Semi-Arid Woodlands



Requirements

- Australia is signatory to international agreements
 - o United Nations Framework Convention on Climate Change (UNFCCC)
 - Montreal Process

Australia has currently proposed not to ratify the Kyoto Protocol.

- o Strong commitment to meet emission reduction targets
- Australian Greenhouse Office (AGO) has been developing a National Carbon Accounting System (NCAS) for land-based emissions.
- Within NCAS, Landsat data (with ancillary data) are used to provide monthly to annual information at < 1 ha spatial resolution on land cover and land use/cover change.

Data requirements:

- o spatial and temporal information on:
 - Land cover/use
 - Biomass (carbon) stocks
 - Forest and woodland structure
 - Species/community composition



Background

- A major finding of Australia's first National Greenhouse Gas Inventory (NGGI) was that greenhouse gas emissions from land use change and forestry sector were significant
- These losses of greenhouse gases were attributed largely to vegetation clearance, particularly in Queensland
- Requirement to quantify biomass and biomass



State	1971-1980	1981-1990	1991-1995	1996-1999
	Area Cleared (ha/year)			
NSW	428151	52232	19120	30000
TAS	11817	2413	940	940
WA	92464	92562	21150	3145
SA	4171	28797	1370	2088
VIC	21200	10766	2450	2450
QLD	886257	350791	289000	382500
NT	21094	12843	3320	3320
ACT	-	163	-	-
Total T	1465153	550567	337350	424444
Australia				

Model Grants Trans

Injune Study Area within Southern Brigalow Belt - Montreal Vegetation (1999)



Smooth barked apple (*Angophora leiocarpa*)



Sandalwood box (*Eremophila mitchelli*)



Silver-leaved ironbark (*E. melanaphloia*)



Brigalow (*Acacia harpophylla*)



Poplar box (*E. populnea*)



White cypress pine (*Callitris glaucophylla*)

LULUCF Products (2005-2007)

- Land Cover Change Maps
 - o **Deforestation**
 - o Regeneration
 - o Vegetation thinning/thickening
- Woodland structural type classifications
- Relative biomass

- Initially Queensland
- Australia-wide (for woodlands)
- **Other regions (southern Africa, Brazilian Cerrado)**

Data Requirements

- Dual POL ALOS PALSAR
- **Optical sensor data (e.g., Landsat ETM+ and AVNIR-2)**

Targeted End Users

- Australian Greenhouse Office (AGO) National Carbon Accounting System
- □ State Agencies (Queensland Department of Natural Resources) Statewide Landcover and TREES program; Northern Territory Government)

Land use and cover change

- Landsat sensor data acquired over Injune
 - o **1990**
 - o **1991**
 - o **1995**
 - o **1997**
 - o **1999**
- Time-series comparisons of land cover classifications undertaken to establish
 - The history of vegetation clearance over the decade
 - The patterns of regeneration.









 Time-series comparison of Landsat sensor data POLSAR (Lband HH, VV and HV in RGB) image, September, 2000.

JERS-1 L-band HH SAR versus fully polarimetric L-band SAR



JERS-1 SAR image

D POLSAR (4th

Dates of image acquisition

- o 29th June, 1994
- o 12th August, 1994
- o 8th November, 1994
- o 16th June, 1995
- o 12th September, 1995







JERS-1: 940812









Structure and Biomass





Aerial Photography

1 m spatial resolution laser scanner data

1 m spatial resolution CASI data (bands 14, 9 and 1 in RGB)



AIRSAR (POLSAR) data













Estimation of Total Biomass (Mg ha⁻¹)





Relationships with biomass







Mixed CP-EUS

Mixed CP-SBA



CP-SLI



Total Above Cround Biomass (Mg ha-1)

Map of Above Ground Biomass Derived Using SAR and Landsat TM NDVI



- Routinely generated across Queensland from Landsat ETM+ data
- Established relationship with NDVI and Landsat ETM+ Short Wave Infrared (SWIR) data.

Relationships between SAR backscatter and FPC





Simulated L-band SAR return from Poplar Box Woodlands (P142)



Simplified woodland stand with main scattering mechanisms and simulated C-band SAR return. The total L-band return at HH, VV and HV is -11.07, -13.90 and -29.51



Simplified forest stand with main scattering mechanisms and simulated C-band SAR return. The total L-band return at HH, VV and HV is -8.43, -8.98 and -17.10 respectively.

Example of Closed-form Model Fits







CASI data (1 m spatial resolution, 837nm, 713 nm and 445 nm Wavebands in RGB)

POLSAR data (10 m spatial resolution, L-band VV, HH and HV in RGB)

Woodlands dominated by White Cypress Pine (C. glaucophylla)



CASI data (1 m spatial resolution, 633 nm, 549nm and 445 nm Wavebands in RGB)





POLSAR data



Inversion Results for Woodlands Dominated by *Eucalyptus* Species







SAR Image



- Land Cover Change Maps
 - o **Deforestation**
 - o Regeneration
 - o (Vegetation thinning/thickening)
- Woodland structural type classifications
- Relative biomass

Collaboration

- Implementation
 - o Comparison undertaken initially with QDNR SLATS
 - o Subsequent transfer to AGO NCAS and State/Territory governments
 - Standardisation and transfer of products
 - Consideration of coherence