



Spatial Vision

Forest Extent, Health, and Condition

Historical Baselines and Trends

Stephen Farrell
Harmen Romeijn
Simon Jones
Mariela Soto-Berelov
Peter Woodgate
Phil Lacy

Christine Stone
Michael Drielsma
Jamie Love
Megan McNellie
Rajesh Thapa
Tim Danaher
Geoff Horne
Adrian Fisher
Sam Hislop
Masoomah Alaibakhsh

Brief and Deliverables

- Propose historic baselines across all tenures for the indicators of:
 - Forest extent
 - Forest condition
 - Forest health
- Analyse trends in the indicators of forest extent, condition and health:
 - across all tenures in NSW RFAs and across NSW
 - in Coastal IFOA for state forests only
- Discuss possible drivers for these trends
- Leverage existing data products and project outputs

Measure of 'Forest Extent' – Approach

Forest Extent uses Forest Cover and is defined as:

- containing as minimum a mature or potentially mature stand height exceeding 2 metres
- containing stands dominated by trees usually having a single stem
- where mature or potentially mature stand component comprises 20% canopy coverage using a Crown Projective Cover (CPC) measure
- minimum mappable unit of 0.2ha
- relates to the presence of canopy cover at a given point in time.

Key Inputs

- National Greenhouse Gas Inventory (NGGI) National Carbon Accounting System (NCAS)
 - National Forest and Sparse Woody Vegetation Database
- Landsat 25 m grid resolution
- Annual / Biennial temporal coverage from 1988 to 2019/20

Measure of Condition - Approach

- Due to absence of data, this project could not measure condition as a measure of vegetation integrity (i.e. composition, structure and function)
- Condition measured for this project is canopy cover connectivity and fragmentation.
- Biodiversity Indicator Program (BIP) Spatial Links methodology for calculating connectivity (Love and Drielsma)
- Assess the trend in average and maximum connectivity values
 - Average assesses condition and connectivity between forest patches
 - Maximum assesses condition and connectivity within forest patches

Forest Health - Approach

- This project could not measure forest health and regeneration due to limitations of available spatial data
- Here health relates to disturbances related to agents or pressures affecting normal ecosystem functions and sustainability and the resulting canopy loss and recovery period.
- To do this the project assessed the loss of cover:
 - against each of these agents of disturbance and measured the total forest extent cover loss.
 - due to a disturbance event and measured the time until canopy cover returned (to a threshold level).

Overview of Approach

Spatial Refinement
 - Land use (3 years) - esp. water, non-forest uses, tree crops
 - SVTM - Classes

Cross Validation
 NSW Woody Vegetation Extent (SLATS)

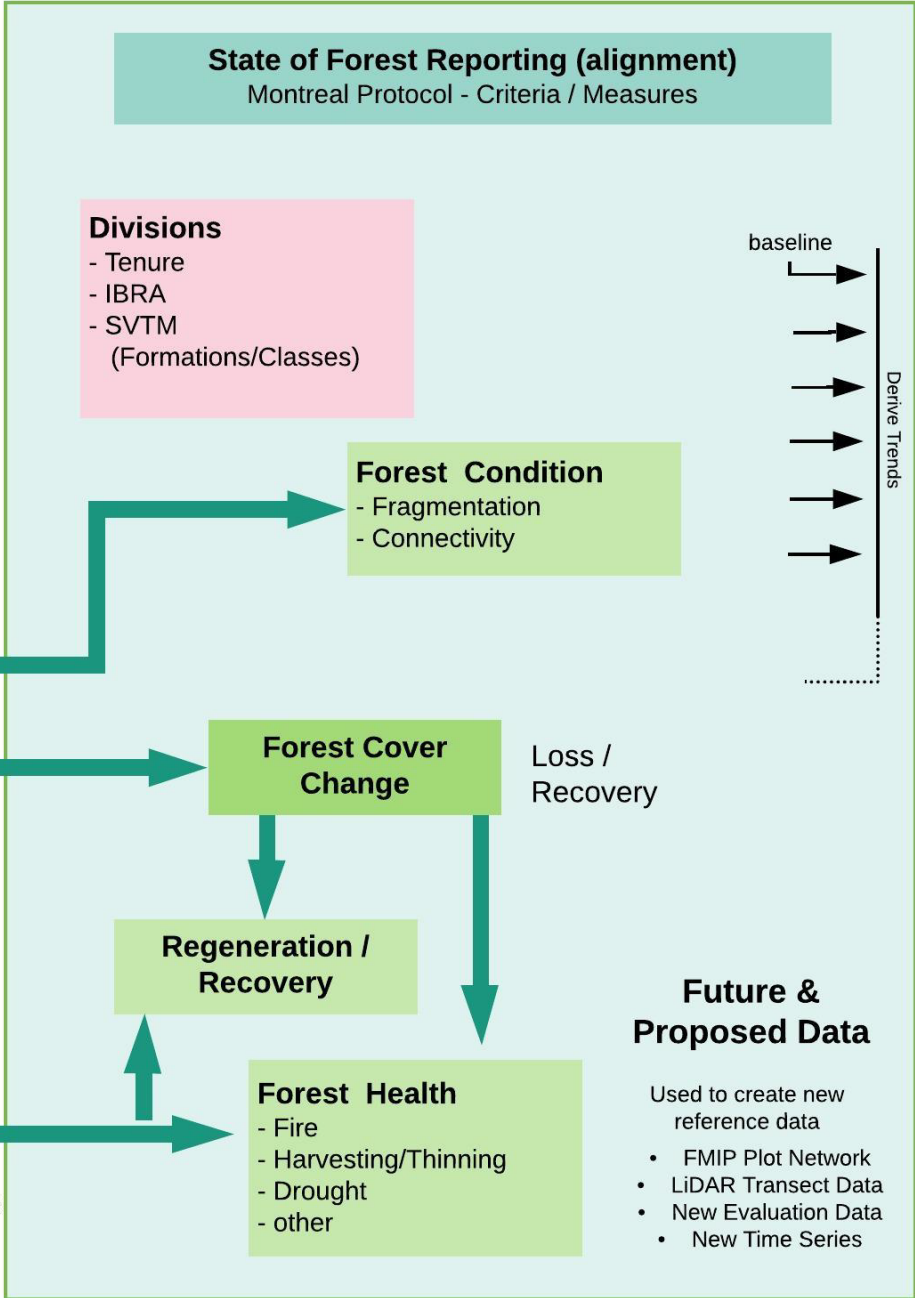
Temporal Sequence Refinement
 Current year plus previous 4 years (Fuzzy logic approach)

National Forest and Sparse Woody Vegetation Database (NCAS)
 25m x 25m
 mostly annual data - from 1988

Forest Extent (Forest Cover)
 Likelihood of being forest (on basis of forest cover) in a given year

Cross Validation
 - NSW Woody Vegetation Change (SLATS)
 - Fire History
 - FCNSW harvesting records
 - DPI disturbance analysis

Assign likely reason for change



NSW DPI Contribution

Overall objective:

- Develop a suite of advanced quantitative methodologies for future operational monitoring of forest extent, condition and health for use state-wide across all tenures

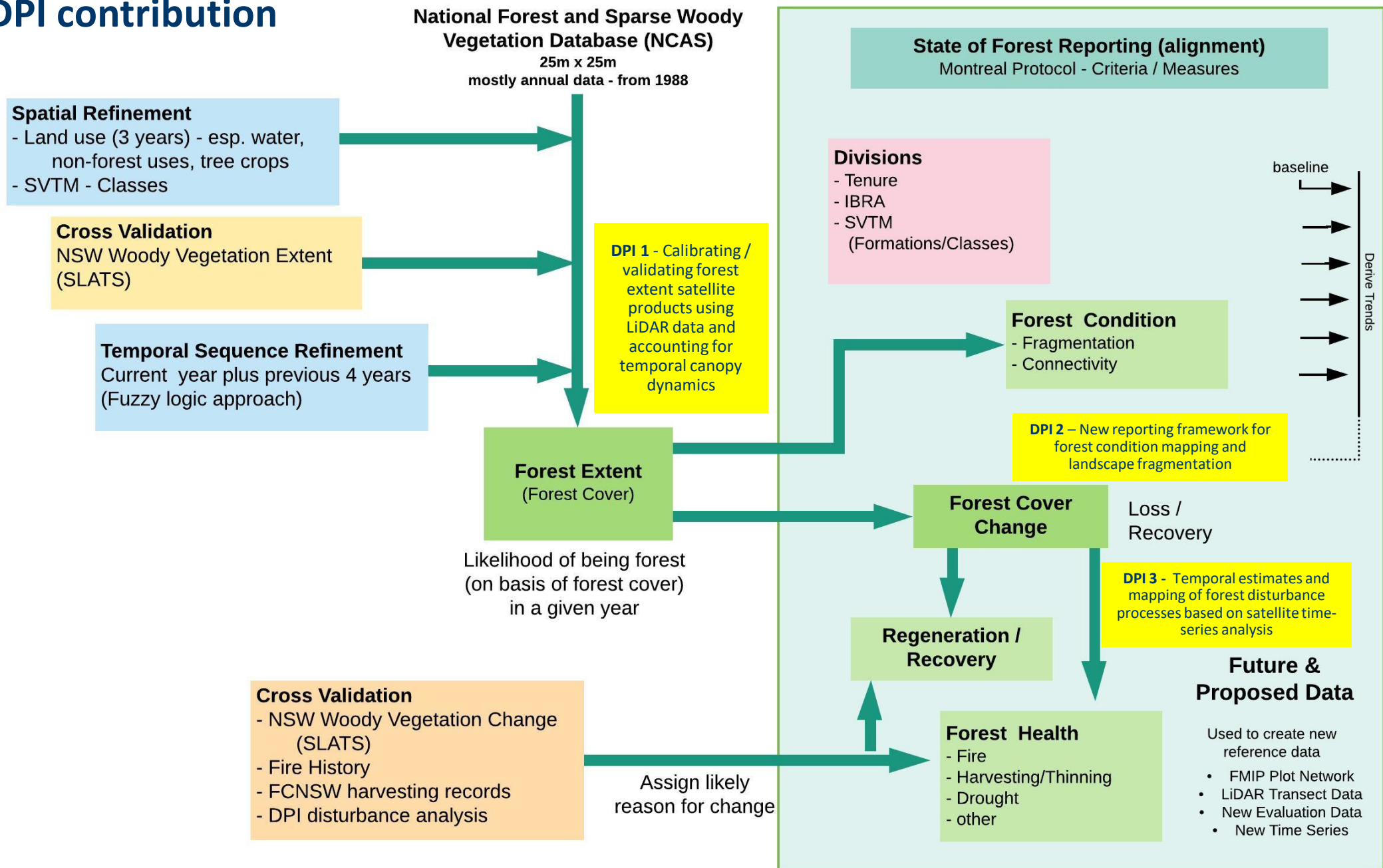
Also:

- All three sub projects highlight the potential modelling benefits of a multi-phase, sampling strategy based on the integration of satellite imagery, high resolution airborne data and a statistically robust plot network

Three sub-projects

- Calibrating / validating forest extent
- New reporting framework for forest condition
- Temporal analysis and mapping of forest disturbance

NSW DPI contribution





Spatial Vision

Forest Extent, Health, and Condition

Forest Extent (forest canopy cover)

Methodology

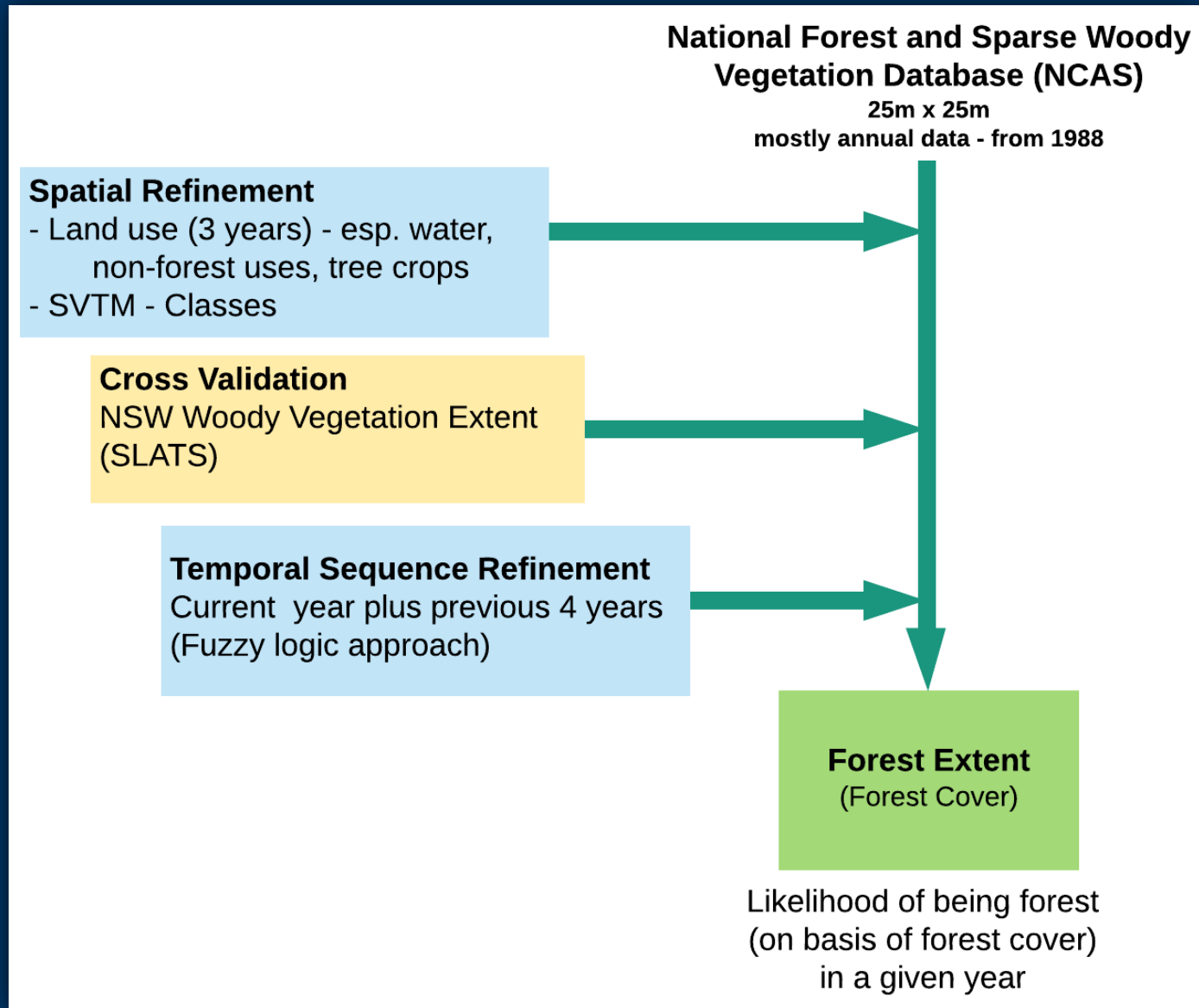
Spatial Refinement

- Area Masking
 - Land Use
 - Land Use 2007, 2013, 2017
 - Vegetation Types
 - SVTM
 - Benchmarks

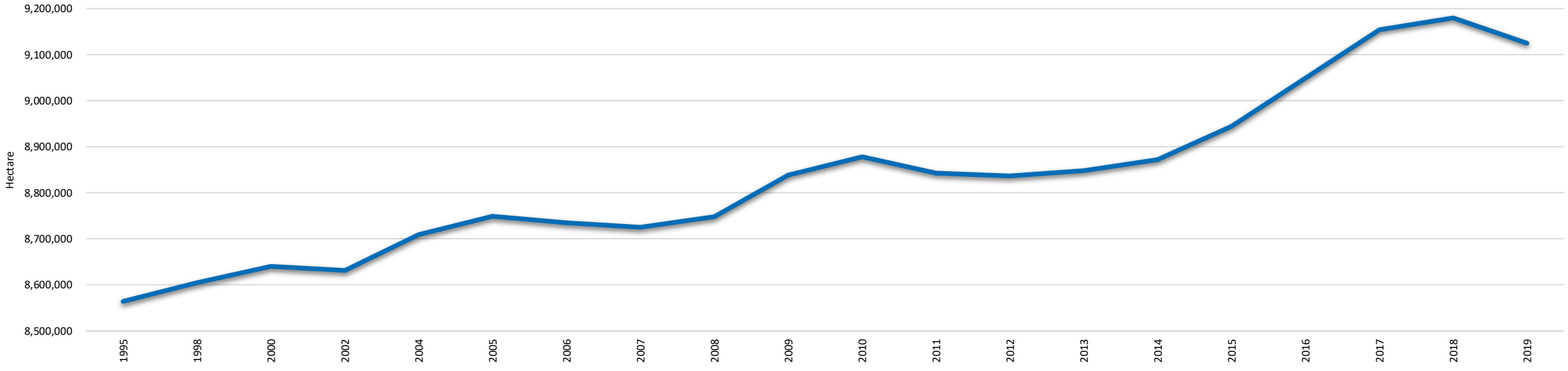
Cross Validation

Temporal Sequence Refinement

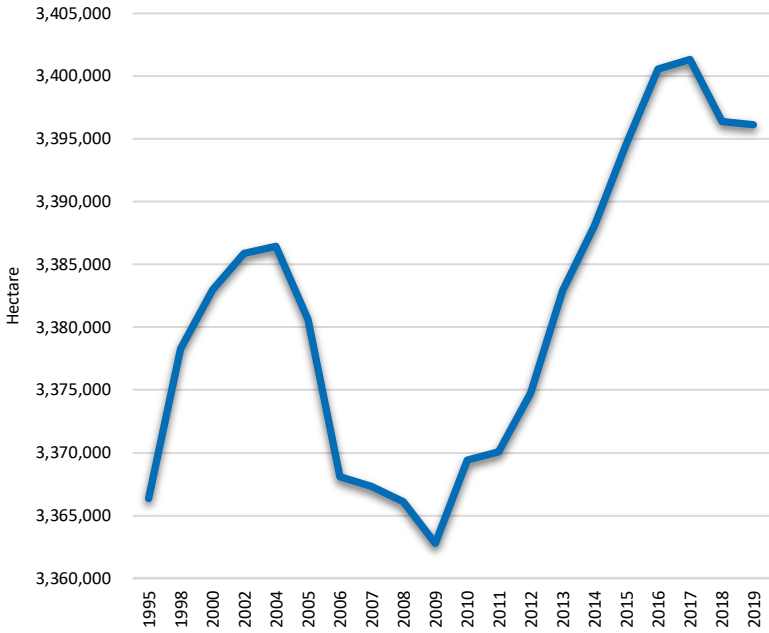
- Fuzzy Logic
 - Probability vs. Levels of Certainty



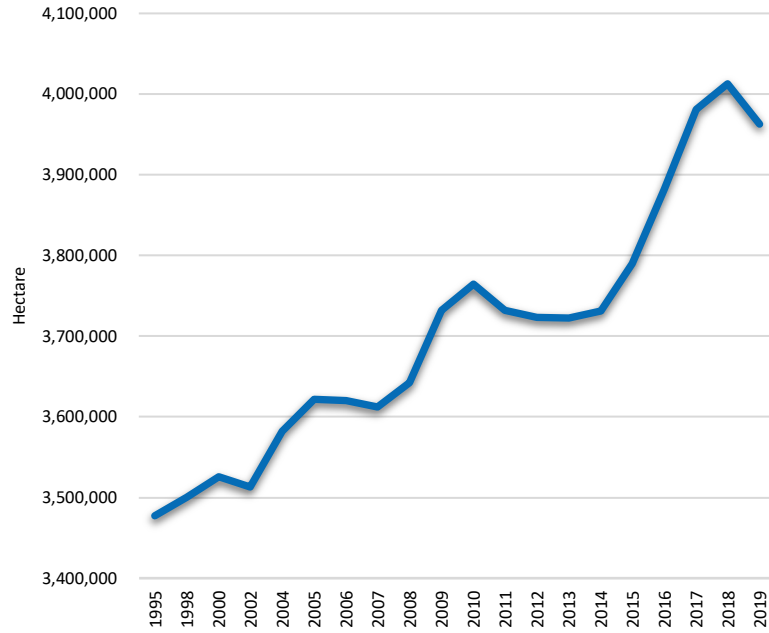
Overall Forest Extent Cover by Year in NSW RFA regions



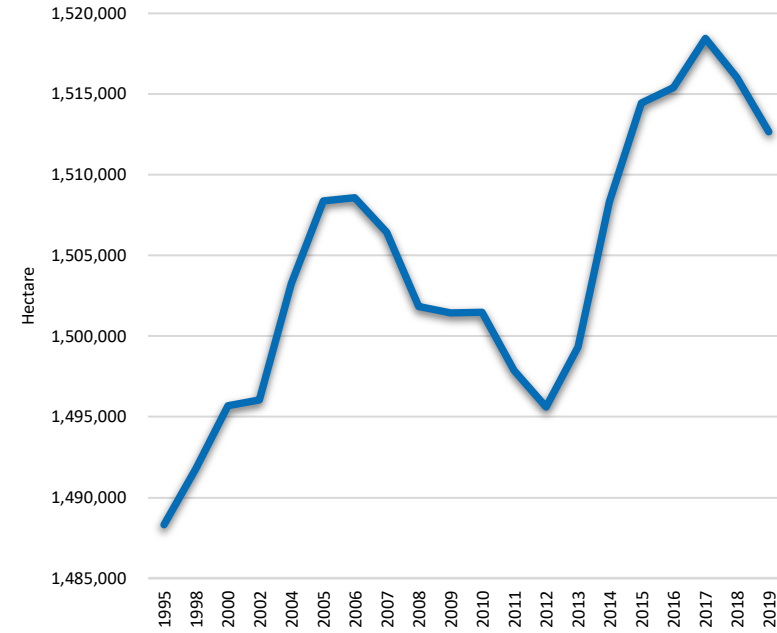
National Parks – Forest Extent Cover by Year



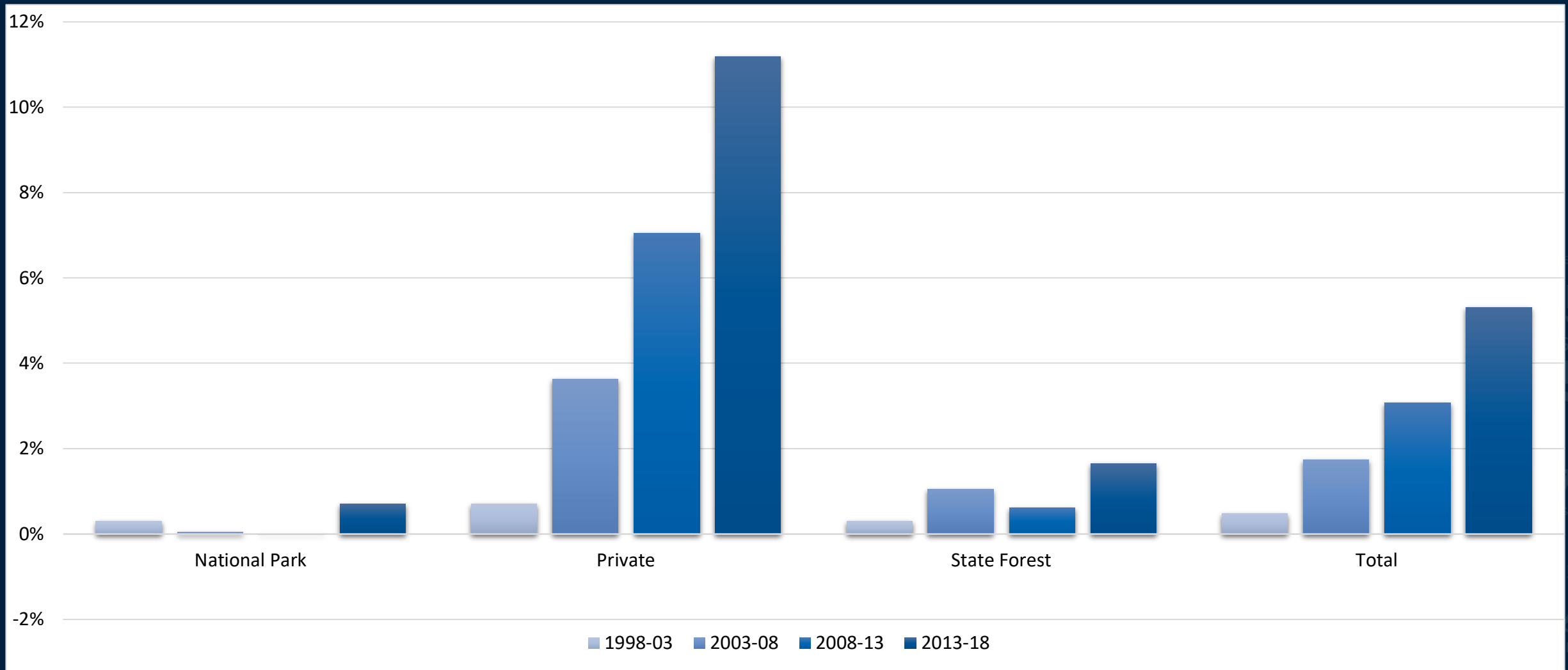
Private – Forest Extent Cover by Year



State Forests – Forest Extent Cover by Year



Relative Change in forest cover extent for Key Tenure Groups





Spatial Vision



Forest Extent, Health, and Condition

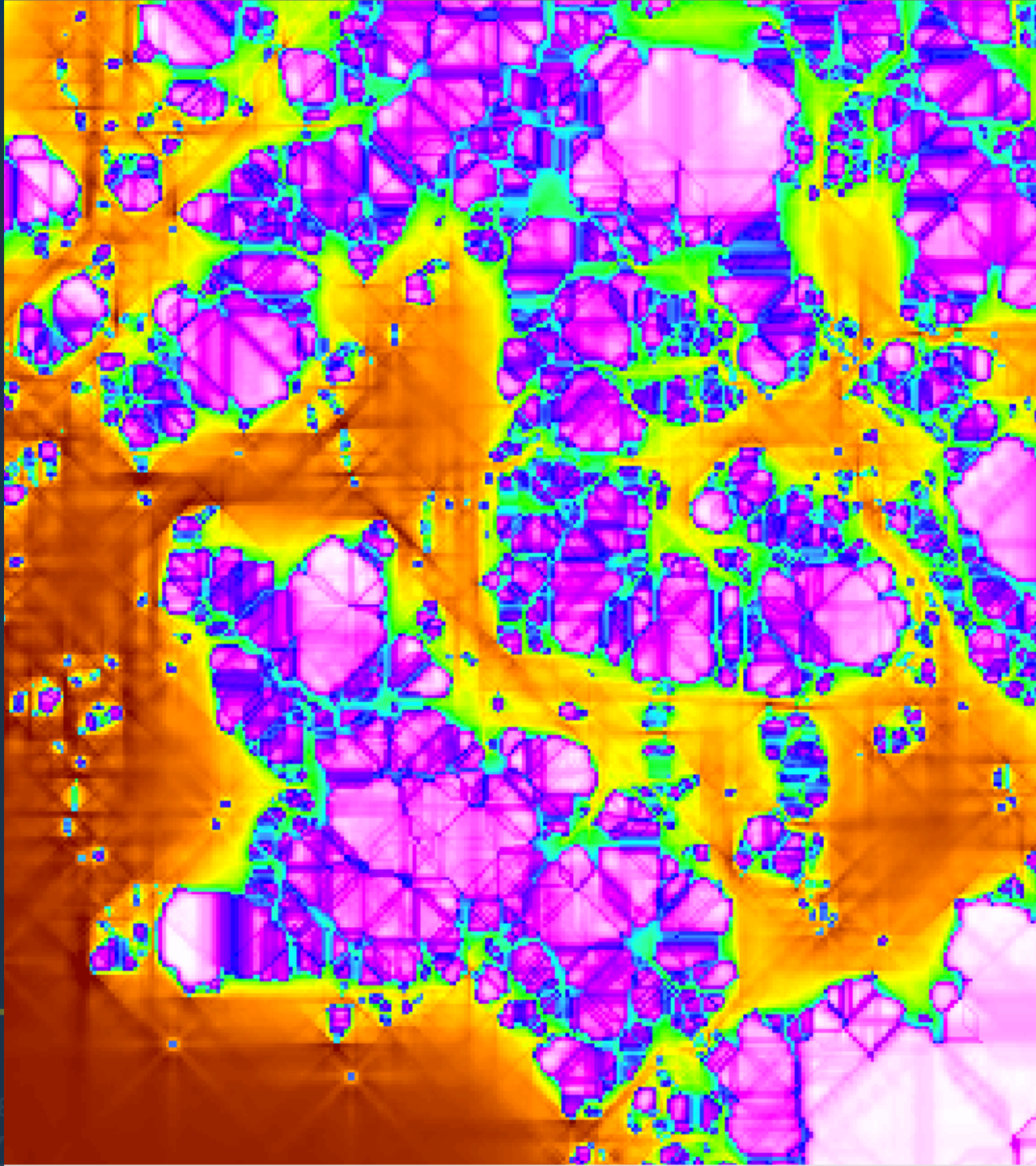
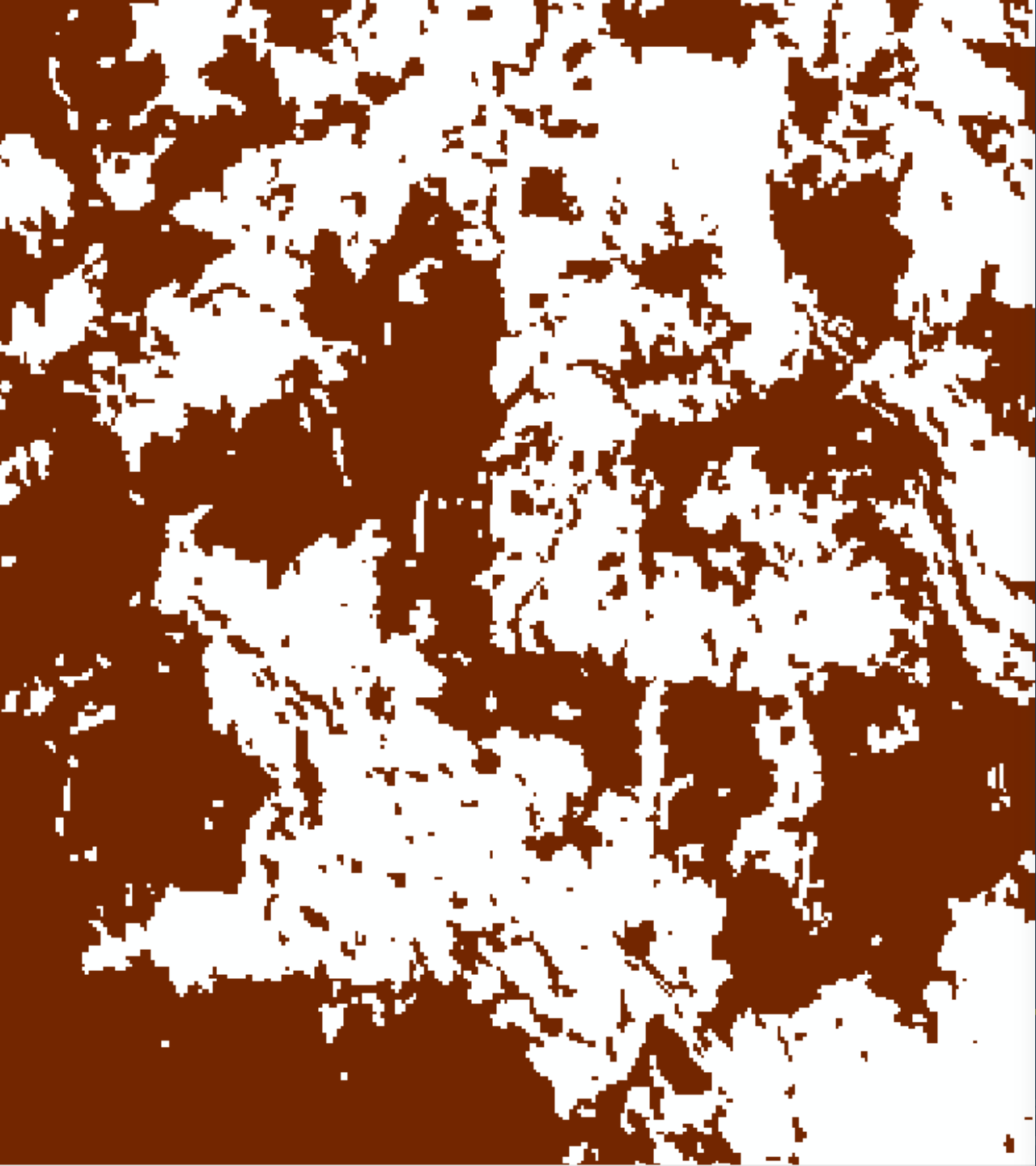
Forest Condition

Condition - Approach

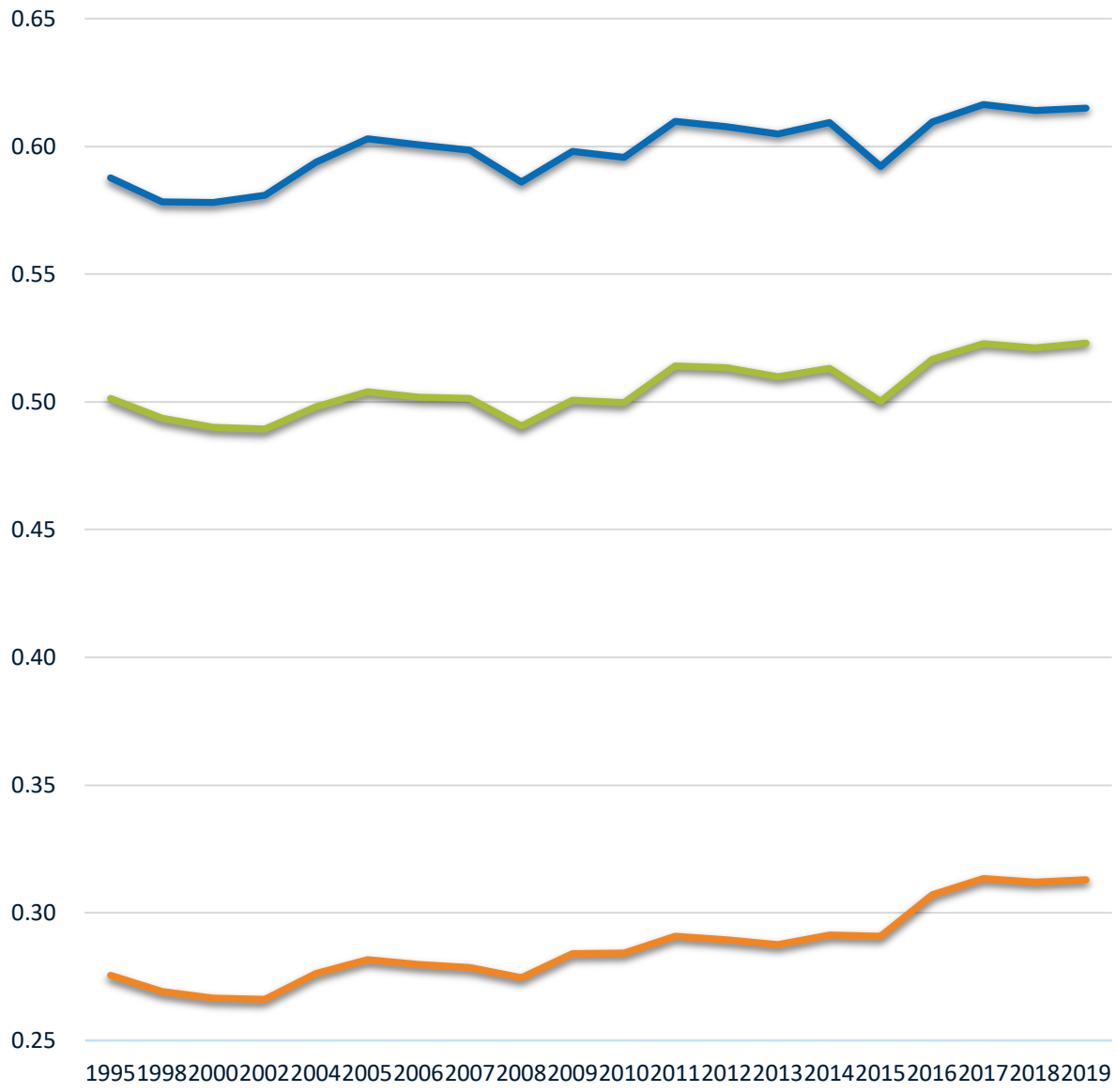
For this project

- condition is concerned with canopy cover connectivity and fragmentation.
- use of the Biodiversity Indicator Program (BIP) Spatial Links methodology for calculating connectivity (Love and Drielsma)
- assess the trend in average and maximum connectivity values



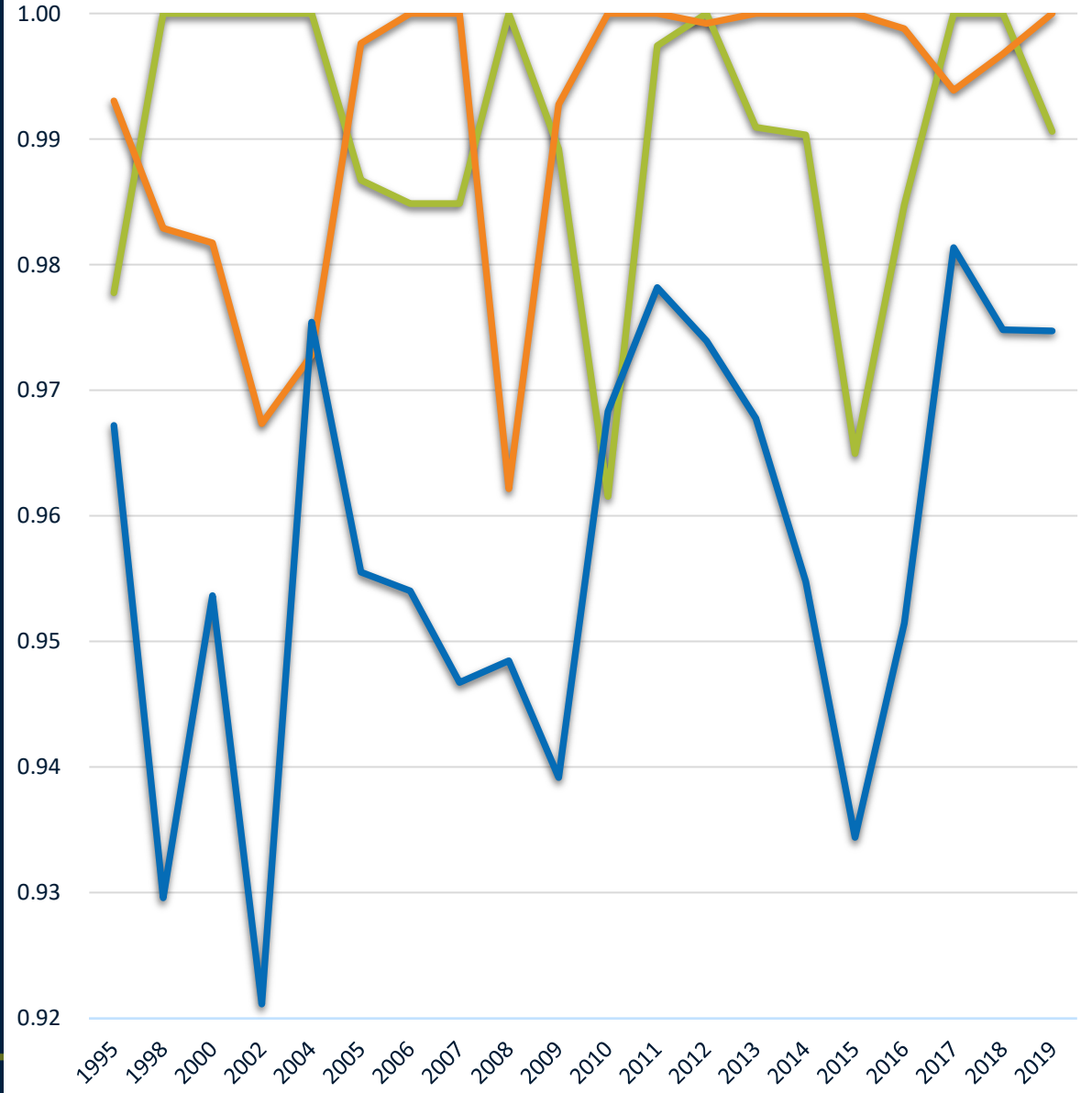


Average Connectivity



National Park Private State Forest

Maximum Connectivity



National Park Private State Forest



Spatial Vision

Forest Extent, Health, and Condition

Forest Health

Health - Approach

For this project

- Forest health relates to canopy loss and disturbances related to agents or pressures affecting normal ecosystem functions and sustainability
- assess the loss of cover against each of these agents of disturbance and measure the total forest extent cover loss
- for recovery - assess the cover loss due to disturbance event and measure the time until the canopy cover recovers.



Disturbances - Multiple Lines of Evidence (MLE)

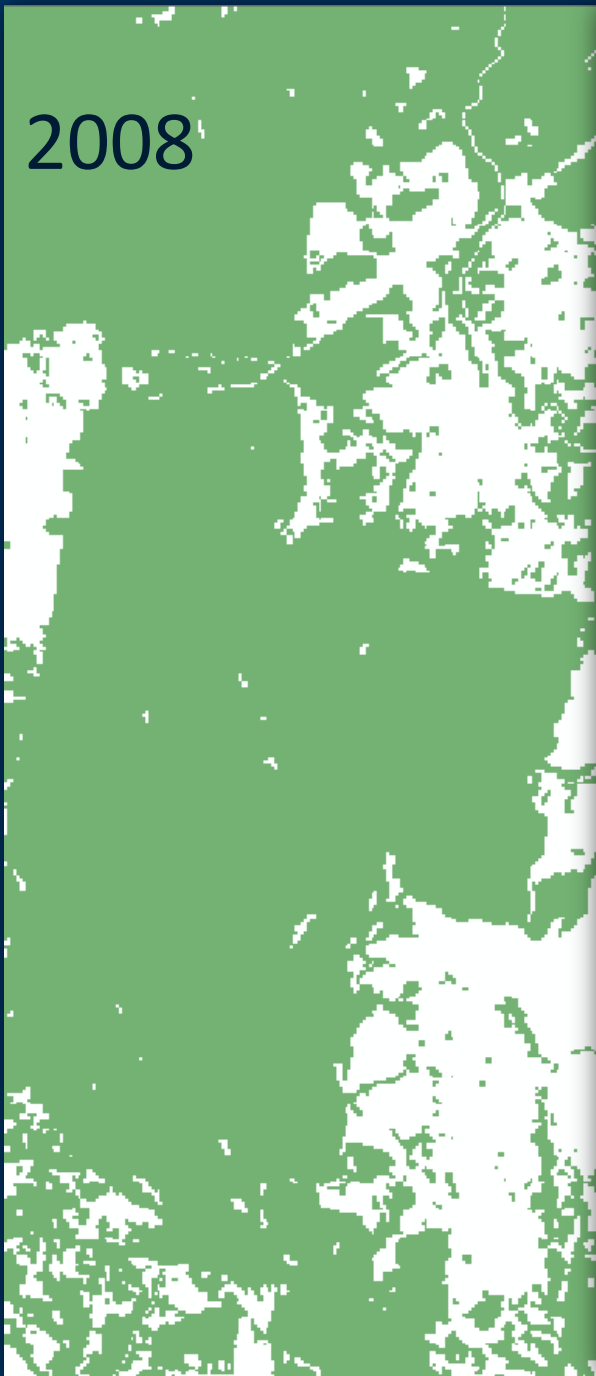
Input Datasets

- SLATS Woody Change database
- Fire History
- Landuse for Plantation locations
- Forestry Management Zones
- Natural Disturbances (including dieback)
- Tenure Types

Identified Disturbances

- Agriculture
- Fire
- Forestry
- Plantation
- Urban or Industrial
- Other
- Unknown

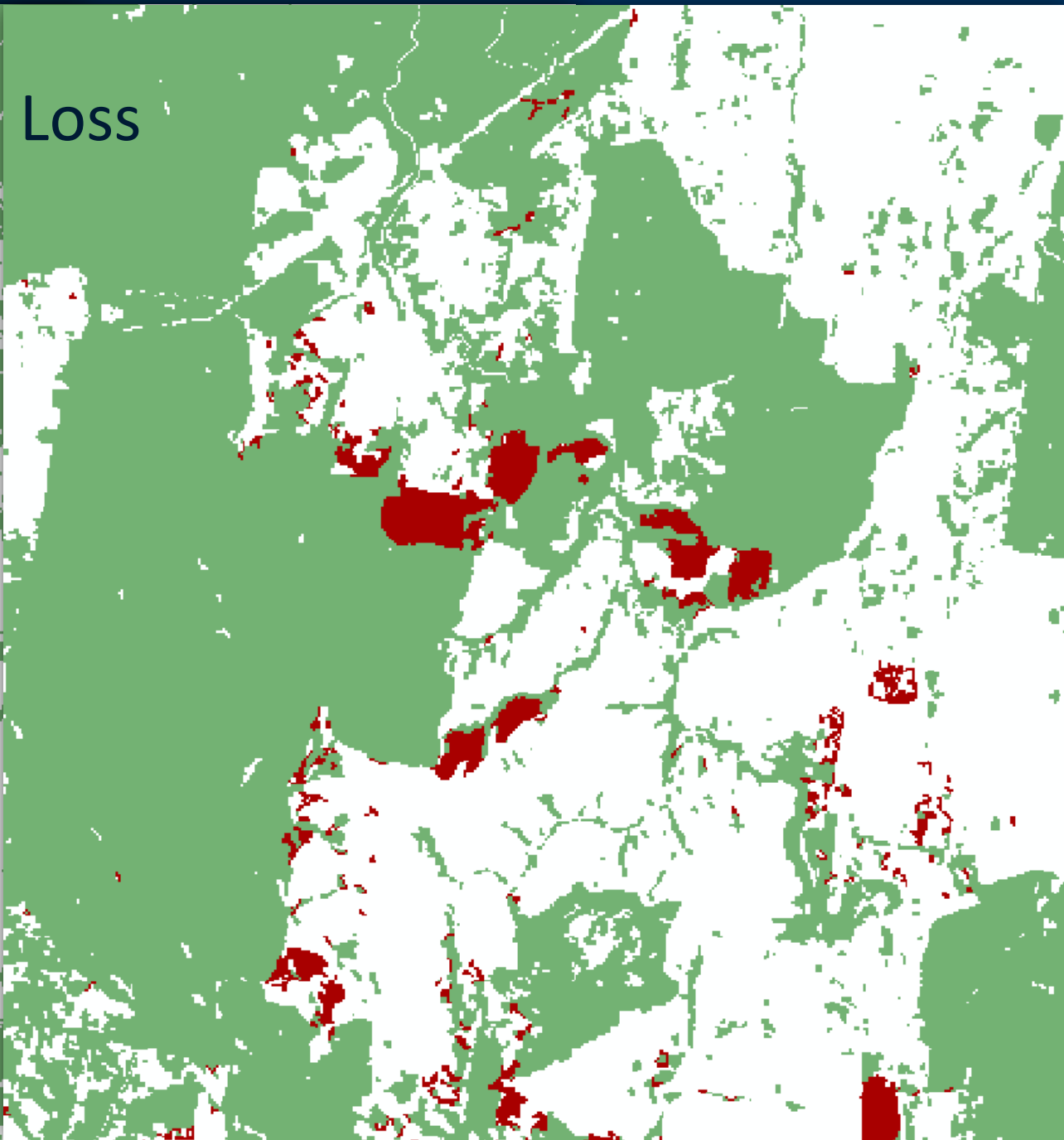
2008



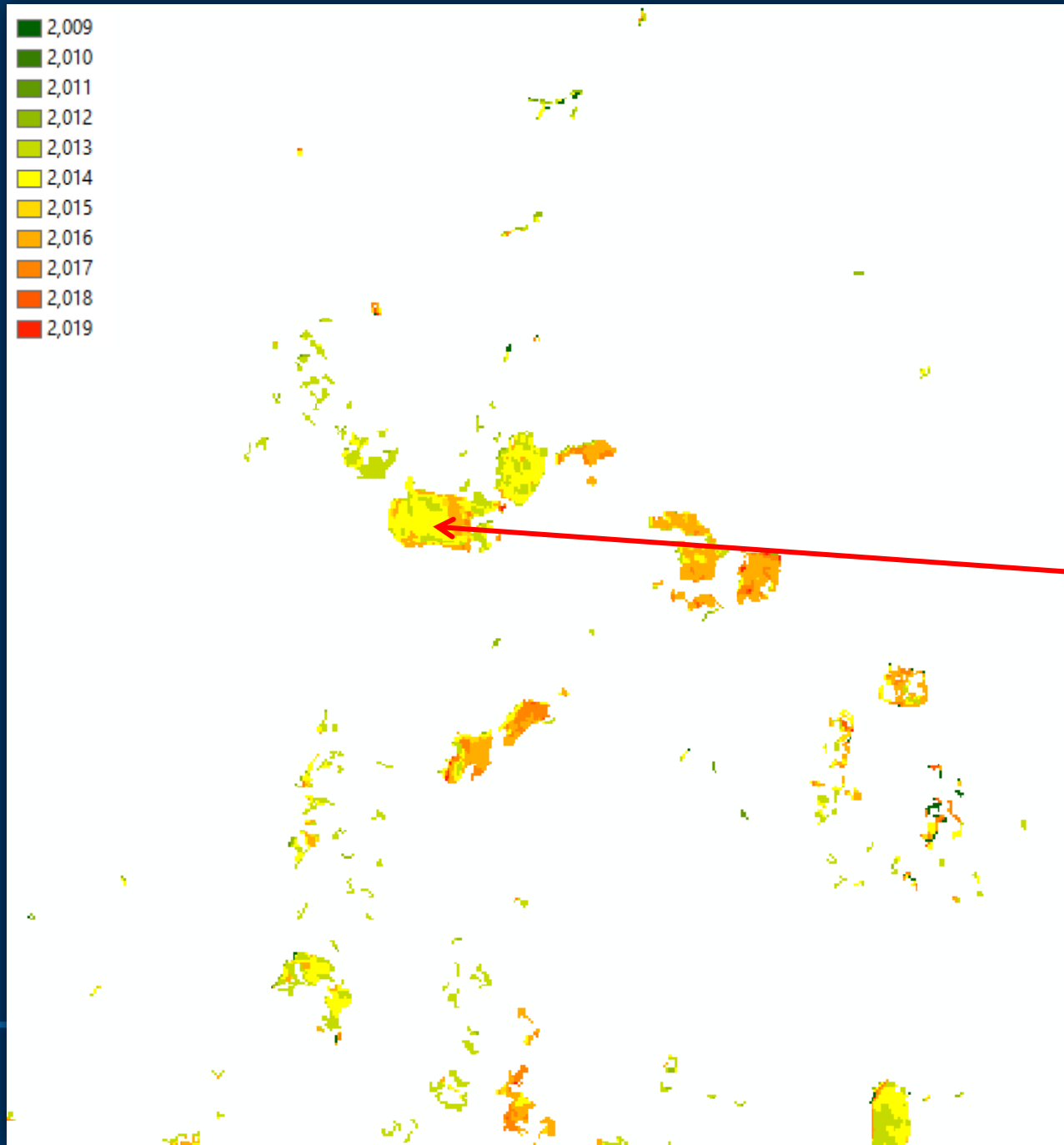
2009



Loss

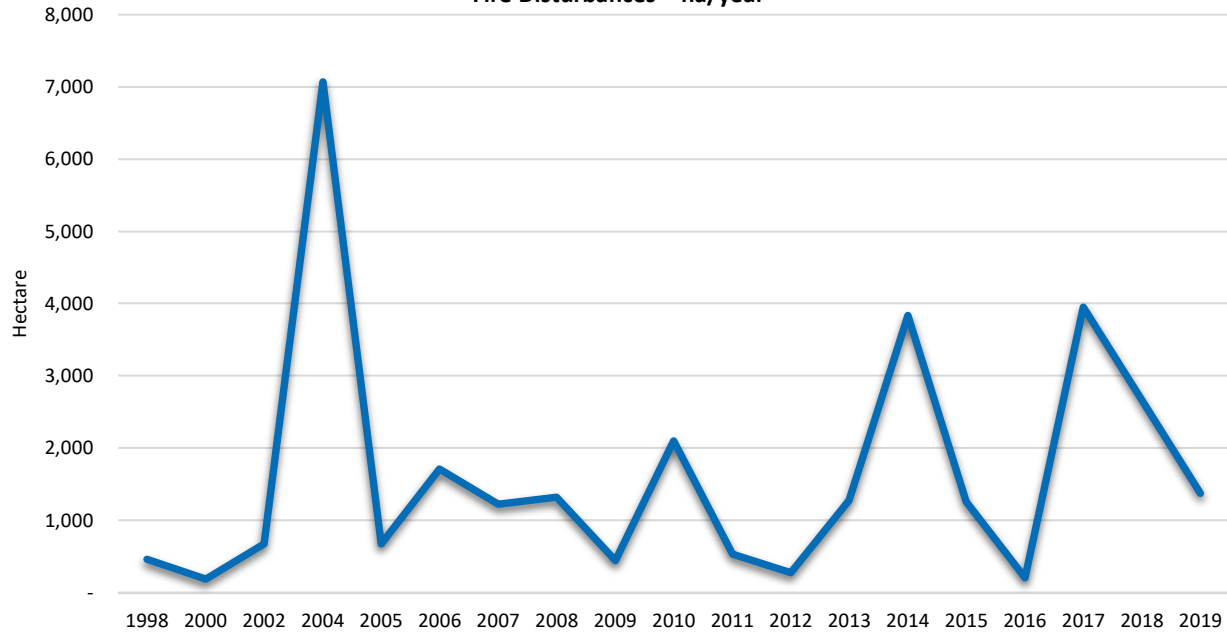


Recovery

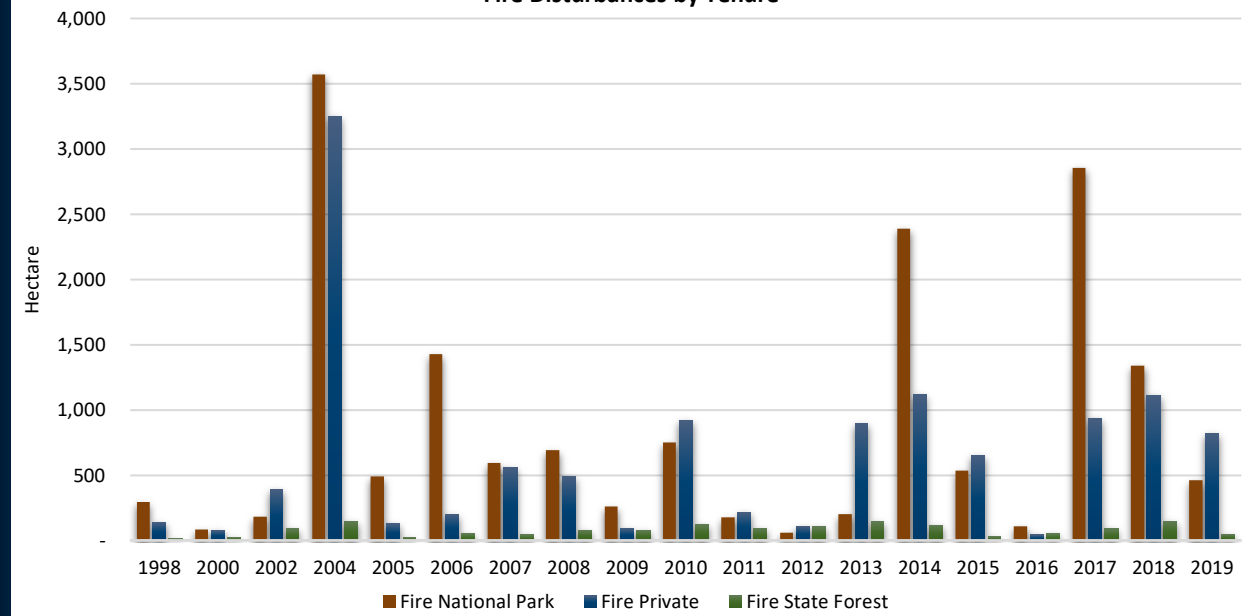


Change_Category	Plantation - Softwood
Source	Plantations
Year	2014
Year_Recovery	5
Area_Ha	21.9255

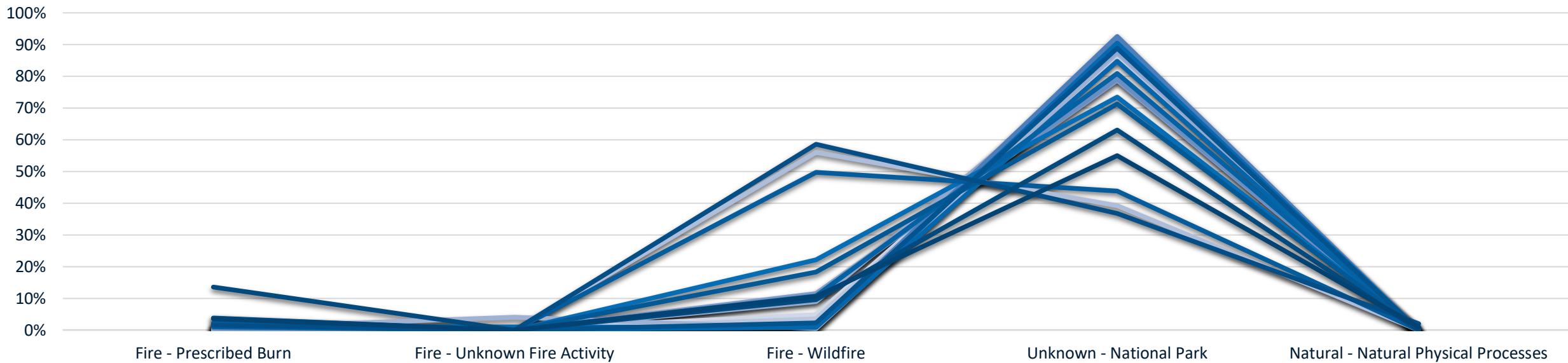
Fire Disturbances – ha/year



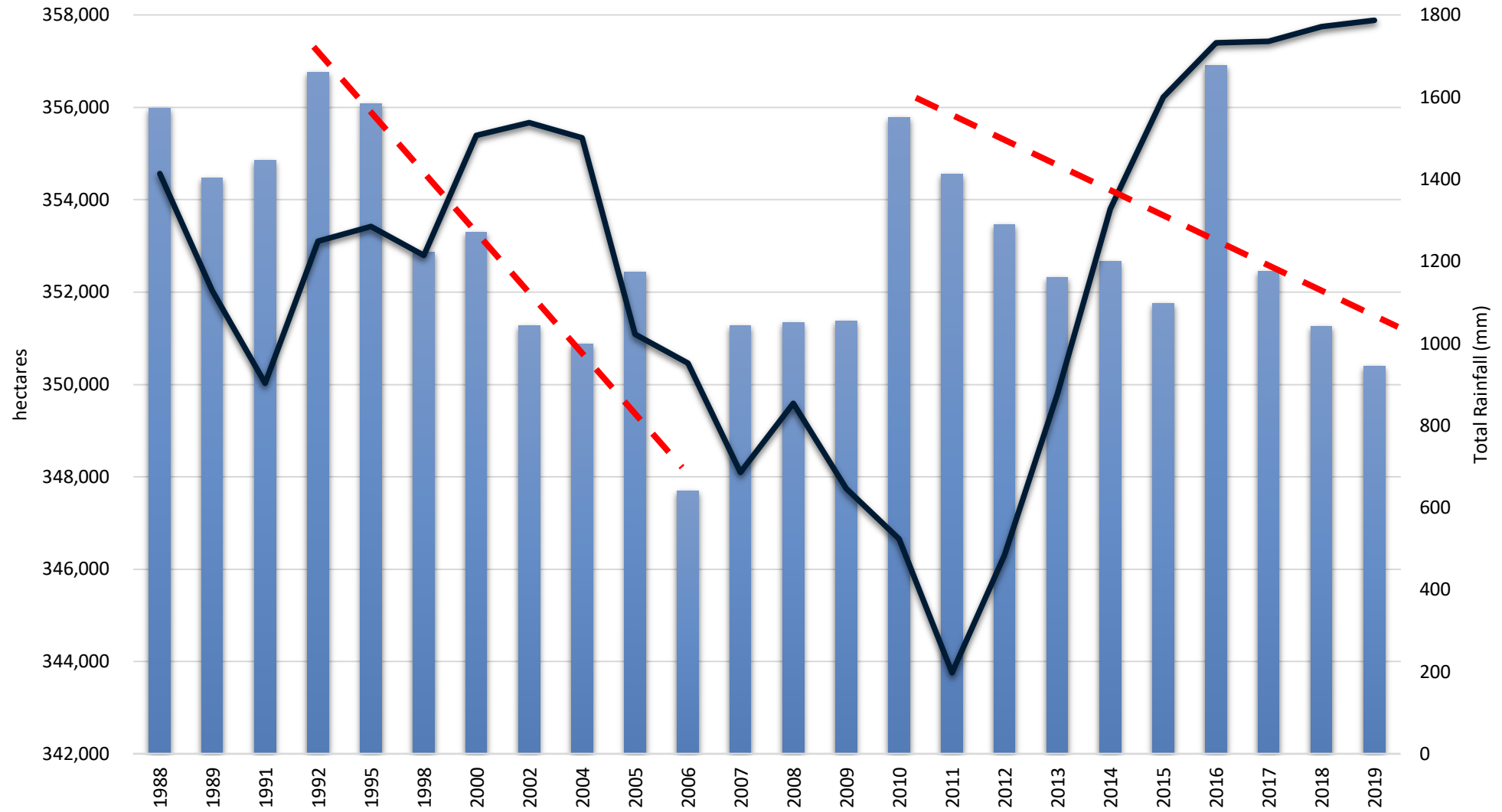
Fire Disturbances by Tenure



National Park



Forest Extent compared to Rainfall in Alpine Bioregion



Key Findings

- Forest extent is increasing across all land tenures within RFA regions and across NSW
- Maximum connectivity of forest is decreasing
- Suggests that although forest extent overall in increasing RFA forests are under significant stress
- Root causes of this stress are likely climate driven, seemingly drought

