Comparison of spatio-temporal burned area distribution

Sriram Krishnasamy Seenivasan
Rishikesh Miriyala
Ghulam Abbas Zafari

Tutor: Prof. Giovanna Venuti
Dr. Daniela Stroppiana

Why Study Burned Area Distribution in Australia?

- Australia faces frequent, intense bushfires, especially during summer.
- The 2019–2020 ‘Black Summer’ highlighted severe ecological and economic impacts.
- Understanding fire dynamics is crucial for risk mitigation and land management.
- Google Earth Engine (GEE) offers scalable tools for spatio-temporal analysis.

Project Objectives

- Compare MODIS MCD64 and FIRMS fire datasets.
- Analyze spatial and temporal trends in burned areas.
- Study environmental impacts: NDVI, LULC, LST, and forest loss.
- Utilize Google Earth Engine for scalable cloud-based processing.

Datasets and Tools

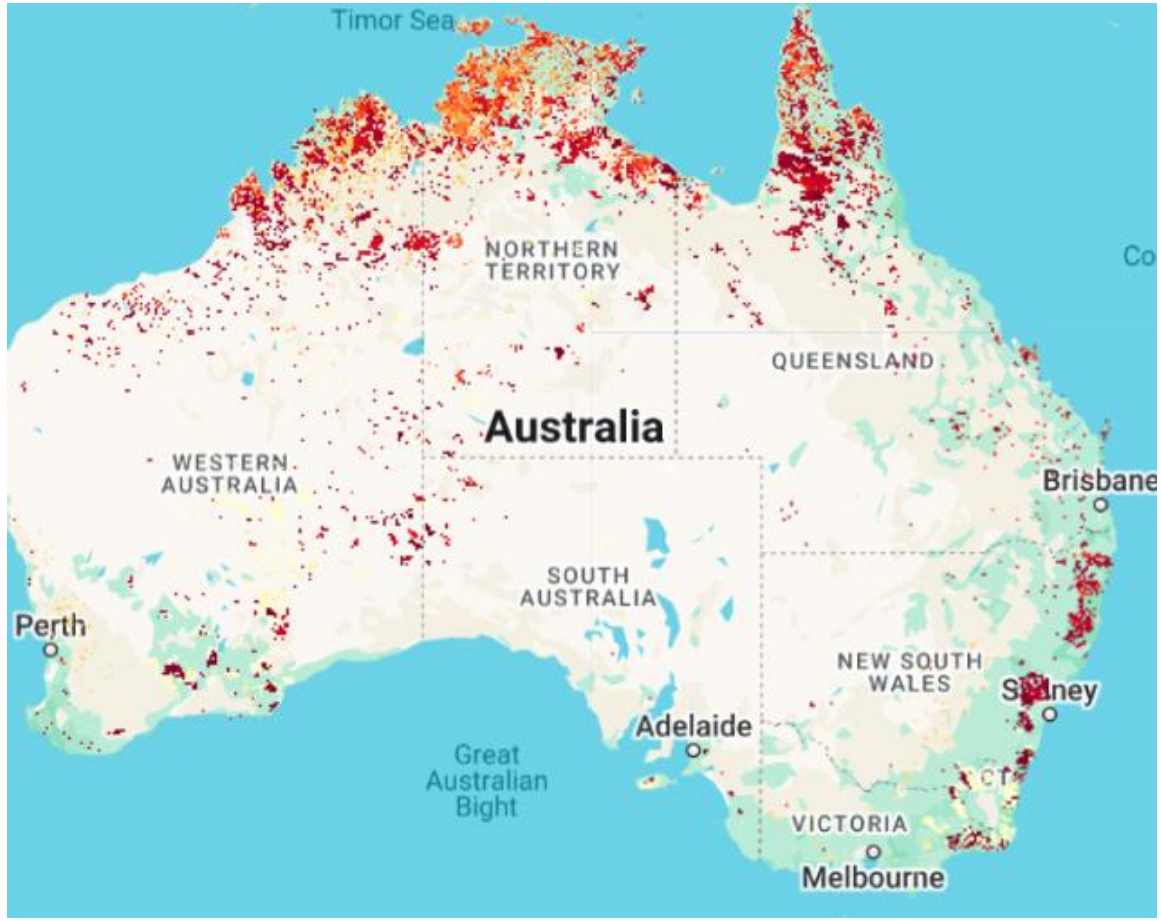
- MCD64A1 (MODIS) – Burned Area
- FIRMS – Active Fire Points
- MOD11A1 – Land Surface Temperature (LST)
- MOD13A2 – NDVI (Vegetation Health)
- MCD12C1 – Land Use Land Cover (LULC)
- Hansen – Global Forest Change
- Tools: Google Earth Engine, QGIS

Workflow in Google Earth Engine

- Define Region of Interest (Australia) using GAUL boundaries.
- Filter and preprocess MODIS, FIRMS, Hansen datasets.
- Calculate burned area, NDVI, LST, LULC, and forest loss.
- Visualize and export results: maps, time series, statistics.

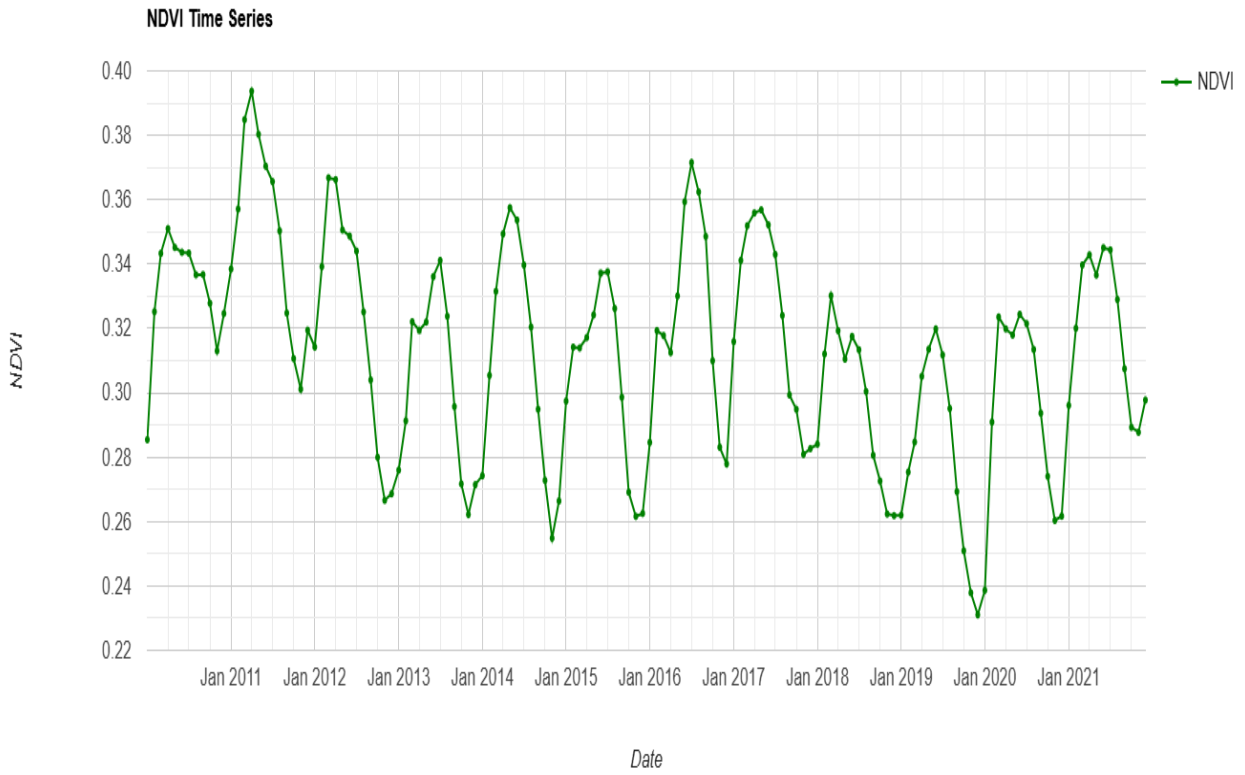
Burned Area Analysis (2019–2021)

- Burned area calculated using MODIS MCD64A1.
- Active fire points categorized by temperature (FIRMS T21).
- Monthly and annual burned area maps generated.
- Exported statistics in hectares to CSV and GeoTIFF.



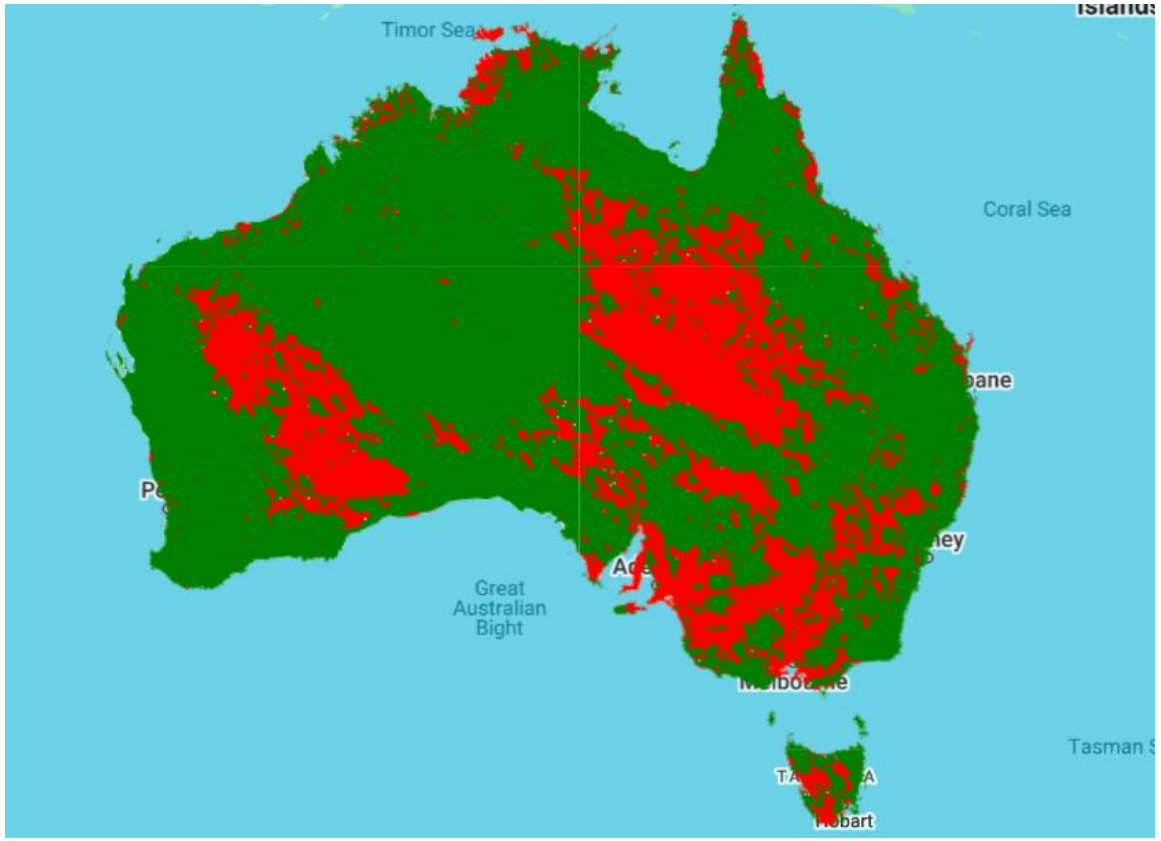
Vegetation Health & Temperature

- NDVI monthly time series from 2010 to 2021.
- Mean LST visualized using MOD11A1 for 2019.



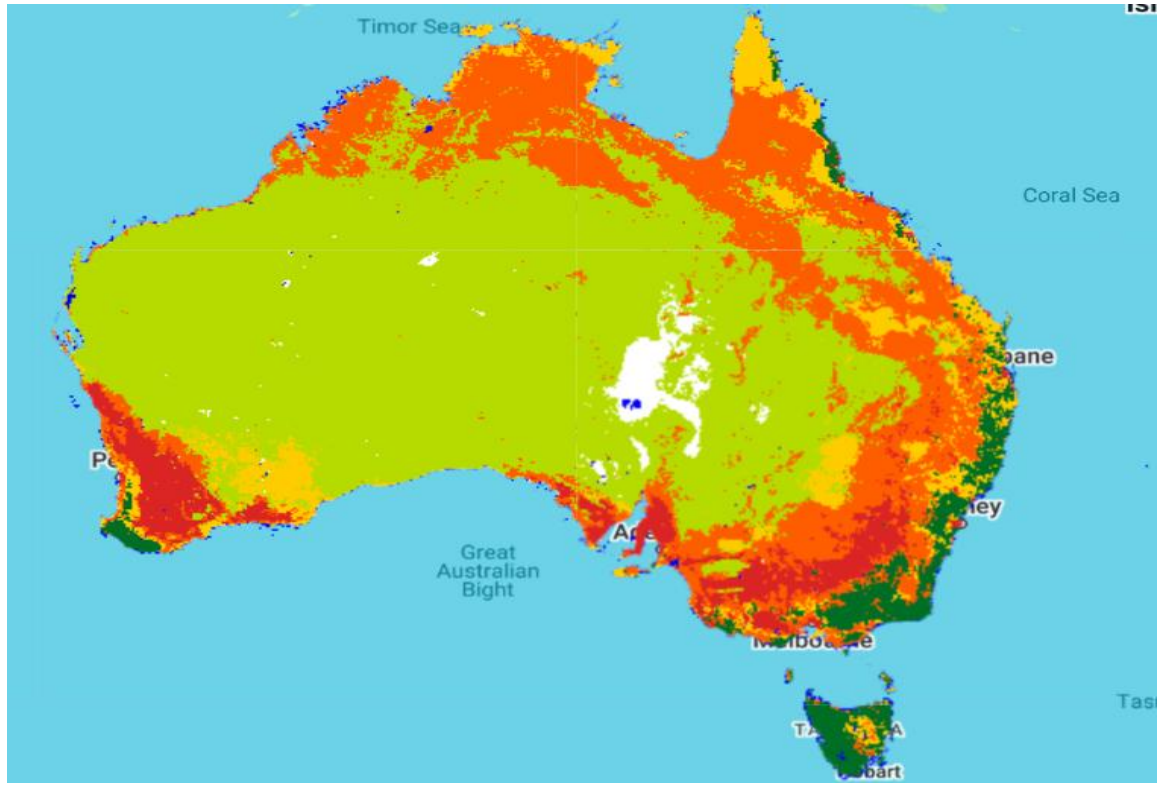
NDVI Anomaly

- NDVI anomaly analysis (2020 vs 2021) detects post-fire recovery.
- Vegetation degradation and regrowth visualized spatially.
  - Indicate a decline in vegetation health or cover in 2021 compared to 2020.
  - Indicate vegetation regrowth or improvement, possibly due to recovery post-fire.



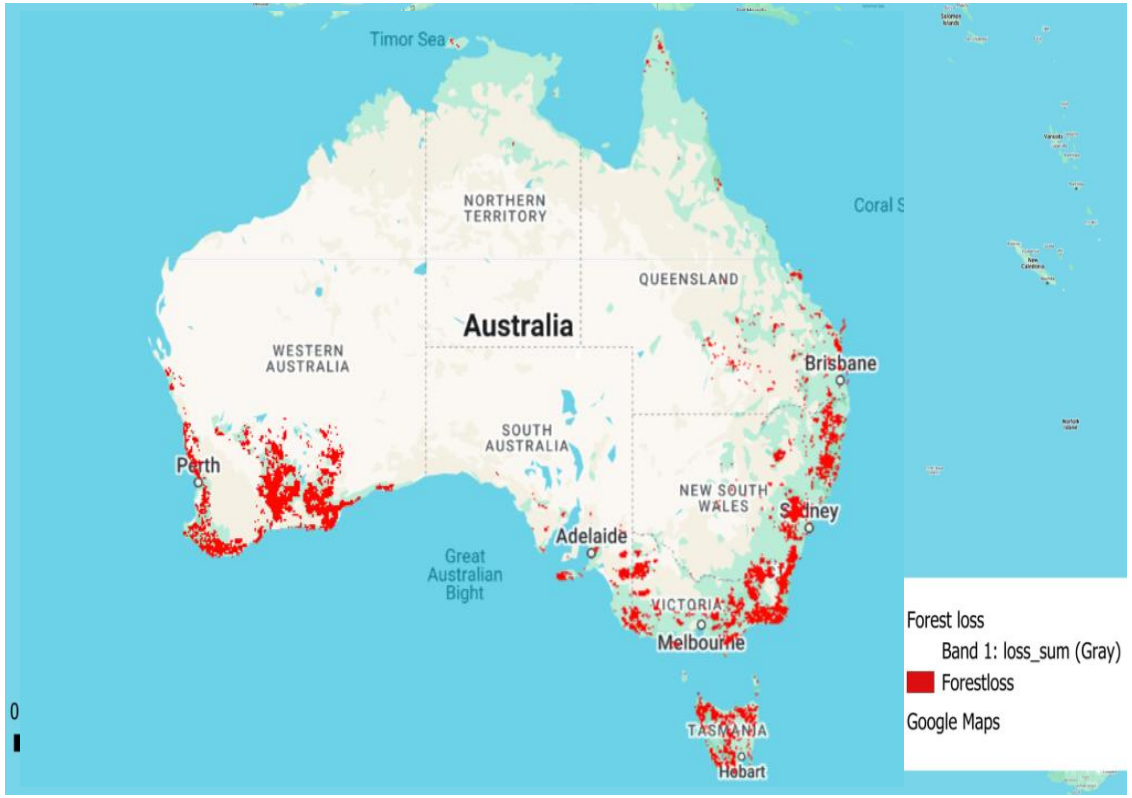
Land Cover and Forest Change

- Reclassified LULC from MODIS MCD12C1 (2022).
- Area statistics calculated per land cover class (e.g., forest, grass, cropland).



Type	Area km²	Type	Area km²
Forest	260450	Shrubs	4474151
Grasslands	527369	Cropland	1890771
Mixed	348860	Sparse	314
Water	42950	Snow/Ice	143696

Forest Loss



- Annual forest loss (2002–2022) using Hansen dataset.
- Hotspot map shows spatial distribution of deforestation.

Insights and Interpretation

- Fires impacted forest and shrub regions the most.
- NDVI anomalies showed clear vegetation loss in 2021.
- Forest loss peaked in 2019–2020; hotspots aligned with fire zones.
- Multi-source data confirmed trends and increased result confidence.

Conclusion and Recommendations

- Google Earth Engine enables efficient multi-year fire monitoring.
- Burned area, LULC, NDVI, and LST integrated into one analysis.
- Findings support sustainable land and forest management policies.

THANK YOU