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Universiti Brunei Darussalam

# **Detecting Forest and Bush Fire Risk Area in Brunei Darussalam: Case Analysis on Brunei Muara and Belait Districts**

**14<sup>th</sup> South East Asia Survey Congress- SEASC-2017  
Presented by**

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16.08.2017



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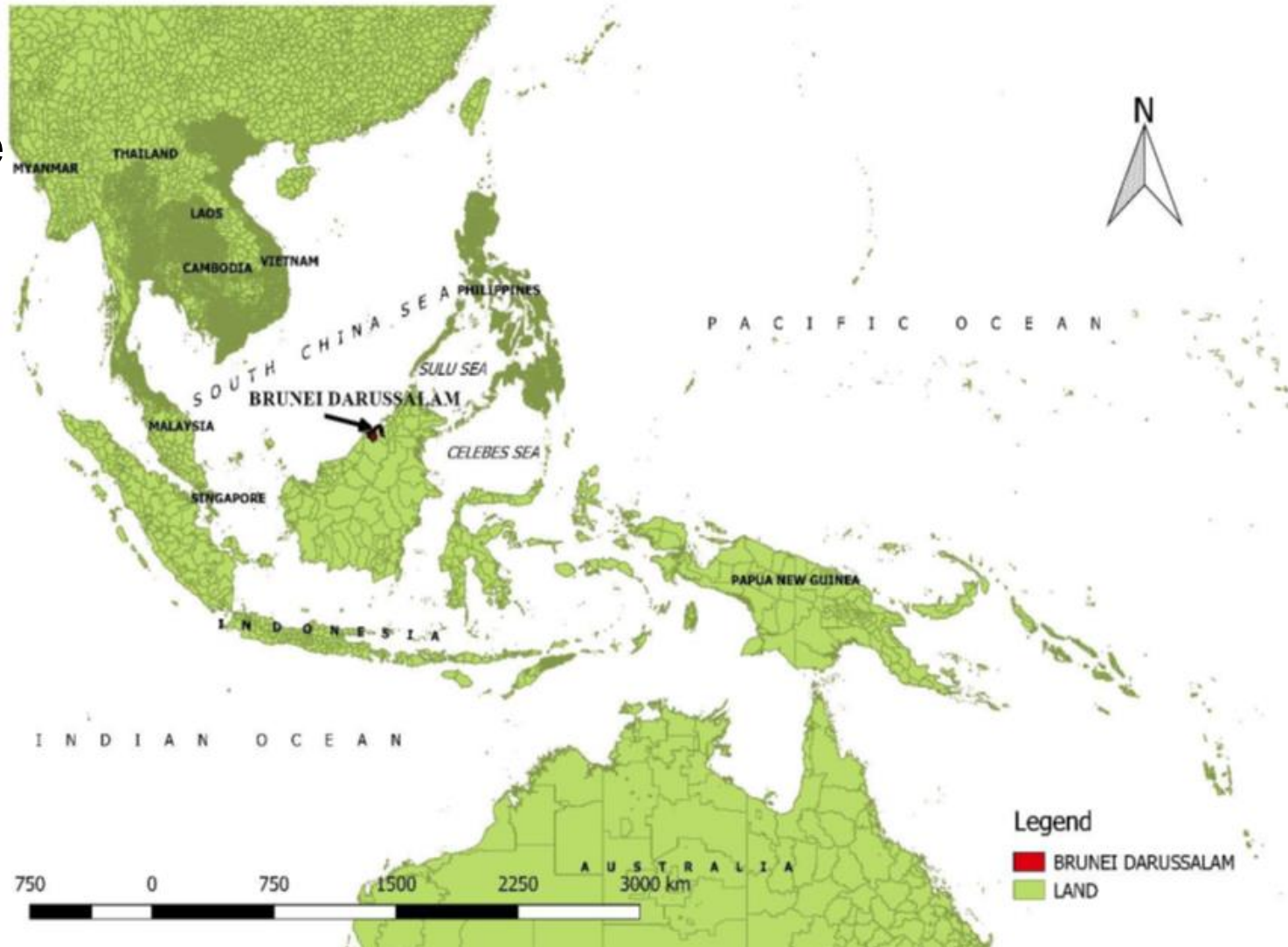
- Introduction
- Objectives
- Geographical location and Problem Identification
- Temperature and Rainfall Variance During Dry Seasons and Climate Change Impacts
- Result and Findings
- Software Application in RS Image
- Recommendations
- Conclusion



# Geographical Location

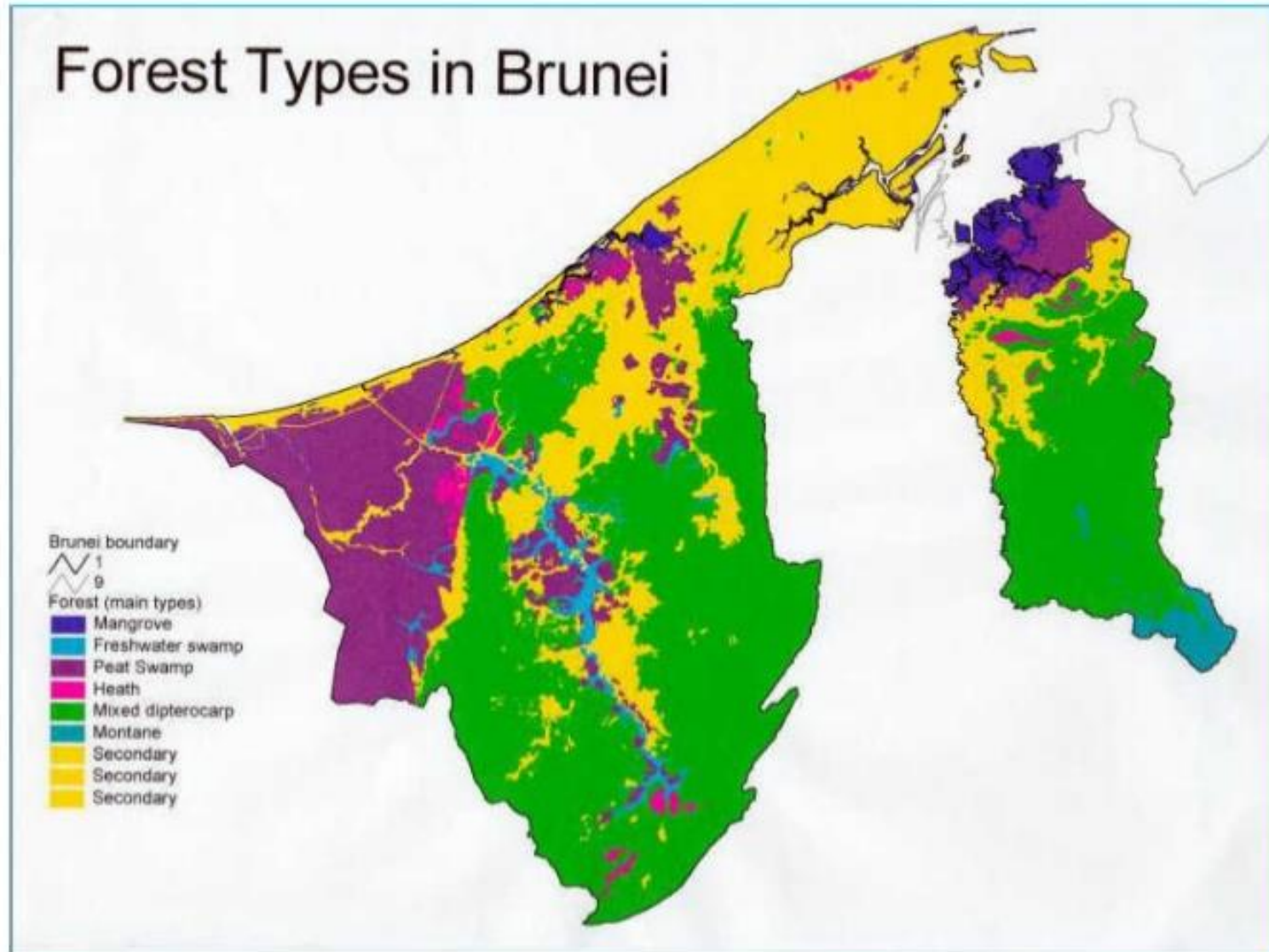
Geographical Coordinates:  $4^{\circ} 30' N$   $114^{\circ} 40' E$

Brunei share  
266 km  
border with  
Malaysia  
and has a  
161 km  
Coastline.  
The total  
area 5,770  
sq.km





# Forest Status of Brunei Darussalam





# Forest Area in Brunei

District Name	District Area (ha)	Total Forest Cover (%)
Brunei Muara	54,795	49.6
Kuala Belait	278,216	88.3
Tutong	121,667	70.7
Temburong	127,270	86.4

Peat Swamp 78,269 ha (2000), 13.4 % it was 18.2% (1980)



# ***FOREST FIRE DURING DRY SEASON IN BRUNEI DARUSSALAM***





***FOREST FIRE DURING DRY SEASONS IN BRUNEI DARUSSALAM***



# Objectives

- To identify the forest and bush fire risk areas distributions and frequency during dry season
- To observe the root causes (natural and anthropogenic) for fire occurrence
- To use RS and GIS in detecting risk areas
- To provide some recommendations for forest and bush fire mitigation and management strategy development





# Introduction

Forest fire is a widespread phenomenon

- Similar term-wildfire, wild land fire (N. America) Bushfire (Australia)
- Increasingly damaging the world forest altering ecosystem process and evolving landscape
- Combination of natural and human factors including dry weather condition, El-Nino, Open burning and recreational fire
- Uncontrollable fire have damaging social and economic effects. Ie activities relating to forestry or natural resources such as timber or property loss





# Causes of Forest and Bush Fire

A fire starts when is a right combination of Oxidizing agent which is usually Oxygen ( $O_2$ ) present in the air, fuel which is any substance that would burn such as trees and other plants, and finally heat which can be of natural causes such as lightning strike, hot air and surrounding temperature or of anthropogenic cases such as carelessly discarded cigarette butts and incompletely put out campfire.



# Conti.....

- Forest and bush fire naturally occurs to return forest to natural conditions such as having of different ages, lower fuel loads and more space between the trees thus a healthier forest.





# Effects of Forest Fires

Loss of valuable resources

- Economic and social purposes
- Loss of livelihoods and property
- Environmental problem
  - Loss of wildlife habitat
  - Species extinction and loss of biodiversity
  - More runoff leading to flooding
- Global warming
  - Reversed role in carbon sequestering process-releasing more CO<sub>2</sub> into the atmosphere
  - Ozone layer depletion,
- Health problems leading to diseases



# Result and Findings

1) Water draining from the peat land- the cause of the draining are

- Uncontrollable human activities such as construction of roads, pipeline, and Fishing
- occurrence of El Nino

2) Increase in the borrow pit in Belait District due to sand mining

3) Commercial farming activities at the peat land area

4) Failure of the developer in implementing EIA and EMMP to developed the area.

5) increase in the number of sand mining activities



# Result and Findings

- The fire and Rescue Dept, Recorded 382 forest fire and 193 bush fire outbreaks in the first 3 months in 2016 (January –March, 2016)
- In Brunei Muara District recorded the highest number of Bush and forest fires totaling 238 during this time.
- The highest numbers are recorded in February 2016, totaling 171 (123 forest and 48 bush fires)



# Result and Findings

- In Belait District recorded a total of 199 cases (117 forest and 82 bush fires) and the highest number was recorded in February totaling 143 (90 forest and 53 bush fires).
- It follows by the Tutong District with 133 outbreaks (90 forest and 43 bush fires) (February 97 cases (67 forest and 30 bush fires))
- Meanwhile only 5 outbreaks in Temburong District within the same period.





# Software Application in RS

The screenshot displays the NASA WorldView web application interface. The main view is a satellite image of a coastal region with a large body of water and a forested landmass. The interface includes a left-hand sidebar with the following sections:

- NASA WORLDVIEW** header
- Navigation icons: Layers, Events, Data
- OVERLAYS** section:
  - Fires and Thermal Anomalies (Day and Night) - Terra / MODIS (Active)
  - Place Labels - © OpenStreetMap (license), Natural Earth
  - Coastlines / Borders / Roads - © OpenStreetMap (license), Natural Earth
- BASE LAYERS** section:
  - Corrected Reflectance (True Color) - Suomi NPP / VIIRS (Active)
  - Corrected Reflectance (True Color) - Aqua / MODIS
  - Corrected Reflectance (True Color) - Terra / MODIS (Active)
- + Add Layers** button

On the right side of the image, there are icons for link, globe, camera, and info, along with a vertical zoom control (+/-). A scale bar in the bottom right corner shows 20 km and 10 mi. At the bottom, a timeline navigation bar shows the date **2016 JAN 16** and a playback control. The timeline includes markers for **JAN 2016**, **FEB 2016**, and **MAY**. On the far right, a dropdown menu is set to **DAYS**, with options for MONTHS and YEARS.



# Software Application in RS

The screenshot displays the NASA WorldView interface. The main window shows a satellite image of a coastal region with various data overlays. The interface includes a top navigation bar with the NASA logo and 'WORLDVIEW' text. Below this, there are tabs for 'Layers', 'Events', and 'Data'. The 'Layers' panel is open, showing two sections: 'OVERLAYS' and 'BASE LAYERS'. The 'OVERLAYS' section includes 'Fires and Thermal Anomalies (Day and Night)' (Terra / MODIS) and 'Place Labels' (© OpenStreetMap (license), Natural Earth). The 'BASE LAYERS' section includes 'Corrected Reflectance (True Color)' (Suomi NPP / VIIRS), 'Corrected Reflectance (True Color)' (Aqua / MODIS), and 'Corrected Reflectance (True Color)' (Terra / MODIS). A '+ Add Layers' button is located at the bottom of the layers panel. The main map area shows a satellite view of a coastal region with a scale bar indicating 20 km and 10 mi. A timeline at the bottom shows the date '2016 JAN 25' and navigation controls for time, including a play button and a timeline slider showing 'JAN 2016', 'FEB 2016', and 'MAR'. A vertical menu on the right side of the map includes a search icon, a camera icon, and a zoom control with '+' and '-' buttons.



# Software Application in RS

**NASA WORLDVIEW**

Layers Events Data

**OVERLAYS**

- Fires and Thermal Anomalies (Day and Night) Terra / MODIS
- Place Labels © OpenStreetMap (license), Natural Earth
- Coastlines / Borders / Roads © OpenStreetMap (license), Natural Earth

**BASE LAYERS**

- Corrected Reflectance (True Color) Suomi NPP / VIIRS
- Corrected Reflectance (True Color) Aqua / MODIS
- Corrected Reflectance (True Color) Terra / MODIS

+ Add Layers

2016 MAR 08

FEB 2016 MAR 2016 APR 2016

4°23'10"N, 114°08'32"E EPSG:4326

20 km 10 mi

DAYS MONTHS YEARS



# Software Application in RS





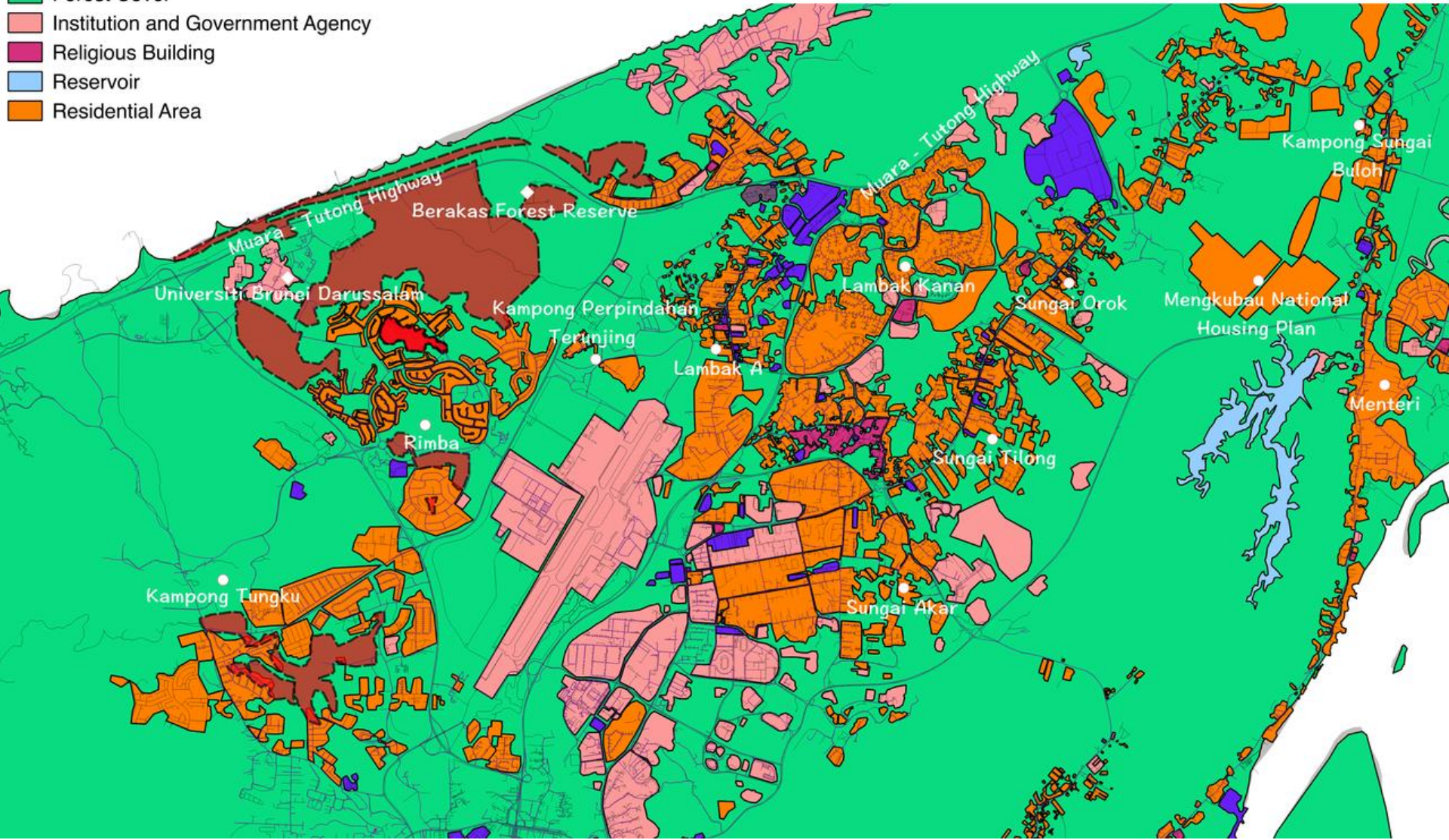
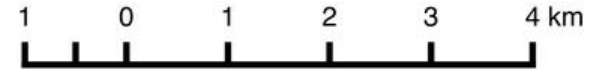
# Software Application in RS



# Forest Fire 2014 - 2015

## Legend

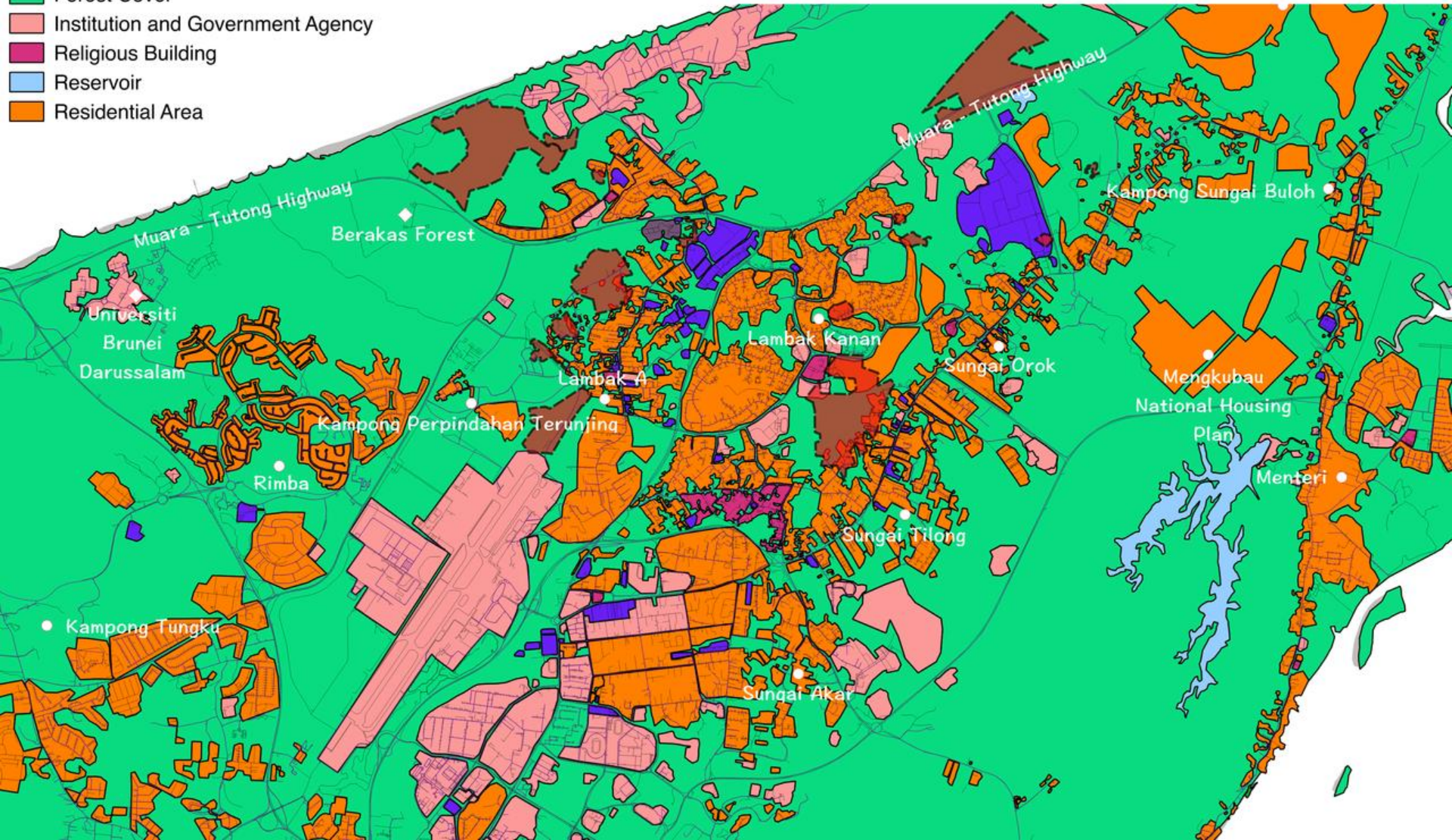
- Road
- Area affected by Forest Fire
- Base Map
- Commercial Area
- Forest Cover
- Institution and Government Agency
- Religious Building
- Reservoir
- Residential Area



# Forest Fire 2015 - 2016

## Legend

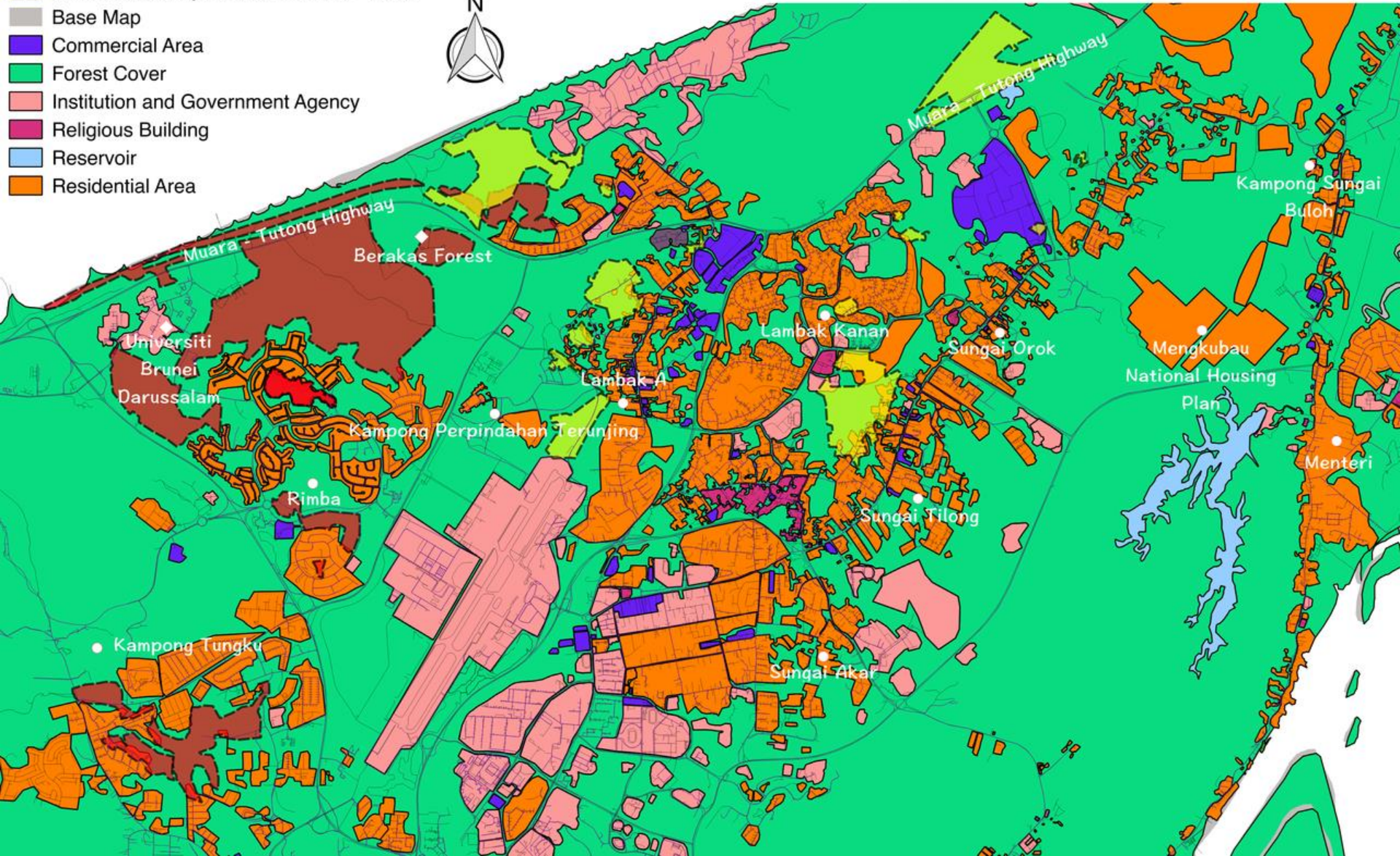
- Road
- Area affected by Forest Fire 2015 - 2016
- Base Map
- Commercial Area
- Forest Cover
- Institution and Government Agency
- Religious Building
- Reservoir
- Residential Area



# Comparison of area affected by Forest Fire (2014 - 2016)

## Legend

- Road
- Area affected by Forest Fire 2014 - 2015
- Area affected by Forest Fire 2015 - 2016
- Base Map
- Commercial Area
- Forest Cover
- Institution and Government Agency
- Religious Building
- Reservoir
- Residential Area







# Forest Fire 2014



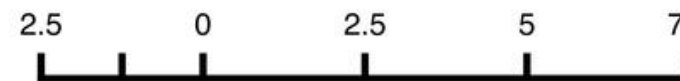
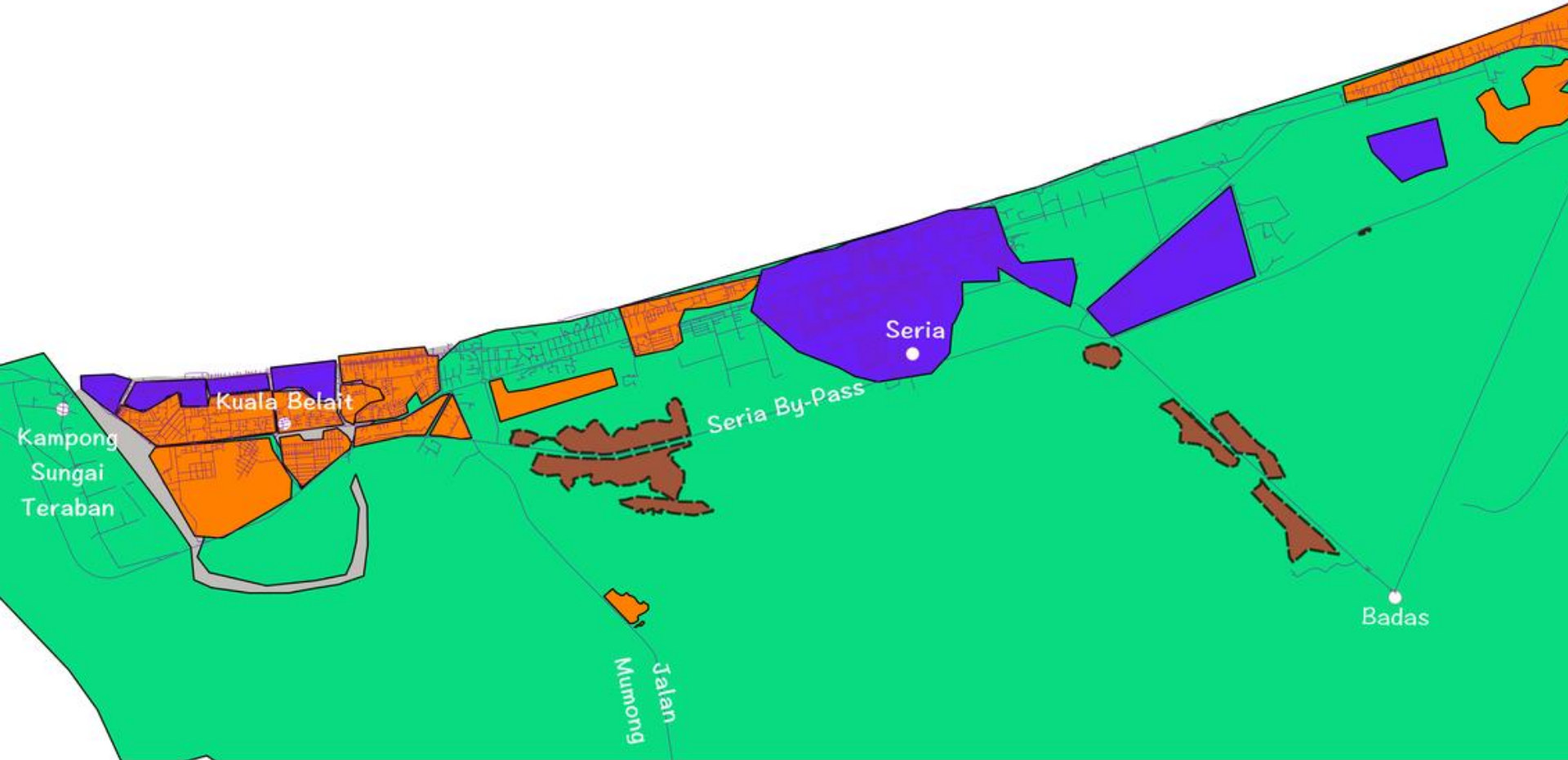
## Legend

- Road
- Area Affected by Forest Fire
- Base Map
- Commercial Area
- Forest Cover
- Residential Area



# Legend

- Road
- Area Affected by Forest Fire
- Base Map
- Commercial Area
- Residential Area
- Forest Cover





# Forest Fire 2016



- Road
- Area Affected by Forest Fire
- Base Map
- Commercial Area
- Forest Cover
- Residential Area

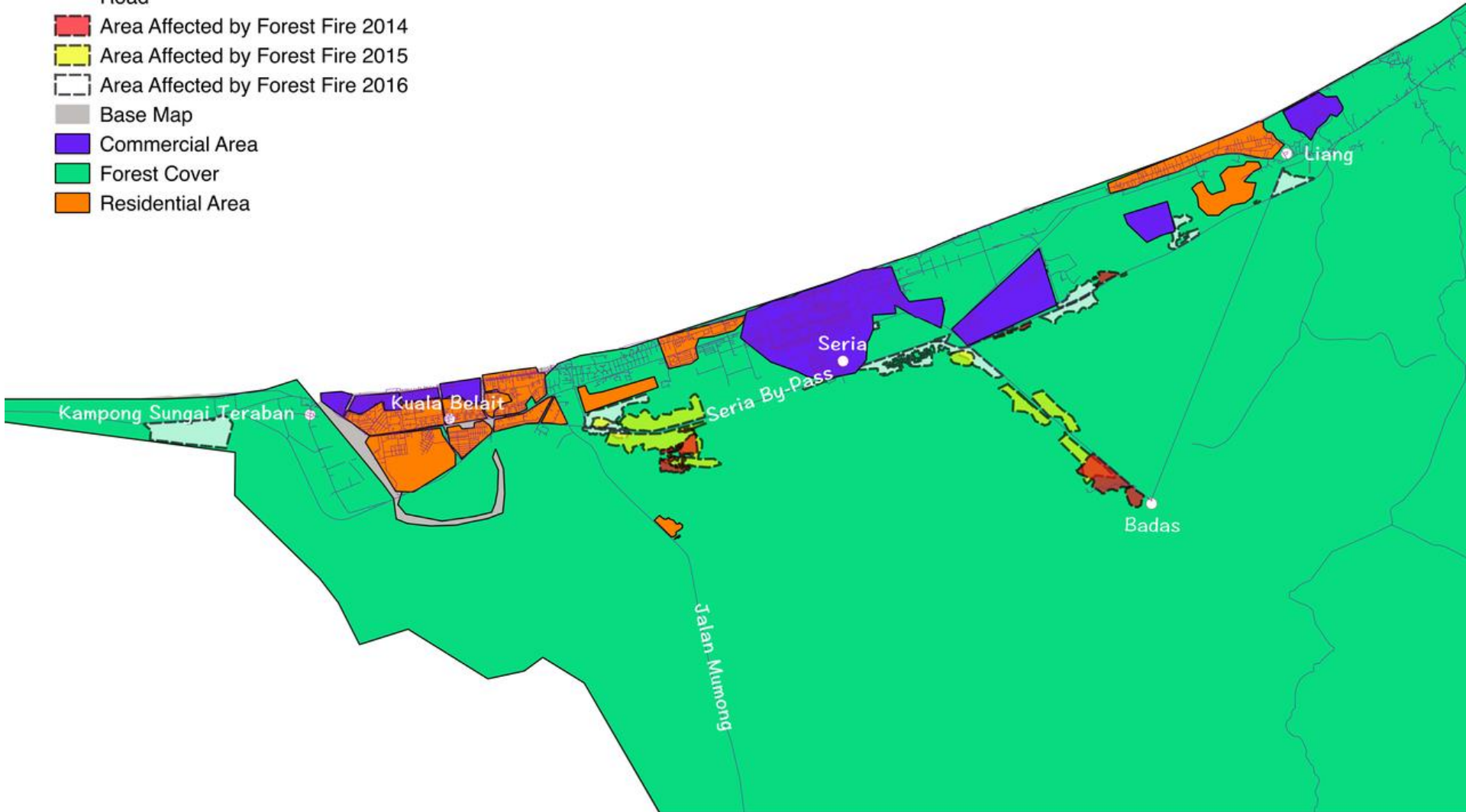




# Comparison of area affected by forest fire (2014 - 2016)



- Legend
- Road
  - Area Affected by Forest Fire 2014
  - Area Affected by Forest Fire 2015
  - Area Affected by Forest Fire 2016
  - Base Map
  - Commercial Area
  - Forest Cover
  - Residential Area



2.5 0 2.5 5 7.5 10 km



# Sustainability of Forest

Sustainability Approach of Sound Ecology, Responsible Society and Viable Economy were followed by strong sustainability rules.

- In Brunei Forest Act Chapter 46 (1934) Revised in 2002 and Amended in 2007
- Wild life Protection Act 1981
- Land code and Land Aquisition Act 1909
- Wild Flora and Fauna Order 2007



# Why Forest Conservation

- It is important for conservation
- It is ecotourism paradise
- It is Botanical paradise (Wildlife)
- It is the source for research , education and training
- Place for environmental assessment
- Source for forest ecosystem services (ES)



# National Forest Policy in Brunei

In Brunei, forestry excellence management agenda act as the national objectives for sustainable forestry ([Forestry Department, 2011](#)). Which are as follows:

- 1) Forest for posterity and prosperity to maintain the pristine condition of the country's forests in perpetuity and as a key for continued prosperity in response to the national agenda of development.
- 2) Forest for sustainable production in goods and services under sustainable management regime. By ensuring optimum provisions of forest goods and services in regard of its effect to ecology and environment



# Conti.....

- 3) Forest for economic strength, maximizing economic contribution from forestry sector to support diversification effort.
- 4) Forest for public involvement and recreation, through the development of recreational parks in bringing people close to nature built with facilities.
- 5) Forest for international prestige. As an exemplar nation in addressing global issue of climate change, biodiversity, food security and greenhouse effect.





# Soil Study



Soil Moisture deficit could be used in prediction of forest fire danger index



# Recommendations

## Country Planning

- *To provide the alternative area for sand mining*
- *Identify the existing borrow pits and consider possible solution to mitigate the problem*
- *Provide proper guideline for the contractor for sand mining*



# EIA and SEA





# Recommendation and Development

## Soil issues

- *Analysis of the peat land soil is need for development to make sure the quantity of sand viable for sale before the development of the land*
- *There is the need of rehabilitation area that need to be monitor and do not allowed further development of the peat land*
- *Monitor the on going rehabilitation project done by the developer*
- *Any project at the peat land area must be authorized by the government agencies involves*



# Recommendations

## Environmental issues

- Provide proper guideline and rehabilitation of borrow pits
- Provide EIA and EMMP report to monitor the project done by the contractor

## 6. land survey issues

- Provide good Integrated mapping system to monitor the land hot spot.
- SEA is necessary for environmental panning in the sensitive Forest and bush fire risk areas in Brunei



# Concluding Remarks

- 1-Anthropogenic and natural factors are the primary causes for forest and bush fires in Brunei Darussalam.
- 2-There is the need for integrated interdisciplinary management approach to control the forest fires in Brunei.
- 3- There is a need the use of Remote Sensing (RS) and GIS to mitigate the forest and bush fires through proper planning.
- 4- The area of forest fire and Bush fire in Brunei Darussalam has increased.

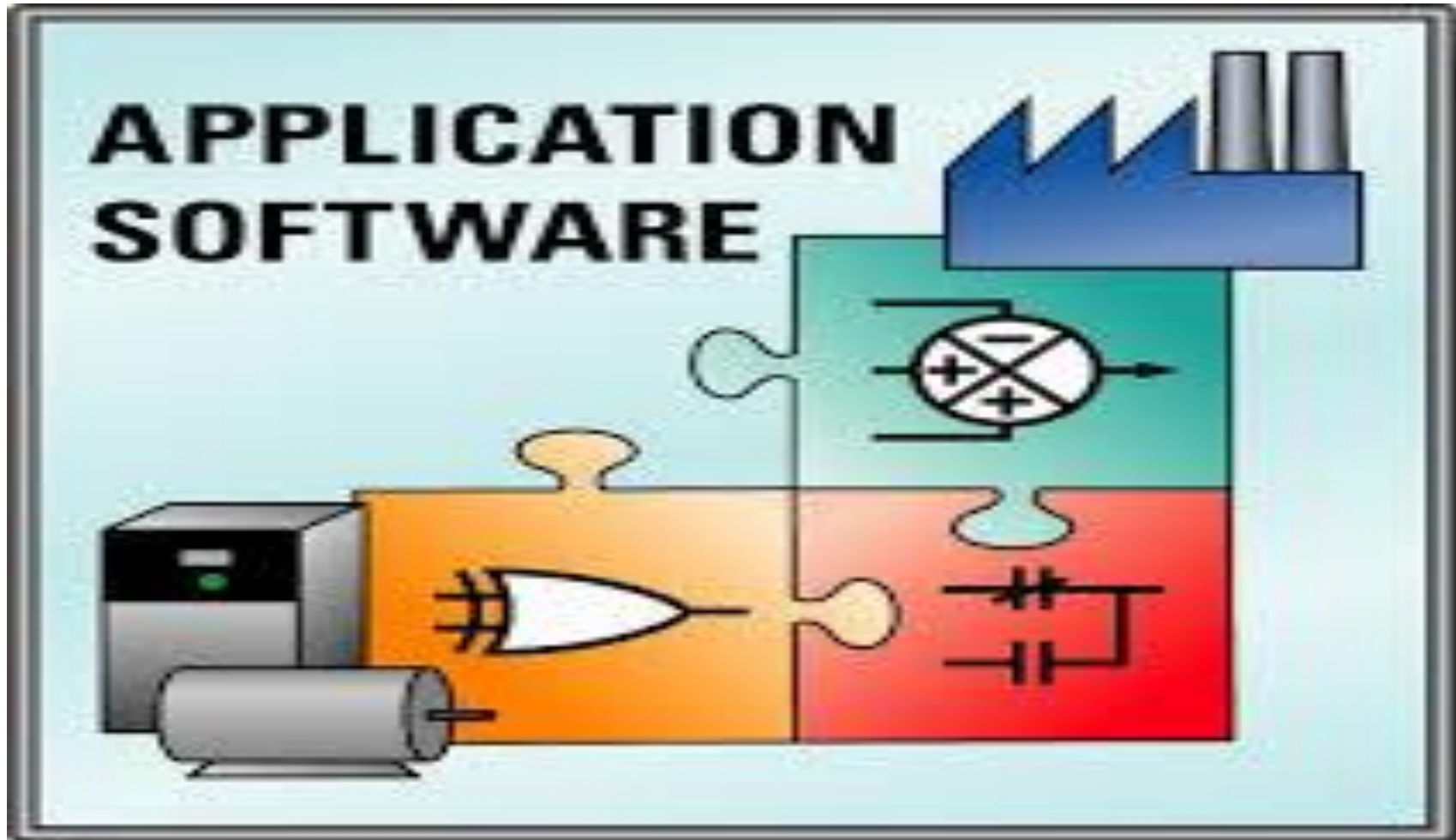


*Thank You  
for your Attention*

*Questions ?*

Email: [shafi.islam@ubd.edu.bn](mailto:shafi.islam@ubd.edu.bn)

# Software Application in RS







# Recommendation and Development

