Remote Sensing of Tree Structure and Biomass in north Australian mesic savanna

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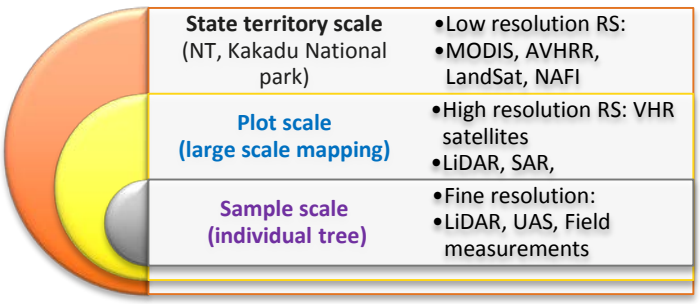
THIS PHD RESEARCH AIMS TO DEVELOP AND ASSESS METHODS, USING STEREO SATELLITE IMAGERY AND LASER SCANNING DATA, TO EXTRACT 3D TREE BIOPHYSICAL STRUCTURAL PARAMETERS FOR THE PURPOSES OF ACCURATELY ESTIMATING BIOMASS/CARBON STOCKS IN NT MESIC SAVANNAS.*

1. Necessity for research

The following actualities determine the importance of biomass estimation:

- ✓ Fires emit large amounts of greenhouse gases
- ✓ Biomass burning is a significant driver of carbon CO2 emissions
- ✓ Above ground biomass (AGB) is approximately 48% carbon
- ✓ In Australia, between 300,000 km2 and 700,000 km2 are affected by fire annually
- ✓ Savanna vegetation is inherently flammable and provides a vast source of forest fuel
- ✓ The vast savanna woodlands occupy 1/3rd of Australia and accurate biomass estimate critical for emissions estimates
- ✓ Low population densities in NT thus accurate, remotely sensed vegetation data critical
- ✓ Fire-affected areas typically occur in remote and inaccessible situations in NT

There is a current information and associated research gap for generating structural information at a tree plot scale from Remote Sensing (RS) data across Australian savanna:



2. LiDAR analysis

Aim: To develop a canopy and tree crown-based geospatial inventory of the study area by developing methods to extract tree structural parameters from high density LiDAR point cloud data.

Objectives: 1) To extract tree structural parameters and to derive models of individual tree relationships between diameter at breast height (DBH), crown area and total tree height as predictors for estimating biomass and carbon stocks;

2) To apply and update existing allometric equations for biomass estimation in the NT savannas.

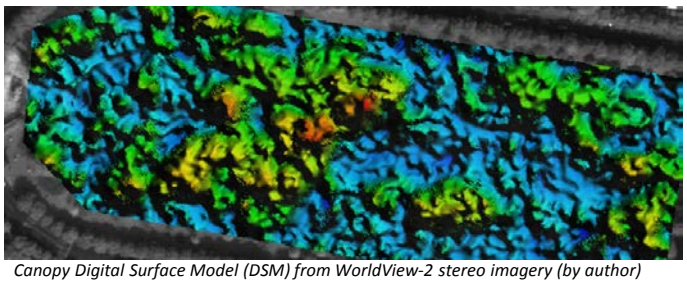
3. Remote sensing alternatives

	Advantages	Disadvantages
Airborne laser scanning	Direct data georeferencing; Provides information from under the dominant canopy; Accurate estimation of forest attributes; Detailed 3D spatial information	Limited information on species diversity and forest health; High cost
Stereo Satellite optical sensors (WorldView2,3 GeoEye…)	Higher coverage at relatively low cost; Regular temporal resolution and homogeneity in acquisition; Image spectrometry information;	Less precise estimates; Unable to penetrate the canopy; Lower spatial resolution; Need precise indirect georeferencing;

4. Stereo Satellite Imagery approach:

Objectives: 1) To assess the accuracy and apply existing ***image-matching*** techniques for optimal generation of high-quality DSM to extract canopy structural parameters from stereo imagery (WorldView-2) in NT savannas;

2) To develop an approach for fast and accurate estimation of carbon stocks using a combination of VHR optical imagery and airborne LiDAR data;



Canopy Digital Surface Model (DSM) from WorldView-2 stereo imagery (by author)

5. Vegetation - 3D structure and fire:

Aim: To Assess the spatial variability of fire effects on woody vegetation, to improve models and predictions of how fire may influence change in biomass/carbon.

Objectives: 1) To apply available remotely sensed fire history mapping products (e.g. using NAFI) to develop a general understanding of fire regime effects on savanna vegetation structure;

2) To assess the level of spatial variability in the relationship between fire metrics (e.g. frequency of severe fires) and savanna vegetation structure.

**** Current status of research: PhD proposal conformation stage***

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