

K&C Phase 4 – Status report

Detection of Biomass and Structural Change using Japanese L-band SAR, Australia

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Project outline and objectives

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Objectives

- 1. Improvement of large area woody extent, height, cover, and aboveground biomass mapping using PALSAR-1 and PALSAR-2 mosaics
- 2. Determine if changes in woody structure due to processes of clearing, regeneration, fire and thickening may be detected using combined Landsat and PALSAR-1 and PALSAR-2 time-series

Supports K&C thematic drivers

- Carbon cycle science products are to be input to carbon data assimilation schemes, carbon offsets research and national reporting frameworks
- Environmental **C**onservation regional mapping at a scale relevant to land management and State Government vegetation management policy

Objective 1

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Improvements to large area woody extent, height, cover, and above-ground biomass mapping using PALSAR-1 and PALSAR-2 mosaics

- 1. Australian vertical profile product improvements
 - o ICESat GLAS vertical profile processing update
 - Validation using TERN Auscover supersite network
- 2. Completion of the Australian biomass plot library
 - o TERN Auscover plot measurement spatial database
 - Biomass assessment and error propagation

K&C-3 Segmentation of continental Landsat persistent green vegetation cover and ALOS PALSAR HH/HV mosaics.

ALOS





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ALOS



ICESat GLAS waveforms linked with segments generated using:

- ALOS PALSAR L-band HH/HV
- Landsat Persistent Green Vegetation (PGV)

k-means clustering used to group segments. GLAS canopy profiles were aggregated and profile metrics computed:

- Percentile heights
- Cover (1-Pgap) by height strata

Australian Vertical Plant Profile Products

0m 3m 4m 5m 7m 10m 15m 20m 30m

40m



ALOS





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Australian Vegetation Structural Formation Product



ALOS

Grassland Grassland with shrubs Grassland with trees Grassland with tall trees Grassland with verv tall trees Verv low open woodland Low open woodland Open woodland Tall open woodland Vervitall open woodland Verv low woodland Low woodland Woodland Tall woodland Verv tall woodland Very low forest Low forest Forest Tall Forest Very tall forest Very low closed forest Low closed forest Closed forest Tall closed forest Very tall closed forest

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No Data

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Validation of Vertical Plant Profile Products

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Vertical Plant Profile Height Metric Bias Correction



Bias driven by merged understorey / ground return and local surface roughness

 $H_{p,c} = (H_p - 90\sin(s)/2) + (\sigma - \sigma_0)$

Validation of Revised Vertical Plant Profile Products

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Completion of the Australian Biomass Plot Library

Source project

- Ausplot Forest Monitoring Network (Aus)
- CATER (Qld)

ALOS

- · Cobar Peneplain biomass study (NSW)
- CSIRO Environmental Plantings (Aus)
- Cyclone Monica (NT)
- DSITI RSC (Qld)
- Forestry Corporation Commercial Estate (NSW)
- Forestry Tasmania Lidar (Tas)
- Herbarium Biocondition (Qld)
- Herbarium Brisbane City Council (Qld)
- Herbarium Bunya Mountains (Qld)
- Herbarium Cali1 (Qld)
- Herbarium Cali2 (Qld)
- Herbarium Gidgee (Qld)
- Herbarium GlennInnes (Qld)
- Herbarium Grid (Qld)
- Herbarium Mulga drought (Qld)
- Herbarium NQ dieback (Qld)
- Jarradale thinning experiment (WA)
- NATT (NT)
- NFPP (Qld)
- NT Bushfires Cape York (NT)
- NT Bushfires Kimberley (NT)
- NT Bushfires Three parks (NT)
- OEH Forest Monitoring Program (NSW)
- SMAPEX (NSW)
- TERN Supersite Network (Aus)
- TRAPS (Qld)
- UNSW redgum study (NSW)
- UQ brigalow habitat study (Qld)
- UQ brigalow regrowth Dwyer (Qld)
- Victorian Forest Monitoring Program (Vic)
- WAPW South West Forests (WA)
- Wog Wog Fragmentation Experiment (NSW)
- 1,073,837 hugs
- 839,866 trees (1,467 species)
- 16,391 observations (12,663 sites)



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Australian Plot Measurement Database



OS



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Carbon Analysis Tool (CAT)

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Australian Biomass Plot Library



Future data needs for earth observation CAL/VAL

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Number of satellites supporting regional to global biomass mapping

Optical	C-band	L-band	P-band	Spaceborne lidar
Landsat-7	ERS-1 SAR	JERS-1 SAR	BIOMASS	ICESAT GLAS
Landsat-8	ERS-2 SAR	ALOS PALSAR		ICESAT-2
Sentinel-2	RADARSAT-1	ALOS-2 PALSAR-2		GEDI ON ISS
	RADARSAT-2	SAOCOM CONAE		
	Sentinel-1	NISAR		
		ALOS-4		

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Objective 2

Determine if changes in woody structure due to processes of clearing, regeneration, fire and thickening may be detected using combined Landsat and PALSAR-1 and PALSAR-2 time-series

- 1. Quantifying and understanding the response of terrestrial ecosystems and environments to change
 - Injune Landscape Collaborative Project (ILCP)
 - Tree and site level AGB change
- 2. Quantifying regrowth structure and AGB following clearing
 - Queensland SLATS (Qld DSITI and Herbarium)
 - New South Wales SLATS (NSW OEH)
- 3. Impact of fire management on vegetation structure and fuel loads
 - Landscape scale fire experiment (Kapalga Station, Northern Territory)
 - Severity of planned burns (Victoria DELWP)

Early-dry season fire at Kapalga Research Station, Kakadu National Park, NT (B. McKaige, CSIRO) Processed ALOS-2 L1.1 data Injune Landscape Collaborative Project Impacts of fire management Queensland (DSITI, 2015) Quantifying woody regrowth ILCP ecosystem change 雷 Mulga regrowth harvesting, Queensland Cobar Peneplain Cypress Pine, NSW (DSITI, 2014) (Daryl Green, 2013)

Project site locations

Controlled burning at Lillimur, Victoria (DELWP, 2007)

Injune Landscape Collaborative Project

- 1. Airborne data acquisitions 2000, 2009 and 2015 (Lidar, HS, AIRSAR)
- 2. Spaceborne data C-/L-band SAR/optical/ICESat
- **3. Ground data -** 2000, 2004, 2006, 2009, 2015

ALOS

ILCP PSU 0708

ILCP PSU 0508

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August 2000 - Optec ALTM1200

April 2009 - Riegl LMS Q560

August 2015 - RiegI LMS Q560

0 25 50 100 Metres

August 2000 – Optech ALTM1200

August 2015 – RIEGL LMS Q560

Quantifying regrowth structure and AGB following clearing

ALOS

Schmidt et al. (2015) RSE

Extent and trends in PGV

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Denham et al. (in review)

ALOS-2 PALSAR-2 2015 Australia mosaic

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ALOS

Project milestones, deliverables & data sharing

Objective 1 milestones:

ALOS

- Release of revised Australian height metrics (Mar 2016)
- Release of biomass plot measurement database (Apr 2016)
- Revised above-ground biomass map (Jul 2016)
- o JRSRP forest and woodland extent (Dec 2016)

Objective 2 milestones:

- ILCP and destructive harvesting fieldwork (complete Aug 2015)
- Victorian planned burns fieldwork (Apr 2016)
- Case study evaluation of methods for detecting AGB and wooded extent change using PALSAR-1/2, Sentinel-1, and Landsat time-series (Mar-Jul 2017)
- Regional application of selected case study results using mosaic data -Queensland (Dec 2017)
- Validation of AGB change at nominated reference sites using Auscover airborne and terrestrial laser scanning, and validation of updated national maps (Mar 2018)

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