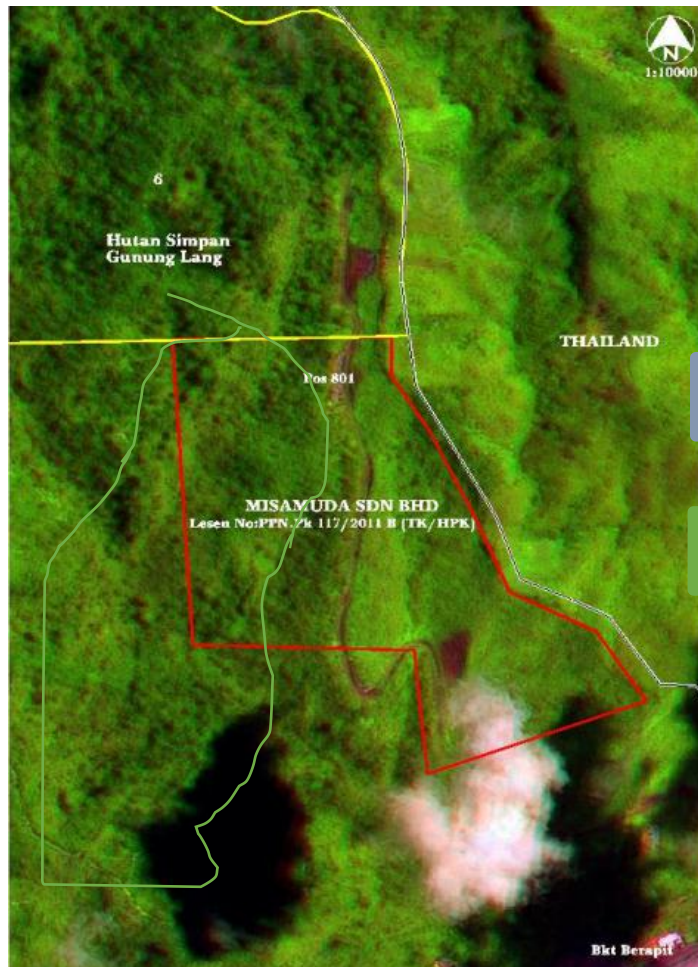


# FMRS Plus

## Functionalities FMRS Plus



# ANALYSIS CONCEPT OF FMRS PLUS



BEFORE

Logging within  
License

Logging (Illegal)  
outside License



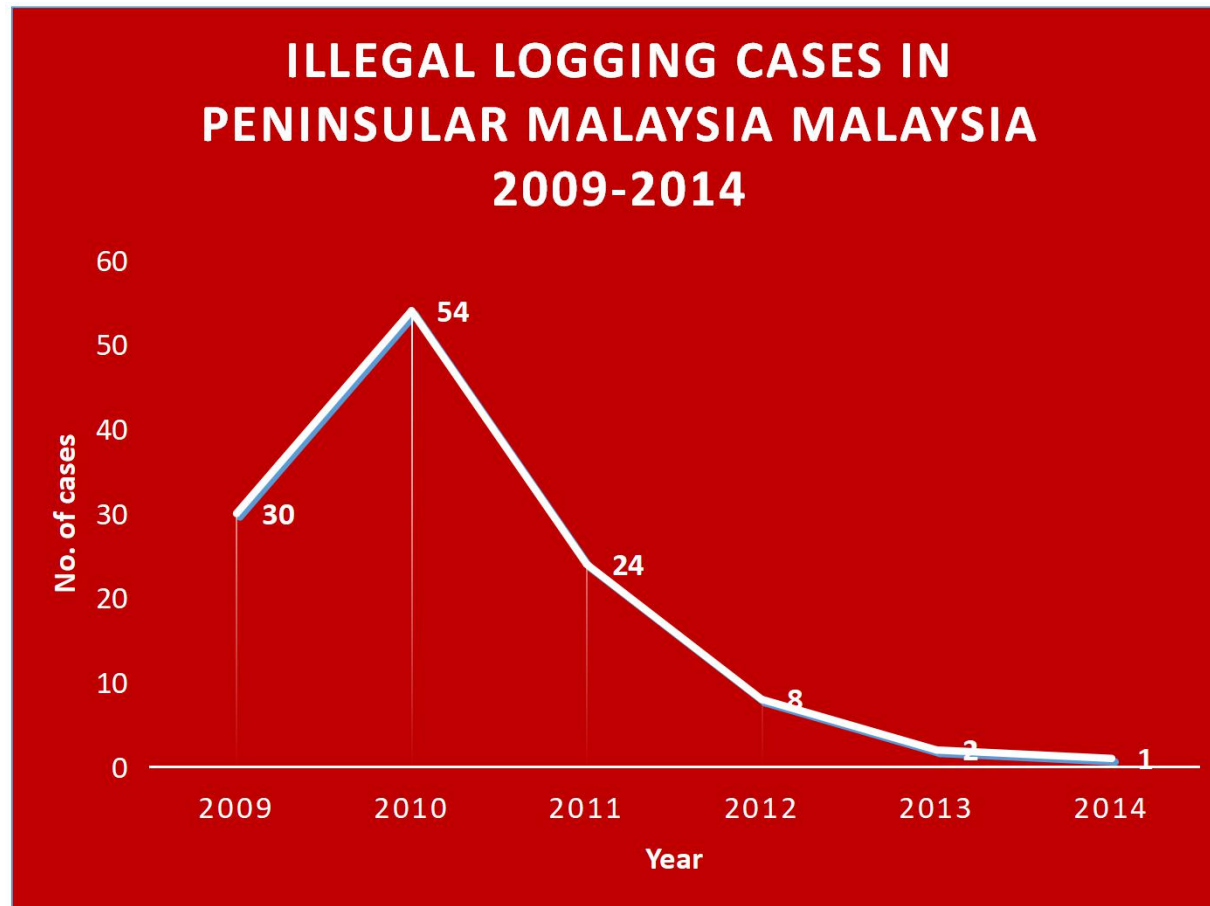
AFTER

# Registered users

- As at end of 2018, 460 registered users made up of forest officers, forest rangers and foresters mostly responsible for forest operations and enforcement
- Average usage = 300 hits/ month
- Usage monitored through monthly reports and reporting in FDPM's technical and high-level meetings

# APPLICATION IMPACT

Reduction of illegal logging cases from 2011 to 2014



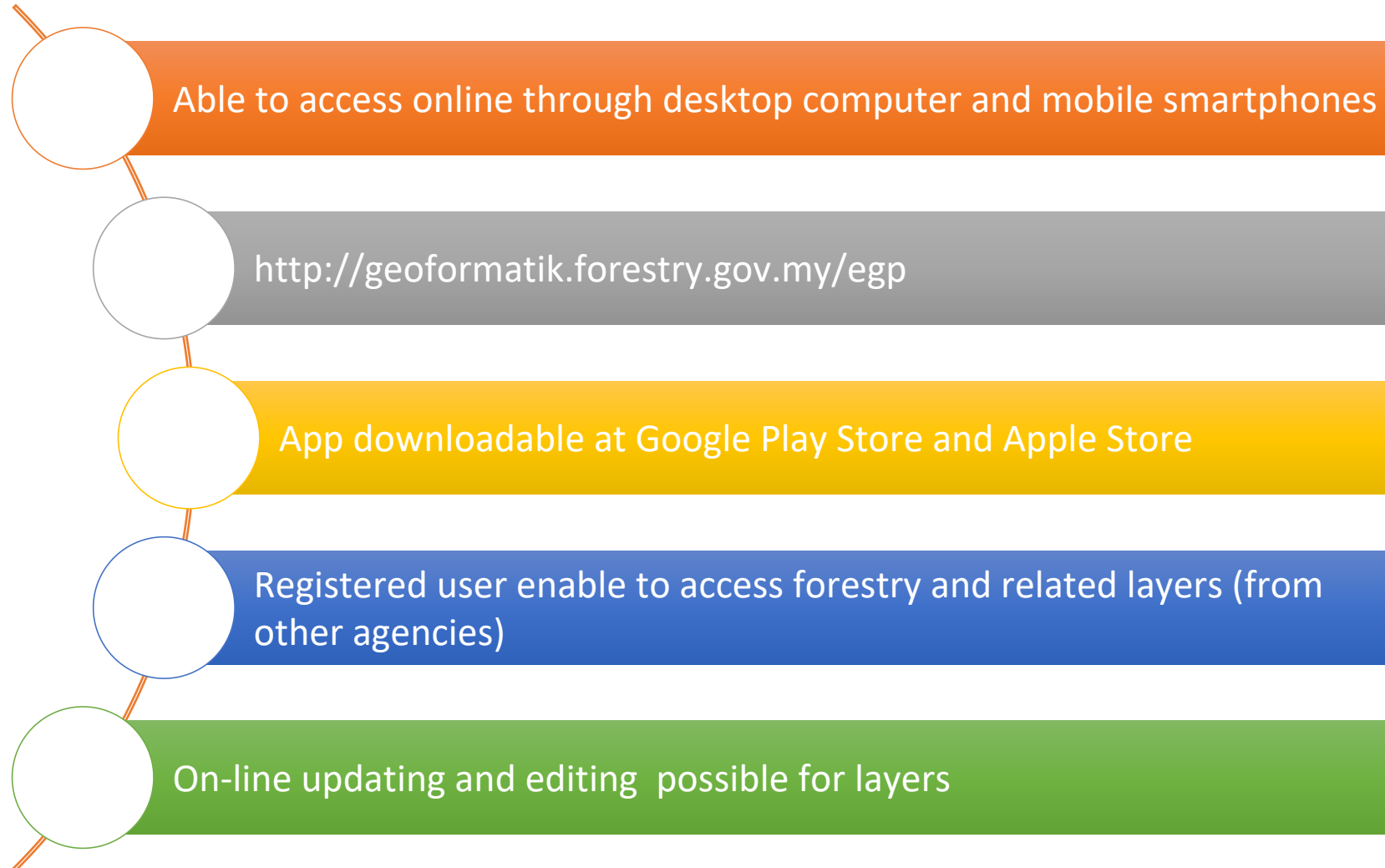
# E-Geospatial Perhutanan (Forestry Geospatial)

- For Forest management, planning and monitoring
- Spatial database updating application of forestry/relevant data

- As center for forestry geospatial/mapping data/information
- Provide centralised data for consistent analysis and reporting

- Integration with non-spatial data for comprehensive info
- Avoid redundancy and provides complete info

# E-Geospatial Perhutanan (Forestry Geospatial)



## E-GP 3 levels of Access

### Registered User

- Able to use all tools for data display, analysis and map production
- Cannot do editing to database but can create own data in graphics only

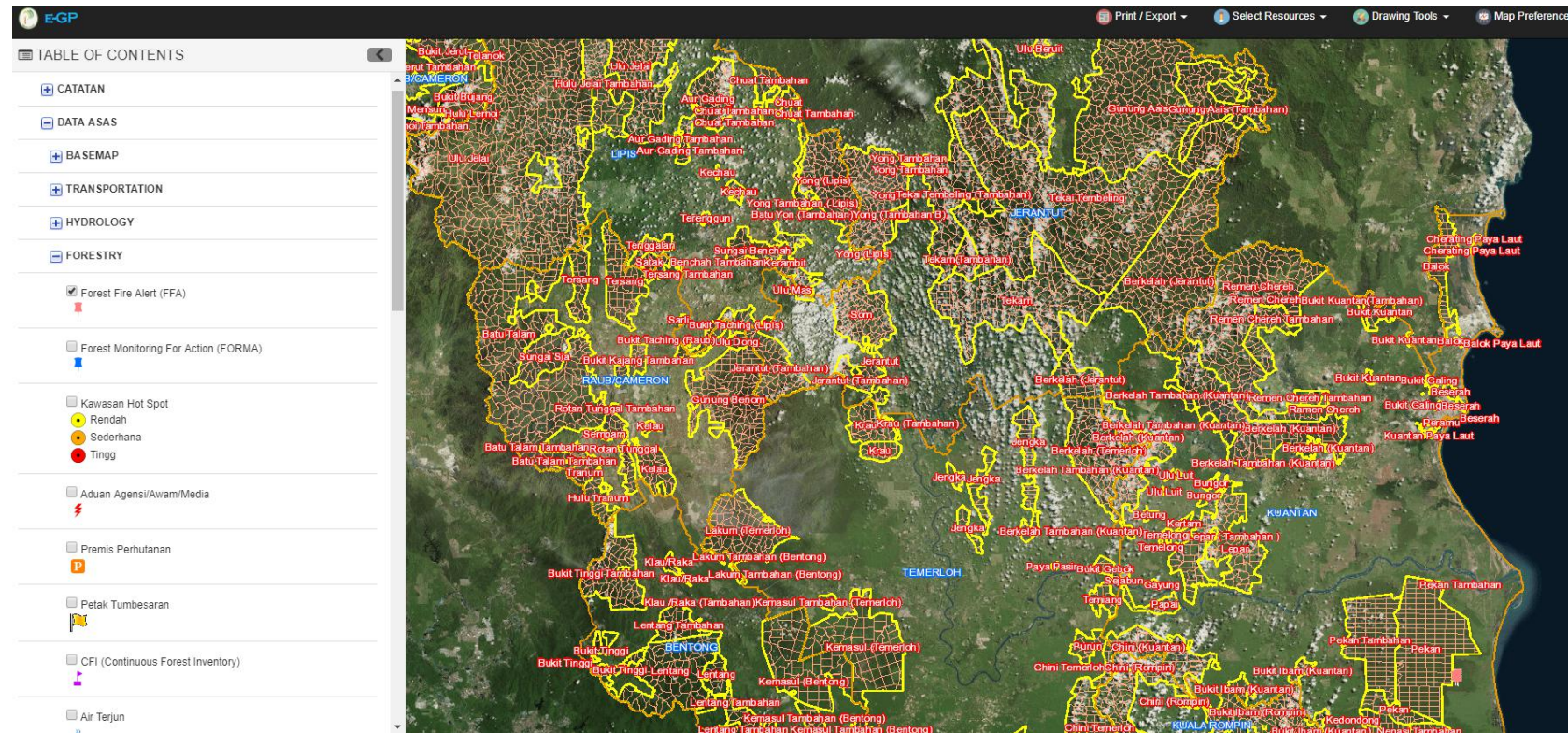
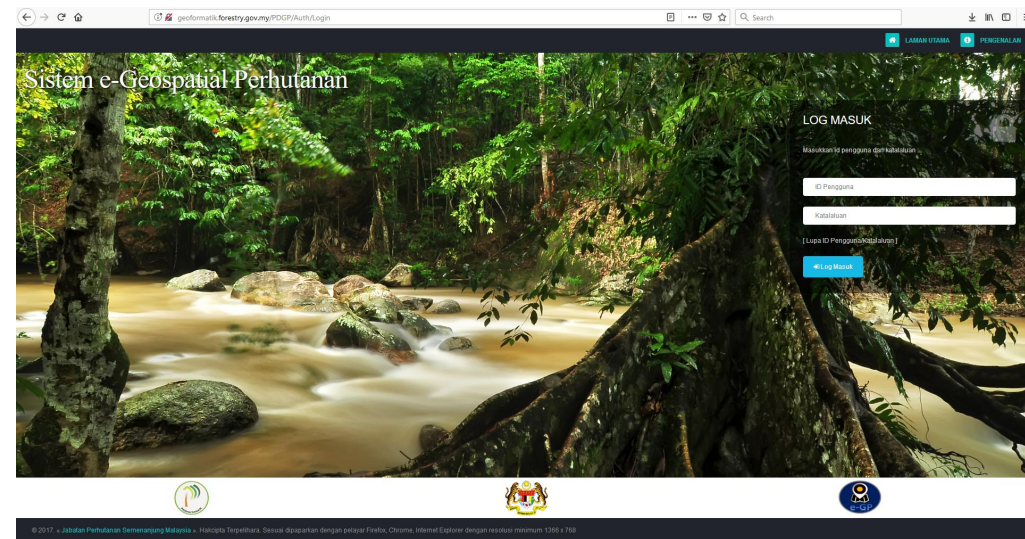
### State Administrator

- Able to use all tools for data display, analysis and map production
- Able to do editing and data updating for registered state only

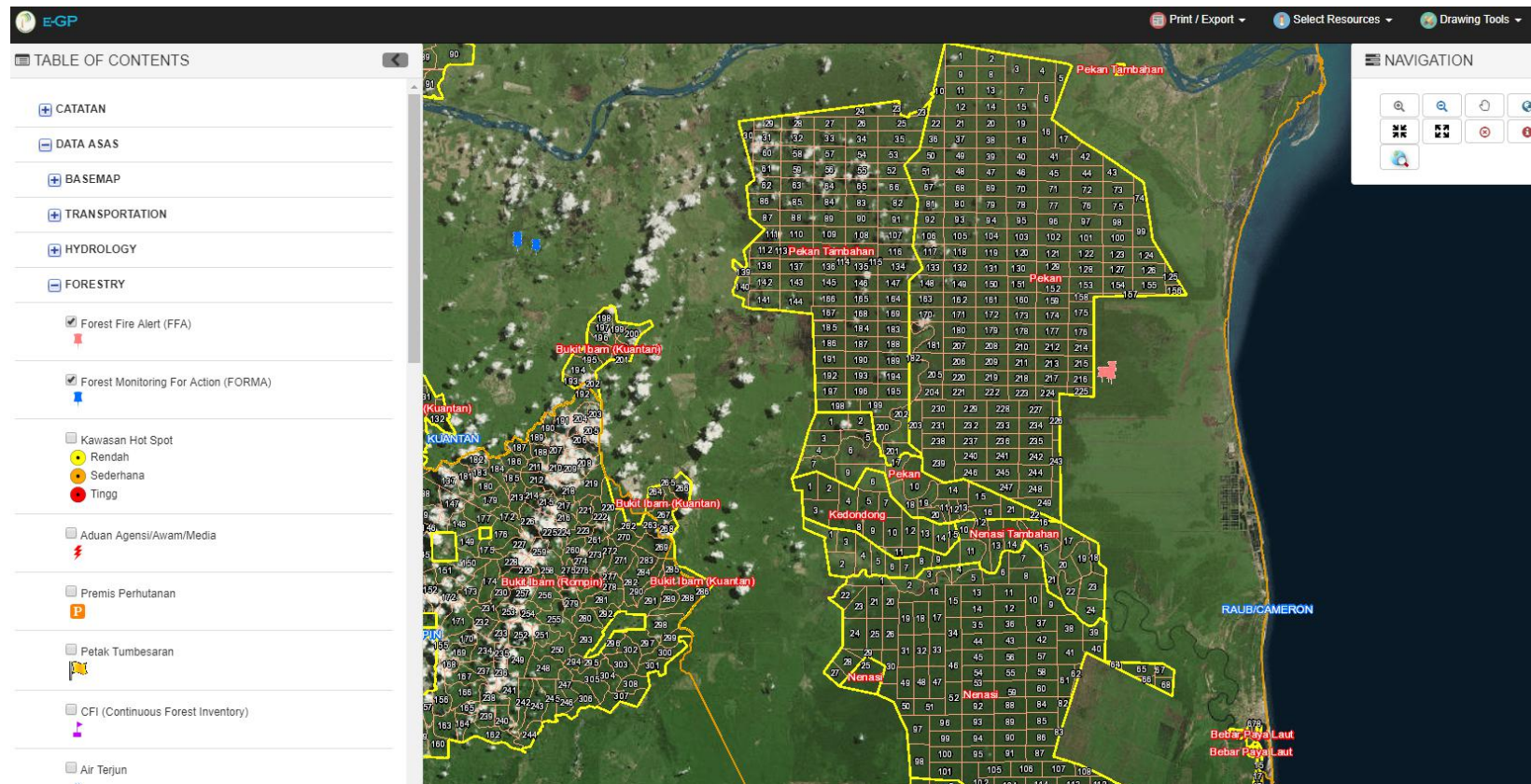
### Main Administrator

- Able to use all tools for data display, analysis and map production
- Able to do editing and data updating for all states
- Able to register users and generate usage report
- Insertion of new layer

# E-GP Interface



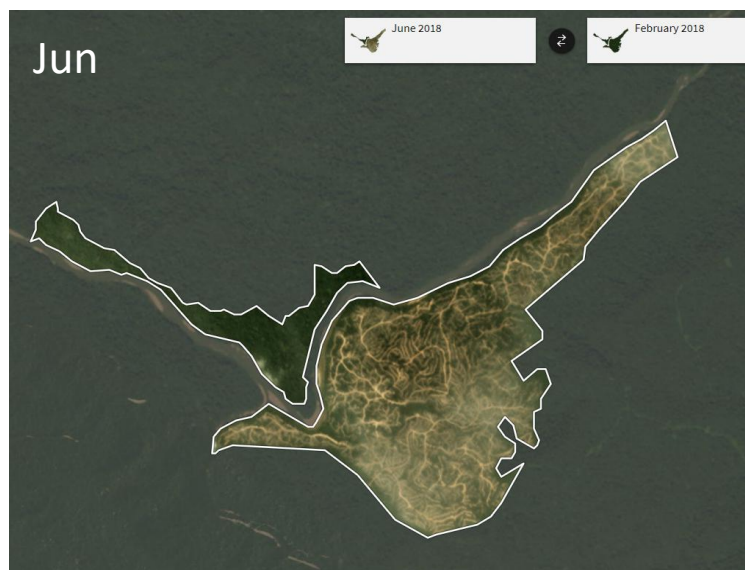
# GFW (FOREST FIRE ALERT DATA)



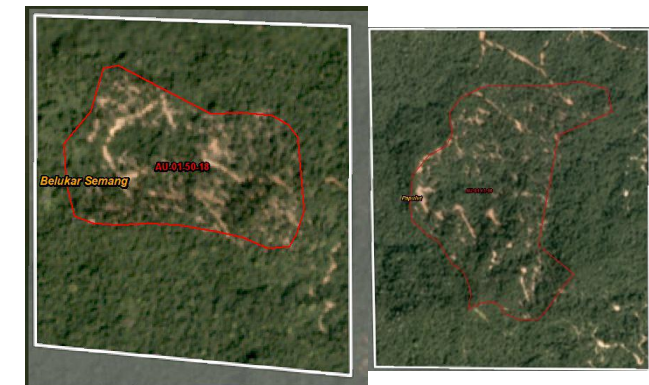
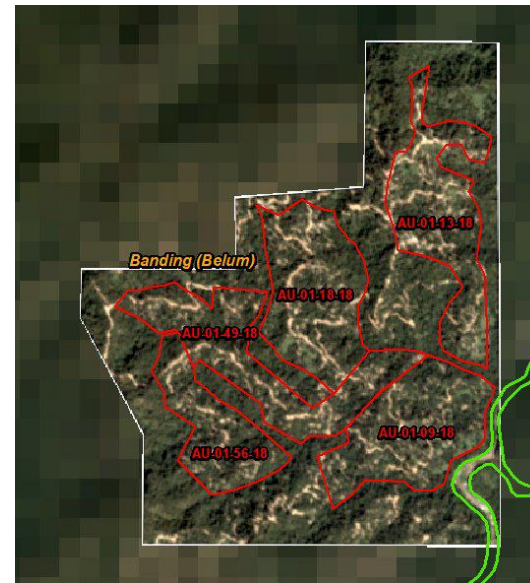
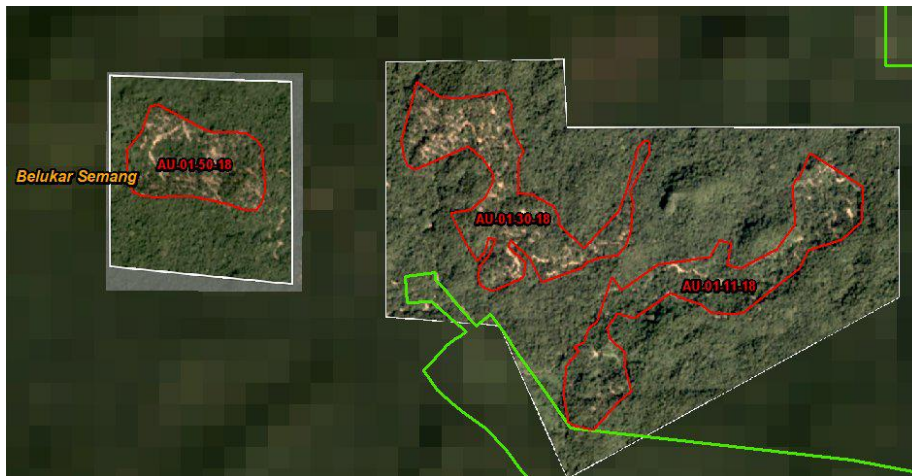
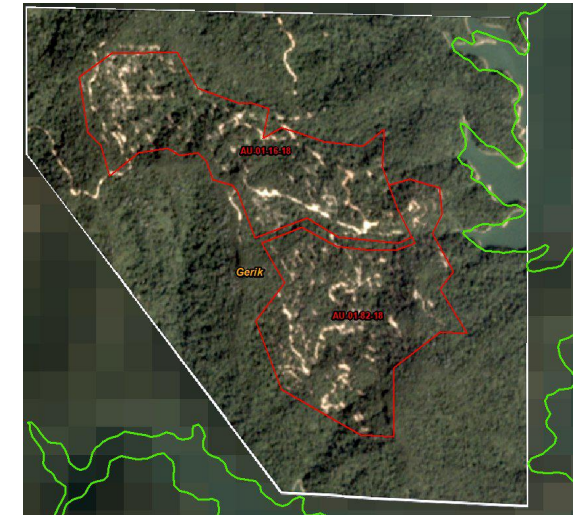
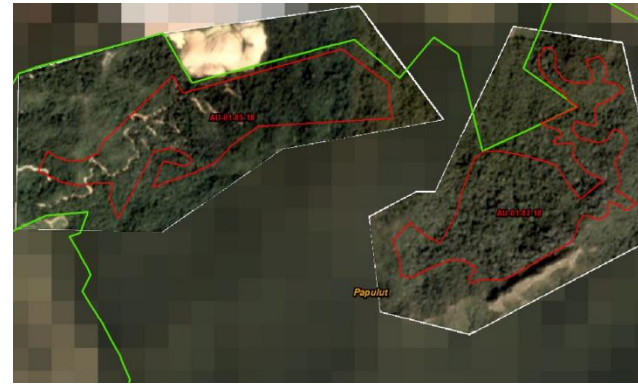
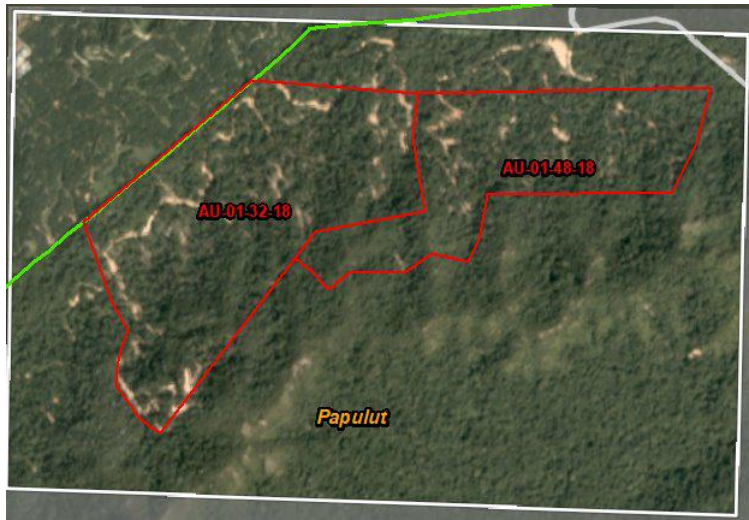
# Additional functionalities

- Plot/Block generations :
  - (i) Pre/Post F inventories
  - (ii) tree marking
  - (iii) planting plots
- COGO – plotting of areas based on ground land survey data
- Map compare of before and after images (including from Planet.com)
- Auto-reminder for non-usage
- Mobile version :
  - (i) Inclusion of management area layers
  - (ii) point and track capture/mark of GPS navigation

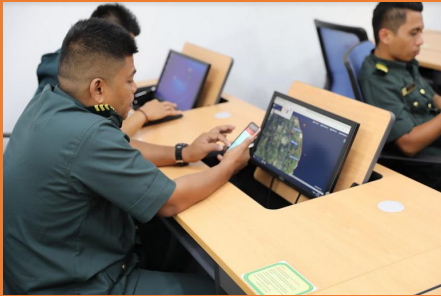
# Dove Satellite Images(3 m) from Planet.com (Feb-May 2018)



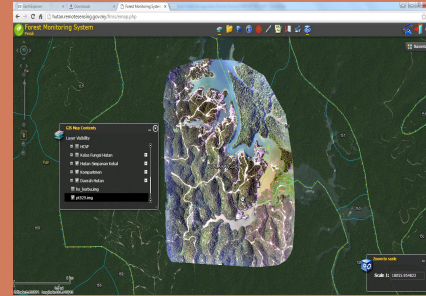
# Harvesting conformity analysis (Planet.com data)



# Way Forward



Continuous capacity building to enhance application literacy including permanent organizational structure for data updating and analysis



Acquisition of near real time data including from Planet.com, air photos from drones and radar analysis to obtain better change detection results



Detection and reporting as KPIs plus applications documented as part of FDPM's procedures/SOP – incentives/rewards for achievers



Upgrade Internet speed and infrastructure with sufficient capacity (especially in remote/interior areas) plus cloud storage for image archives



**TERIMA KASIH**  
**THANK YOU**  
**GRACIAS**