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P4.104 | Extrapolating forest biomass dynamics over long time series and large areas using remote sensing

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Objectives To develop a new robust approach for extrapolating forest biomass measurements throughout long time periods over large areas using composite Landsat time series data and single-date forest inventories.

Outcomes

- A transparent and consistent solution to producing biomass change estimates over time with single-date forest inventory information
- Creation of a Spatial Disturbance and Recovery Matrix and associated Spatial Transition Matrix representing Forest Land Coverchanges on a per pixel per year basis over 30 years
- Estimates of changes in biomass across the Victorian public land forest estate during the 30-year period.

Introduction

A practical innovative framework for estimating biomass carbon dynamics using ~30 years of Landsat time series data.

The Purpose of the Research

Global vegetation biomass, of which over 80% is accounted for in world forests, is considered as a key factor in the global carbon cycle. Thus, estimating biomass and its dynamics is key to understanding the net sources and sinks of terrestrial carbon.

In the context of international climate change agreements, developing countries aiming to establish a consistent and robust estimation of biomass carbon through time, are often faced with a problem of having single-date forest inventory information. This study aims to provide a method for extrapolating single inventory data over long-time periods and large areas.

The study area is the state of Victoria which contains ~7M ha of forests located on public land. Although Victoria is not a country, it is currently in a similar scenario to developing countries. The Department of Environment, Land, Water andPlanning (DELWP) has established a comprehensive forest inventory plot network of 786 2km x 2km plots systematically distributed across the State (Figure1).

This study will create a robust and repeatable approach to extrapolate forest biomass measurements through space and time using over 30 years of Landsat imagery and one-off forest inventories.

Research Questions

- What is the utility of remote sensing time series in creating a Spatial Disturbance and Recovery Matrix over long time periods and large areas?
- How can the forest extent layers be defined using Landsat data and one-off forest inventories?
- Which are the most appropriate spectral metricsfor capturing the transitions between forestcanopy cover classes?
- How can the Spatial Transition Matrix be improved using disturbance and recovery trajectories

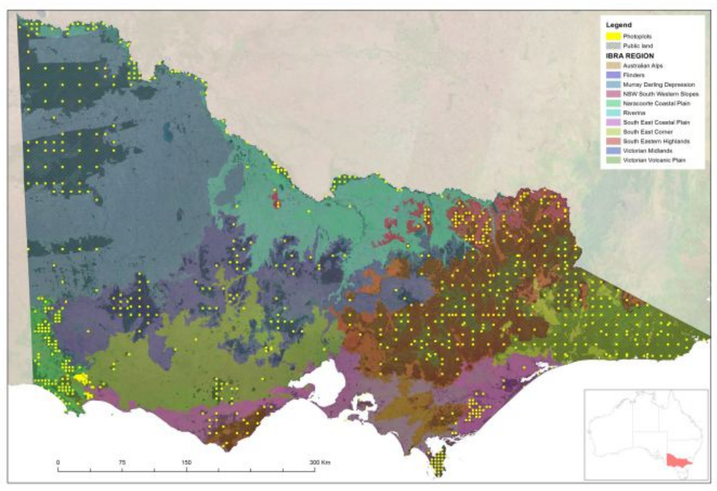

Figure 1:
Map of Victoria showing the 786 Aerial Photographic Interpretation (API) plots across the public forest land and IBRA regions (Mellor, Haywood et al. 2013).

Research Methodology

The methodology is divided into five main components and briefly described in Figure 2.

- Creating a robust Spatial Disturbance and Recovery Matrix and associated metrics that indicate the disturbance and recovery history of every pixel over the 30 year period through temporal spectral trajectories (Kennedy, Yang et al. 2010).
- Generating a forest extent dataset: historical forest extent layers will be defined by back-casting one-off forest inventory dataset.
- Creating and evaluating the Forest Activity Dataset which is a robust Spatial Transition Matrix representing the Forest Land Cover changes on a per pixel per year basic over the study period.
- Extrapolating biomass dynamics through space and time using the Activity Dataset and Emission Factors (IPCC 2006).
- Research outcomes will be validated with an independent data source (LIDAR).

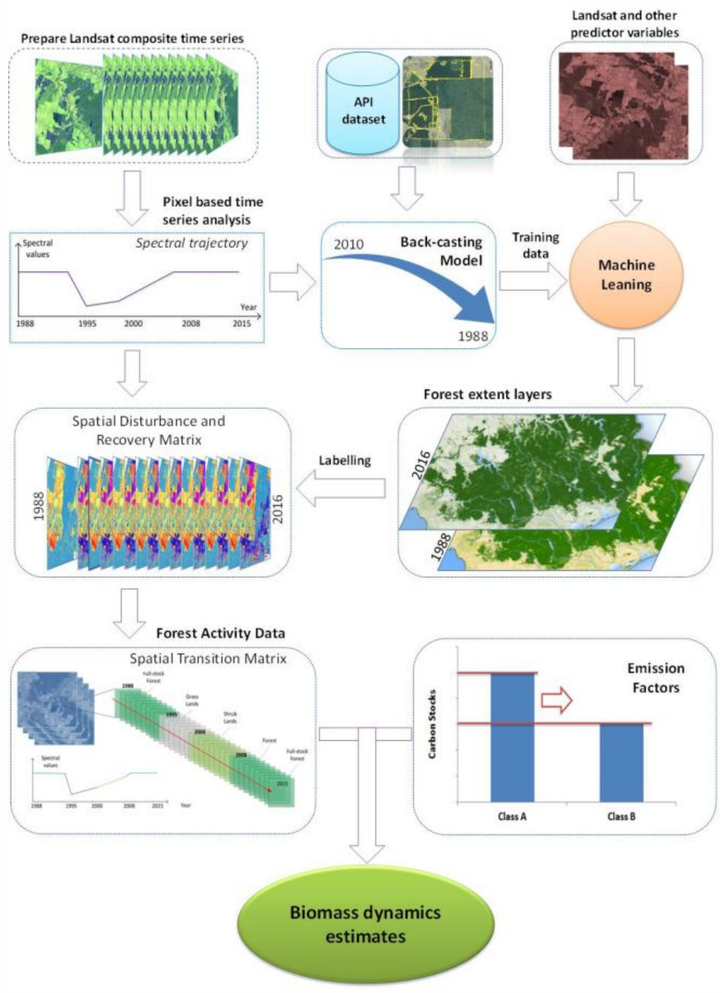

Figure 2:

The overall methodology flow chart representing the key stages of the study.

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