ALOS

Statewide Mapping of Forest Above Ground Biomass, Queensland, Australia

K&C Initiative
An international science collaboration led by JAXA

Project objectives

1. To generate a map of forest growth stage (as a function of above ground biomass) for Queensland.
2. To detect change in forest structure in Queensland (including woody regrowth)

Generating regional mosaics

- Over northern Australia, a limitation of generating maps relating to forest growth stage has been the occurrence of banding within the mosaics.
- To resolve this issue, JAXA provided K&C strip data (50 m) for all acquisitions over Queensland during 2007 and 2008.
- Comparison with Advanced Microwave Scanning Radiometer-EOS (AMSR-E) soil moisture and SILO meteorological (rainfall) data suggested that banding was attributed to differences in surface moisture conditions at the time of ALOS data acquisition.

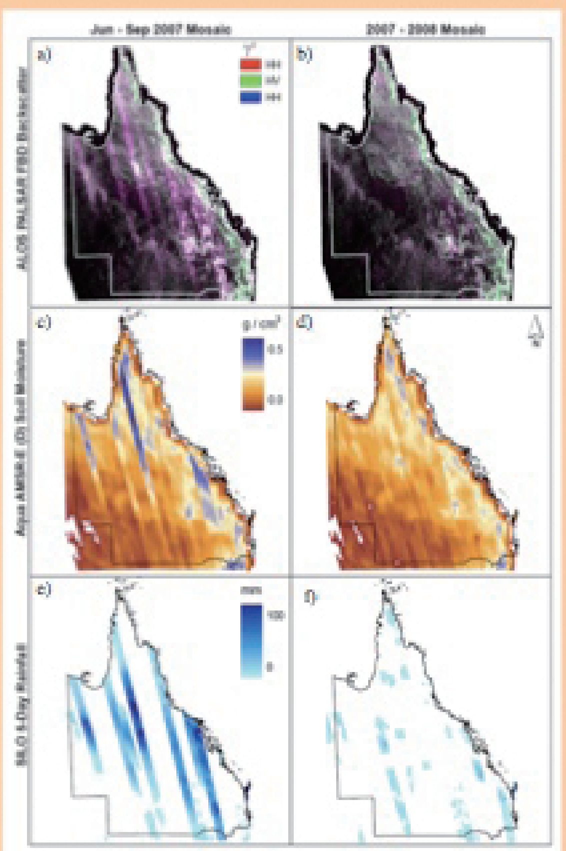

Figure 1. ALOS PALSAR mosaics generated for Queensland using strips acquired a) on the earliest date of acquisition in 2007 and b) following periods where soil moisture was at a minimum. The soil moisture and rainfall over the periods of the ALOS PALSAR acquisitions are given in b-c) and d-e) respectively (© JAXA/METI).

Field-based estimates of above ground biomass

- 2779 plot-based estimates of tree diameters (by species) representing 1160 sites were collated (Figure 2).
- Above ground biomass was estimated using generic allometric equations
- ALOS PALSAR data were extracted and relationships then established with AGB for forests, open woodlands and sparse open woodlands (Figure 3)

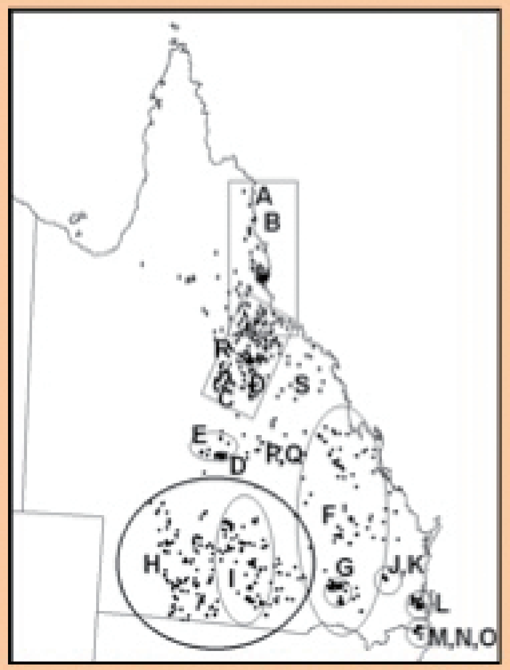

Figure 2. The location of sites with available field-based measurements of tree size. A-S represent different studies.

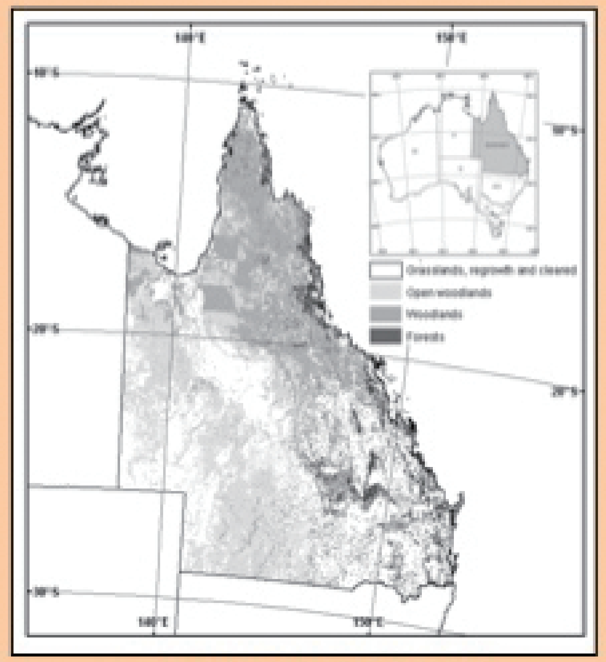

Figure 3. The location of the state of Queensland, Australia, and the distribution of forests, woodlands and open woodlands.

Relationships between ALOS PALSAR and above ground biomass

- Using ALOS data acquired during periods of minimal surface moisture, L-band HV gamma 0 (γ^o) data increased asymptotically with AGB up to ~400 Mg ha^{-1} (Figure 4a). For woodlands and open woodlands, saturation of HV γ^o occurred at ~ 50-60 Mg ha^{-1} (Figure 4b).

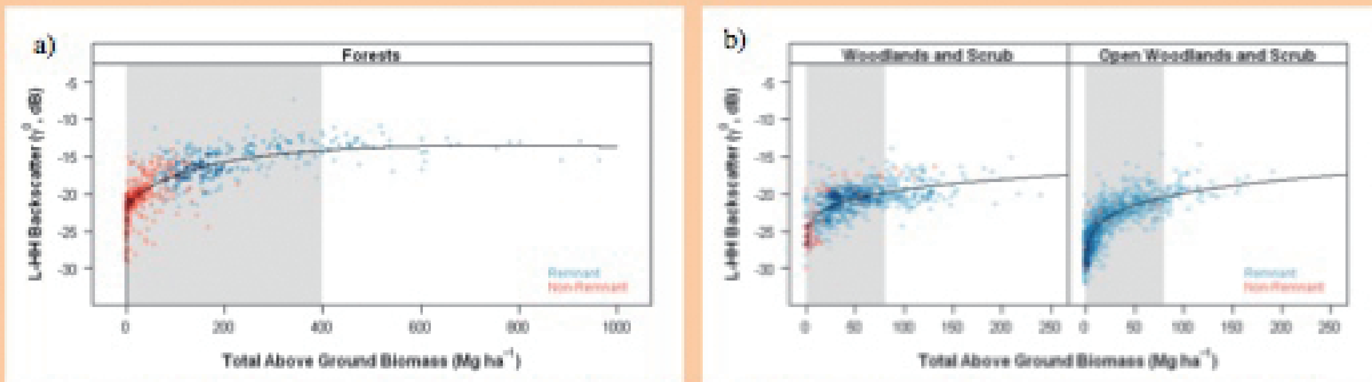

Figure 4. Relationship between AGB and L- band HV γ^o for a) forests (up to 1000 Mg ha^{-1}) and b) woodlands and sparse woodlands (up to 250 Mg ha^{-1}) associated with minimum soil moisture over the 2007 observation period. Areas shaded indicate the approximate saturation level.

- When strips associated with maximum soil moisture were used, HV γ^o for forests was enhanced relative to both woodlands and open woodlands, with saturation occurring at 150-200 Mg ha^{-1} in all cases.

Results and future work

- The spatial distribution of above ground biomass for woody vegetation across Queensland agrees with other studies (Henry et al., 2002; Berry et al., 2006) in that greater amounts (in terms of Mg ha^{-1}) are located in the coastal and highland tropical and sub-tropical forests although greater amounts (in terms of area) are associated with woodlands. Methods for more reliable retrieval towards the saturation level are being investigated.

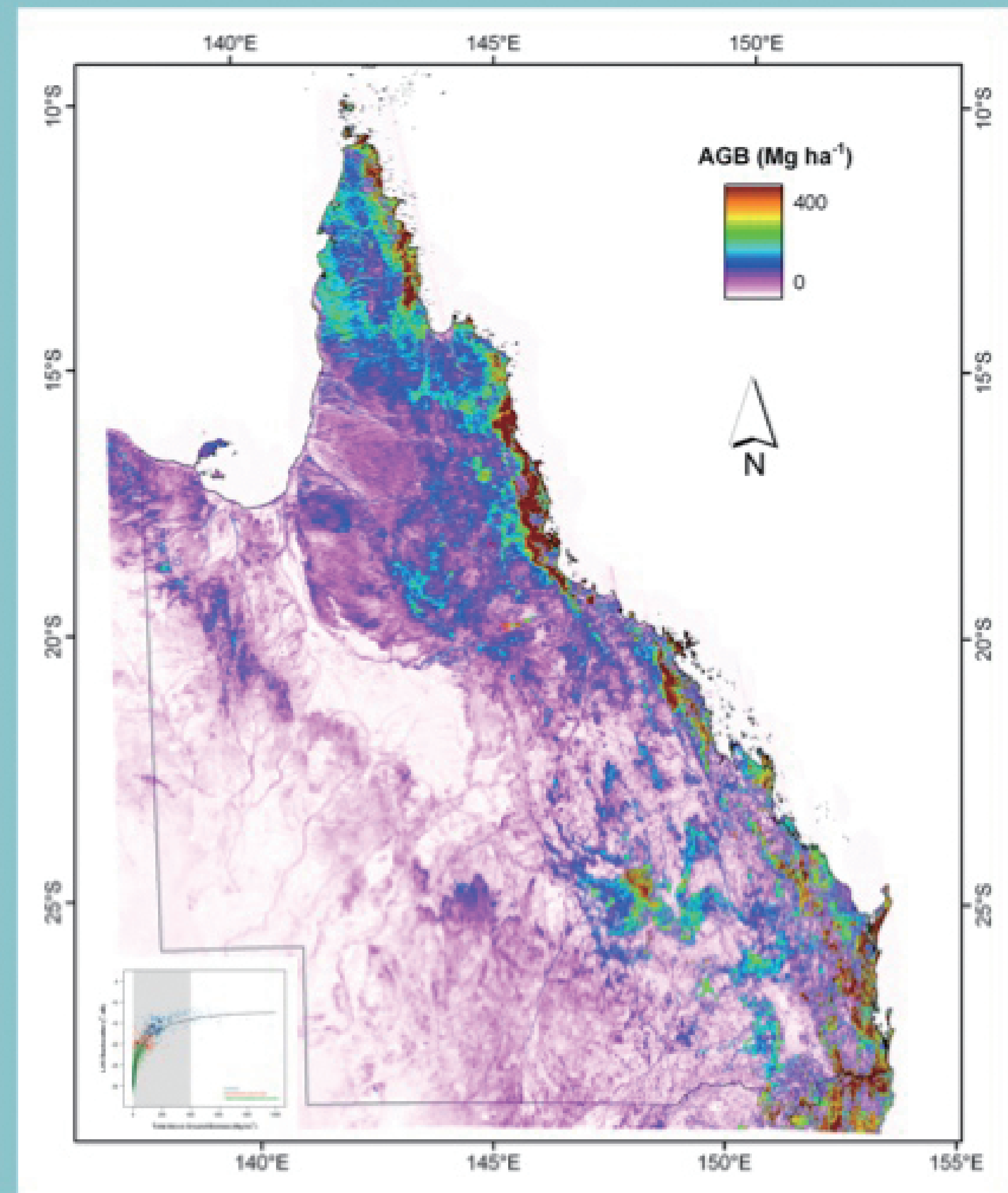

Figure 5. Statewide mosaics of above ground biomass generated from 2007 ALOS PALSAR Strip data acquired under conditions of minimal surface moisture.

- <u>The generation of usable mosaics of ALOS PALSAR data through reference to rainfall and soil moisture surfaces allows generation of additional data products (e.g., maps of biomass for additional years, biomass change and growth stage)</u>

Lucas, R.M., Armston, J., Fairfax, R., Fensham, R., Accad, A., Carreiras, J., Kelly, J., Bunting, P., Clewley, D., Bray, S., Metcalfe, D., Dwyer, J., Bowen, M., Eyre, T., Laidlaw, M and Shimada, M. (2010). An evaluation of the ALOS PALSAR L-band backscatter – above ground biomass relationship over Queensland, Australia. Journal of Selected Topics in Applied Earth Observations and Remote Sensing (submitted).

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