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Mapping Agricultural-Driven Deforestation in Central Kalimantan with Remote Sensing

AI in Urban Sustainability

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Fires in Central Kalimantan (Fauzy Chaniago, 2019)

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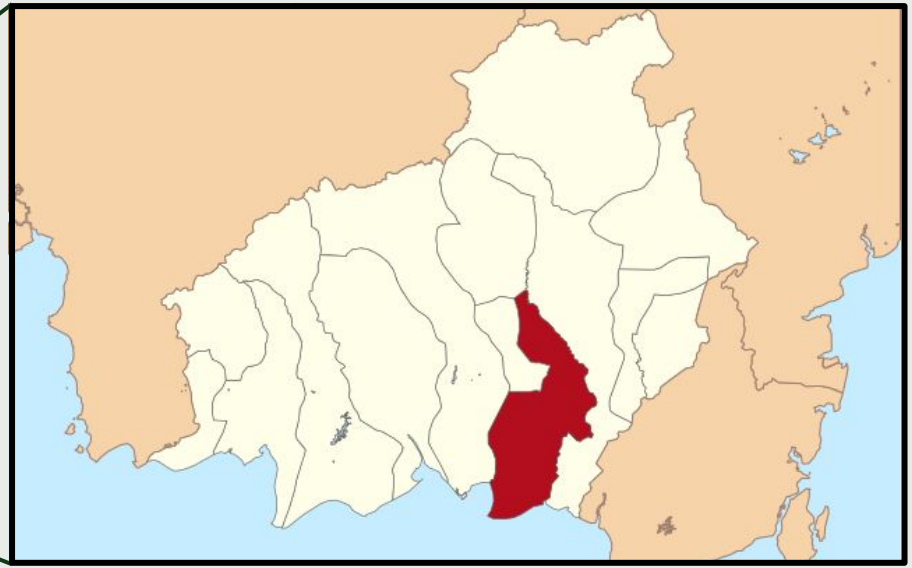
01 Introduction

Fires in Central Kalimantan (phys.org, 2019)

Region of Interest

- Borneo
  - An island in Southeast Asia
  - Brunei, Malaysia, and Indonesia
- Kalimantan makes up 73% of the island's area
  - Fall under Indonesia's jurisdiction

Region of Interest: Pulang Pisau



Bornean Orangutans (Anup Shah)

- Ecologically significant tropical habitat
  - Bornean Orangutan
  - Diverse flora and fauna
- Agricultural production has driven deforestation
  - Rubber
  - Palm Oil
  - Peatland drainage

Palm Oil Plantation in former orangutan habitat (Ulet Ifansasti, 2014)

- Ecologically significant tropical habitat
  - Bornean Orangutan
  - Diverse flora and fauna
- Agricultural production has driven deforestation
  - Rubber
  - Palm Oil
  - Peatland drainage

2015 Haze Crisis in Central Kalimantan (Bjorn Vaughn, 2015)

- Severe peatland fires during dry seasons (June to October)
- Tremendous impacts on:
  - Environmental degradation
  - Health issues
  - Air pollution

02 Methodology

Fires in Central Kalimantan (Fauzy Chaniago, 2019)

Using Sentinel-2 Images to Identify burns

“Redefined burn-area mapping protocol using Sentinel-2 data” (Gaveau et al., 2021)

Purpose

Compared total burn area estimates results between Landsat and Sentinel-2 data

Findings

Using Sentinel-2 data **increased the total estimates** of burned area because:

- **Higher resolution** than Landsat
- Picked up more nuances in the data, including **smaller fires**

More accurate estimates help us consider impacts of fires more accurately.

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Methodology

Step	Action
1	Subset Region of Interest to Pulang Pisau
2	Download Sentinel-2 SR (L2A) 2019
3	Cloud-masking and calculate NBR
4	Apply a moving window for dNBR detection
5	Create pre- and post-fire composites
6	Label training points (burned/unburned)
7	Train Random Forest
8	Map of burned areas
9	Validate with independent points

03 Progress

Fires in Central Kalimantan (phys.org, 2019)

Data Collection

October 21, 2016

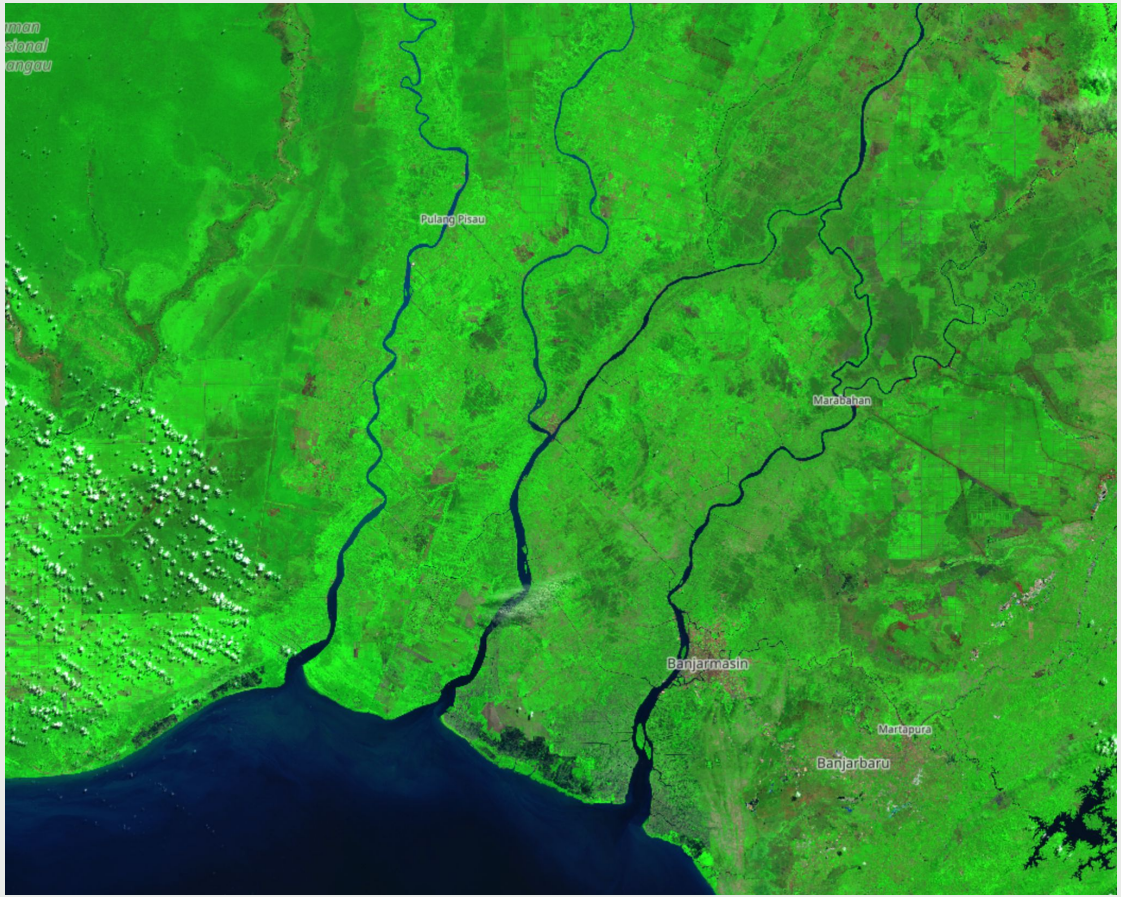
- The quality of images vary drastically due to high cloud coverage.
- Pre-processing is required to remove cloudy pixels
  - QA60 bitmasking

Exploratory Analysis

July 25, 2019

Pulang Pisau - Before the fires

Using composite bands (SWIR2 (R), NIR (G), Red (B)) to show extent of burns

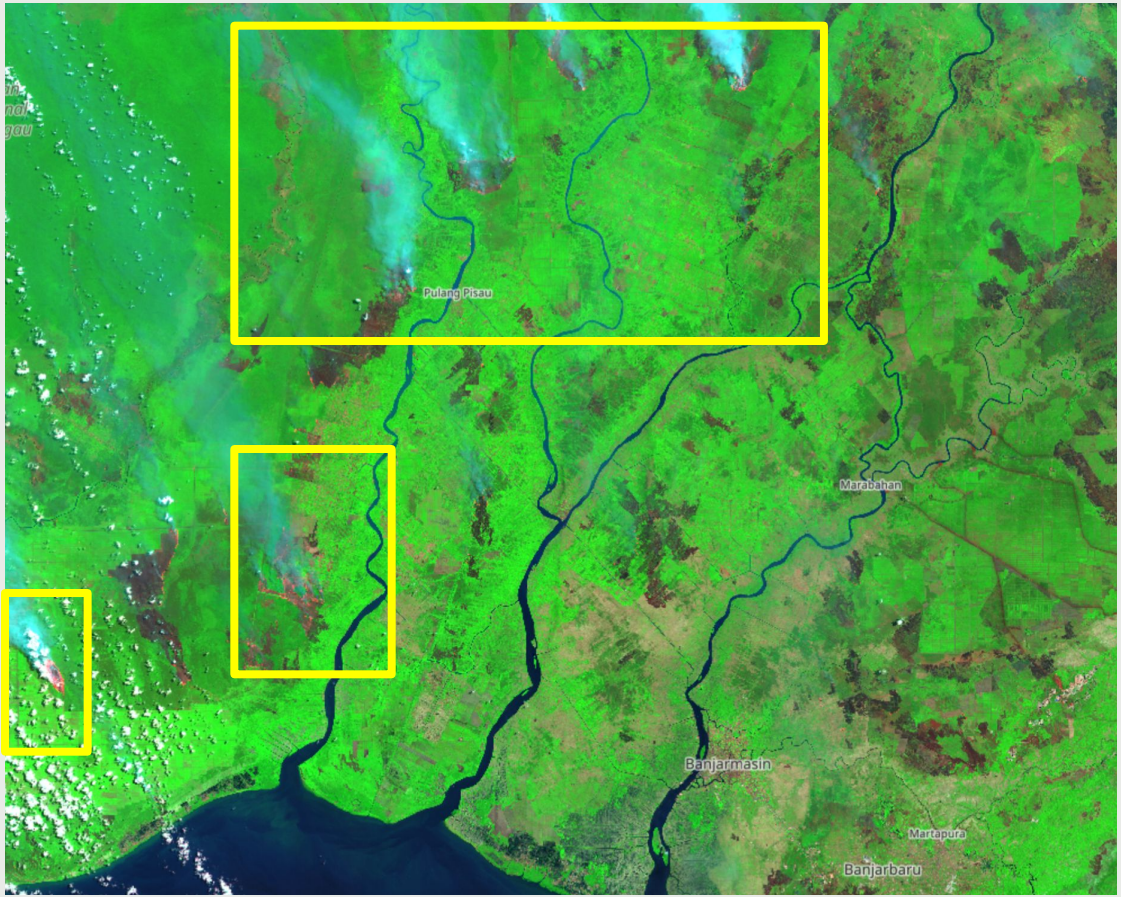


Exploratory Analysis

September 13, 2019

Pulang Pisau - During the fires

Using composite bands (SWIR2 (R), NIR (G), Red (B)) to show extent of burns

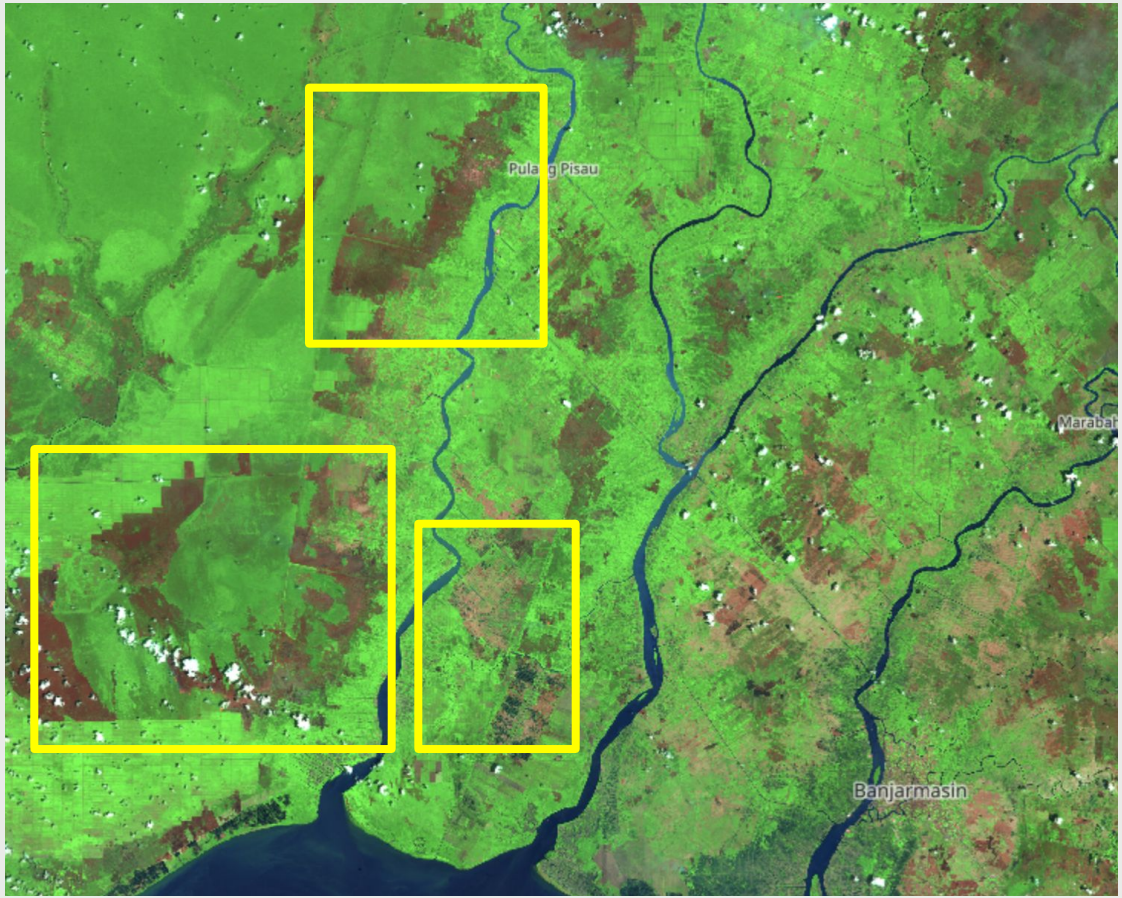


Exploratory Analysis

October 23, 2019

Pulang Pisau - After the fires

Using composite bands (SWIR2 (R), NIR (G), Red (B)) to show extent of burns



Burn Analysis

- Change detection between pre- and post-fire results.
- Dark Red and Black regions show moderate to major burns

04 Next Steps

Fires in Central Kalimantan (Fauzy Chaniago, 2019)

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I could not do a moving window due to the data quality.

Decided to do split the data into two seasons (Jan-Jun and Sep-Dec).

Create 500 labels
30-40% burned
60-70% unburned

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Thank You!