

# Determining carbon outcomes from silvicultural treatments in private native forests on the NSW North Coast



JESSICA SHEEHAN

DPIRD FOREST SCIENCE –  
FOREST CARBON



# Outline

- Project background
- Trial establishment
- Silvicultural management
- Data collected and how it will be used
- Preliminary outputs
- What's next

# Background and importance

- Need for management
- Pressures on PNF
- Australian timber demand
- New markets and uses for residues
- The carbon angle



# The carbon angle

---

- Silviculture > carbon benefit
- How, what or where carbon benefits may be accrued
- Potential for private landholders to claim carbon credits
- Other angles

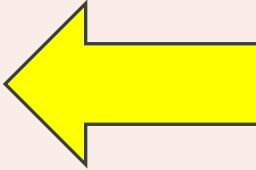


# Initial project design

---

- Literature review (including grey literature)
- Compiled and analysed long term forestry monitoring data from Forestry Corporations Permanent Growth Plots and Continuous Forest Inventory data
- Agreement reached with Forestry Corporation for use of FRAMES (**F**orest **R**esource **A**ssessment and **M**anagement **E**valuation **S**ystem). Our data will be used for predictions of future growth and productivity

# The project timeline

|        | Milestone 1                                                       | Milestone 2                                                     | Milestone 3                                                                         | Milestone 4                                                                                                |
|--------|-------------------------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| Year 1 | Contract signed                                                   | Literature review completed                                     |                                                                                     |                                                                                                            |
| Year 2 | Trial sites identified and plot design completed                  | Silvicultural treatments implemented                            |  |                                                                                                            |
| Year 3 | Simulation of carbon outcomes of implemented treatments completed | 1-year measurement of attributes in control and treatment sites |                                                                                     |                                                                                                            |
| Year 4 | 2-year measurement of attributes in control and treatment sites   | Spatial tool developed and made available to PNF landholders    | Report on carbon options for PNF landholders completed                              | Document prepared with the aim to have suitable management actions included as eligible for carbon credits |

# Silvicultural treatments



Australian Group Selection (AGS)

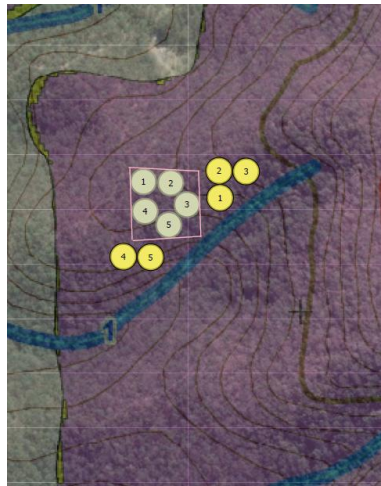


Thinning

# Study sites and locations

Monkerai

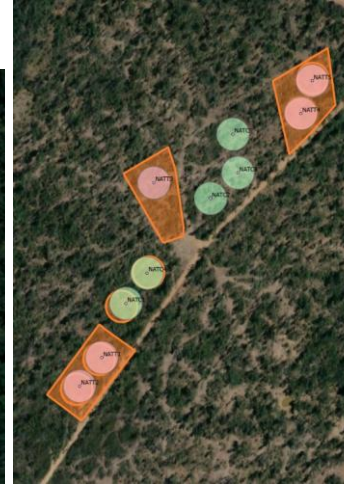
Bungawalbin



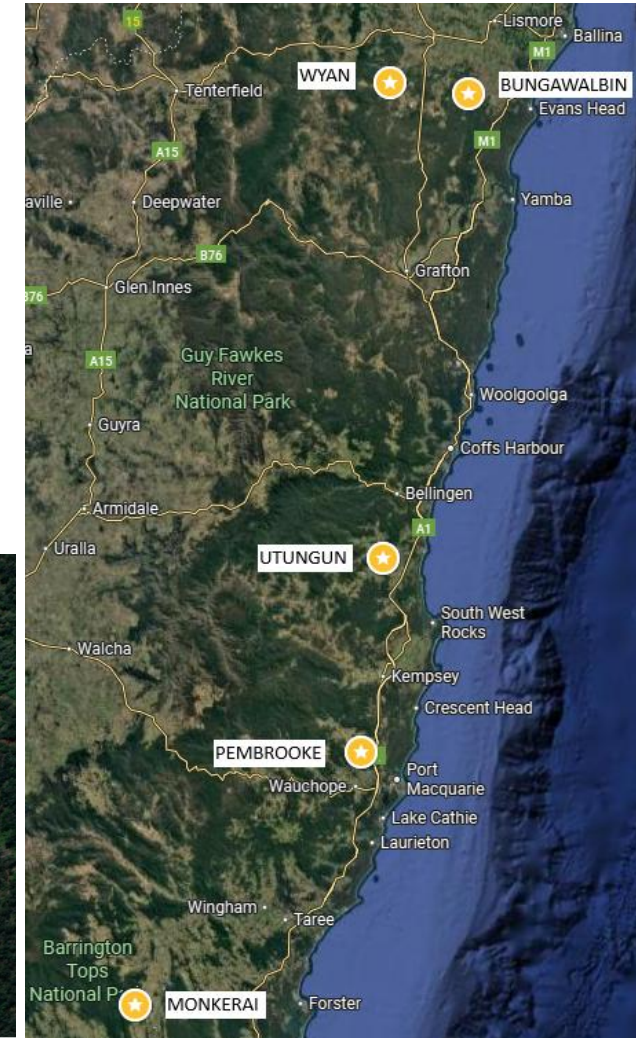
Pembroke



Wyan

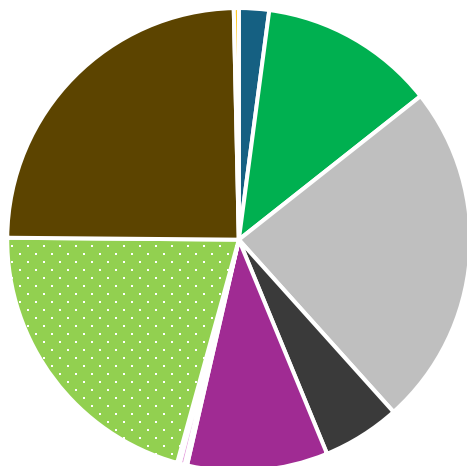


Utungun



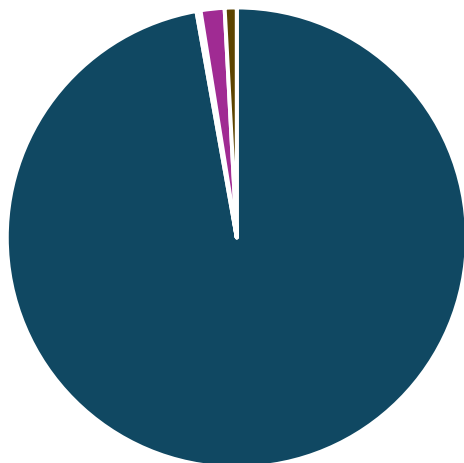
# Species diversity

## Monkerai



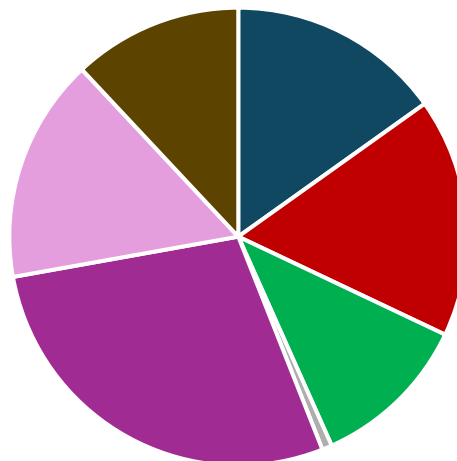
- Brushbox
- Forest oak
- Grey gum
- Ironbark
- Mahogany
- NCO
- Paperbark
- Sydney blue gum
- Spotted gum
- Tallowood
- Acacia

## Bungawalbin



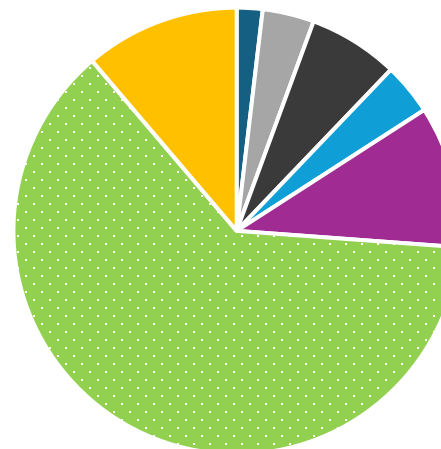
- Blackbutt
- Bloodwood
- Red Mahogany
- Tallowood

## Pembrooke



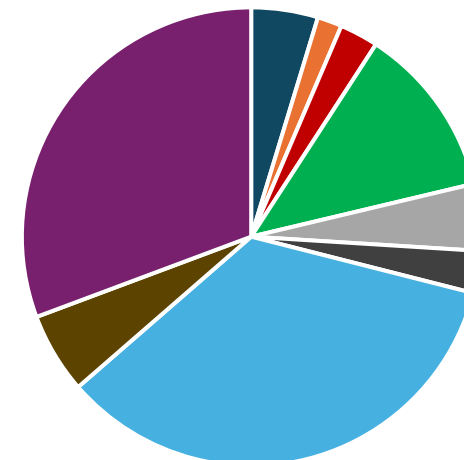
- Blackbutt
- Bloodwood
- Forest oak
- Greygum
- Mahogany
- Paperbark
- Tallowood

## Wyan



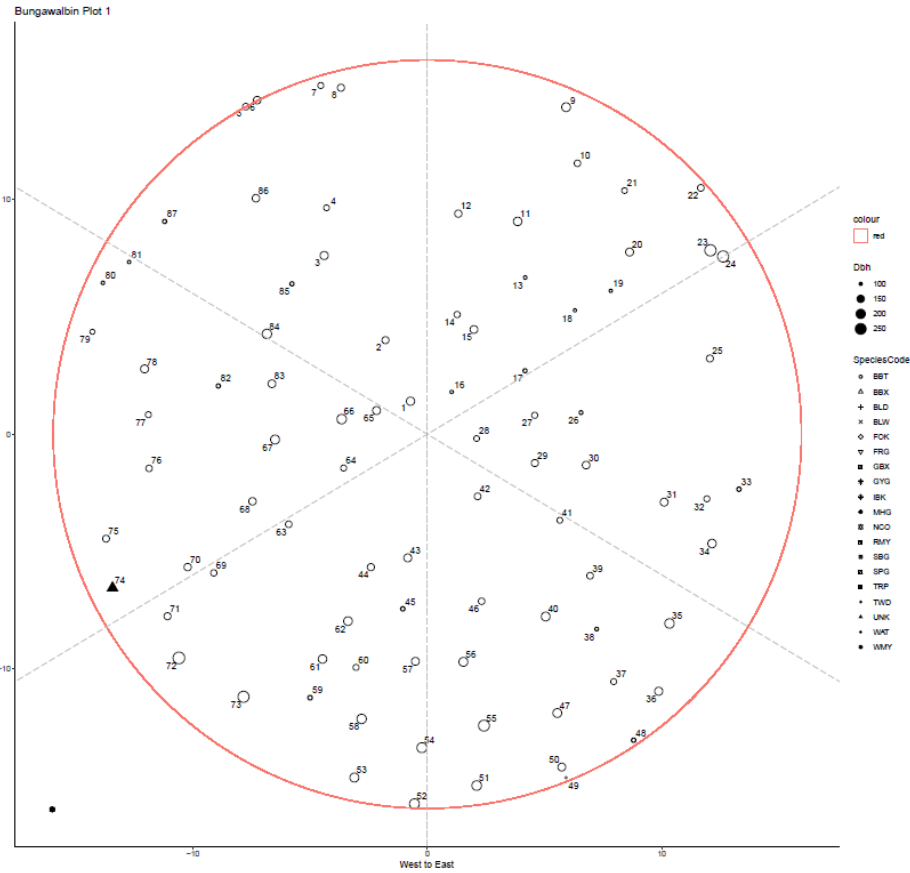
- Forest red gum
- Greybox
- Ironbark
- NCO
- Red Mahogany
- Spotted gum
- Acacia

## Utungun



- Blackbutt
- Brushbox
- Bloodwood
- Forest oak
- Grey gum
- Ironbark
- Turpentine
- Tallowood
- White Mahogany

# Inventory and growth modelling



- Unique tree ID
- DBH
- Species
- Location of all trees
- Sample of height
- Regen within an inner nested plot
- Age cohort
- Competition class
- Tree quality grading



# Coarse Woody Debris

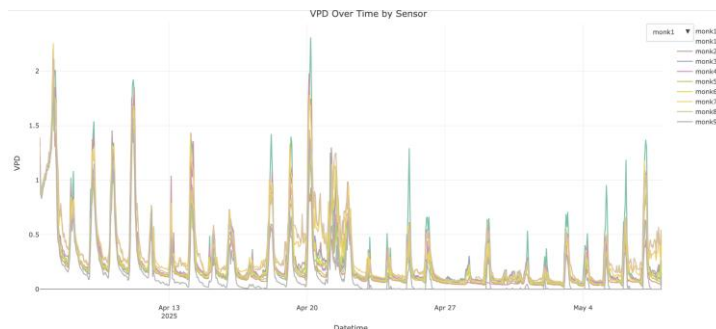


| Method     | State of Decay | Description                                             |
|------------|----------------|---------------------------------------------------------|
| Transect 1 | 1              | Sound                                                   |
|            | 2              | Outer layers and sapwood showing signs of decomposition |
|            | 3              | Signs of decomposition extend to heartwood              |

CWD is defined as detrital biomass that includes stags, stumps, whole fallen trees, dead branches, coarse roots and wood pieces left following tree mortality and/or damage.

# Fuel hazard assessments

- Fuel moisture monitoring devices – temperature and humidity > estimate fuel availability
- Fuel hazard evaluations (McArthur and VESTA models)
- Estimate fuel structure and potential fire behaviour
- Hemispherical photos to estimate plant cover
- Litter depth and weight
- Plus additional surface fuel estimates



# Ecology

- Acoustic devices
- Camera traps
- Ultrasonic bat detectors



# LiDAR

Examine the accuracy of LiDAR compared to ground measurements for

- fuel loads
- inventories
- fire hazard assessments
- species identification
- CWD measurements

Test algorithms developed for comparing native forest on ground scans with aerial scans



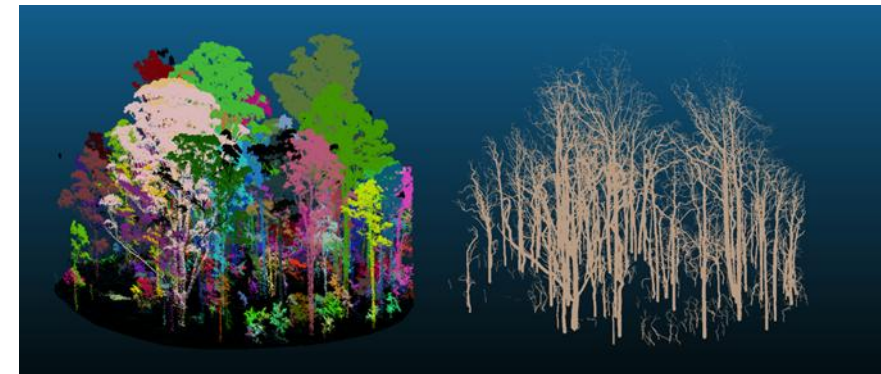
Backpack mounted Hovermap



Drone (DJI Matrice 350) with the  
Hovermap  
ST-X onboard



Single plot located at Pembroke



Segmentation of trees and structure extraction  
of trees found in the above plot

# Bungawalbin thinning

---



**Before**



**After**

# Utungun AGS

---

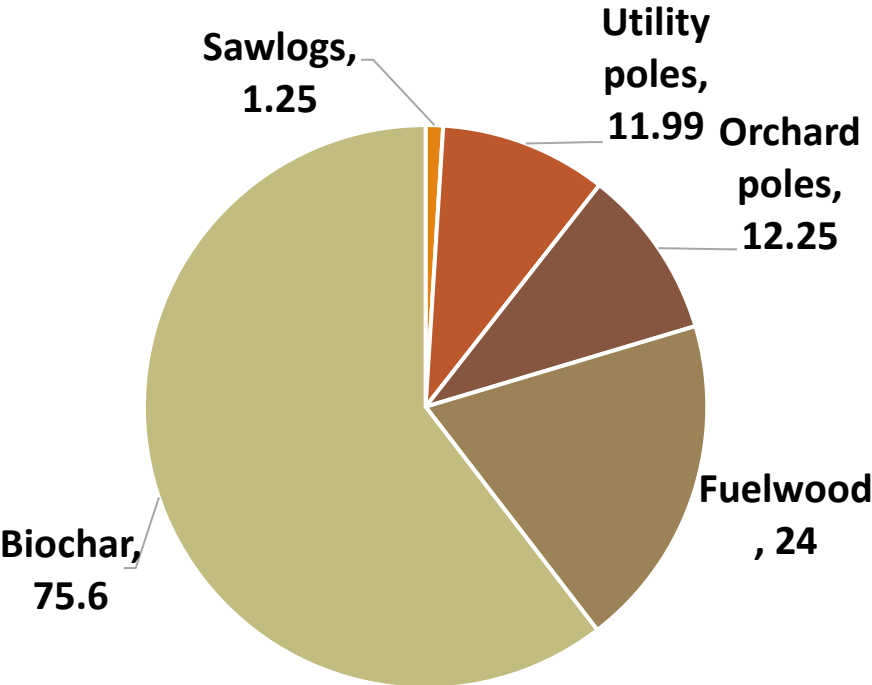
**Before**



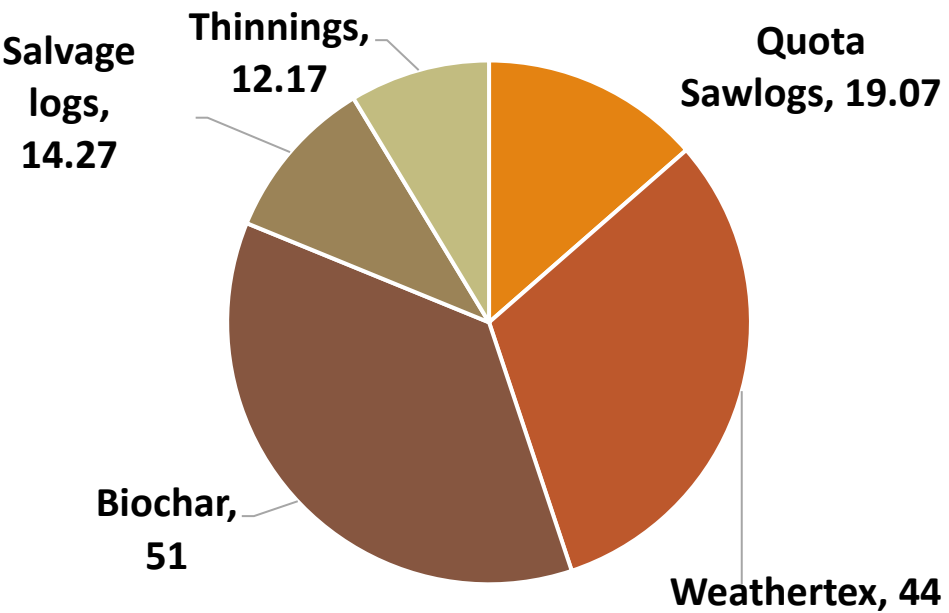
**After**

# Products

Volume of material removed  
from Bungawalbin



Volume of material removed  
from Utungun



| Utungun products | Total carbon (tonnes per ha) |
|------------------|------------------------------|
| Quota sawlogs    | 6.9                          |
| Thinnings        | 4.5                          |
| Salvage sawlogs  | 4.9                          |
| Biochar          | 17.8                         |
| Weathertex       | 13.0                         |
| Total removed    | 47                           |



## Degraded PNF forest



Utungun

### Plot

AGS gap

Control

### Carbon tonnes/ha

Initial aboveground: 107.2

Initial belowground: 21.4

CWD: 29.7

Litter: 7.38

Soil: ?

Residues : 50.2

Products: 47

Aboveground carbon: 120.1

Belowground carbon: 24

CWD: 30.1

Soil: ?

Litter: 7.23

### Carbon tonnes/ha

Biochar: 17.8

Weathertex: 13

Salvage: 4.9

Sawlogs: 6.9

Thinnings: 4.5



# Additional things to come

- Comparing to historical AGS
- Growth models and reports
- Monitoring regeneration
  - 2, 6, 10 years after harvest
  - Minimum stocking must be met
  - Management actions may be required



# Acacia removal

## Mobile biochar unit

- Use of mobile torrefaction unit (prototype completed)
- Light weight, prototype (300 kg/h). Sits on a 6 t flat top truck
- Trial planned for Wyan– deal with thick wattle regrowth
- Range of benefits: Land restoration, improved carbon outcomes, improved social license





Department of Primary  
Industries  
and Regional Development

Determining carbon outcomes from silvicultural treatments  
in private native forests on the NSW North Coast

---

# Questions