Student project

Key Topics:
- Northern Australia [1]
- Remote sensing [2]

Remote sensing of tree structure and biomass in northern Australian mesic savanna [3]

This project is developing a robust approach for measuring biomass/carbon stocks in savanna vegetation. LiDAR data and high resolution stereo satellite imagery is being used to develop methodologies to estimate vegetation biomass in different fire regimes, extracting 3D tree biophysical structural parameters. This can then be used to accurately estimate biomass/carbon stocks. The methodologies developed will be applied to large areas of savanna country across northern Australia.

Research team

Student researcher

Full description

PhD Project Proposal Bushfire and Natural Hazards CRC
Remote Sensing of Savanna Tree Structure and Biomass

Context

A key focus of the ‘Northern Hub’ program of the BNH CRC based at CDU is to investigate, and where possible help develop, sustainable economic options for building the resilience of remote communities across the north. In many parts of the northern savannas, currently there are few mainstream employment options available (pastoral and mining industries, Defence, service industries), and even fewer that meet the aspirations of Indigenous people. Outside of town centres, Indigenous people make up the majority of the population in many northern regions. One of the emerging opportunities for Indigenous communities has been the rapid rise in community-based Ranger groups—focusing on land and sea management activities. While to date these programs have been largely publicly funded, there is a keen desire on the part of the community groups themselves to develop sustainable environmental service enterprises which can offer culturally appropriate employment opportunities, including on part-time and casual bases. Landscape-scale fire management offers one of those opportunities, especially through the provision of greenhouse gas emission offsets and carbon sequestration in living vegetation / biomass, in so-called ‘savanna burning’ projects. The research project outlined below aims to develop a robust approach for measuring carbon stocks in savanna vegetation which, in the future, would have direct application in savanna burning and related biodiversity assessment projects.

Project outline

Fires in Australian savannas are common, cause severe damage to the environment and emit large amounts of greenhouse gases. It is widely recognised that biomass burning is a globally significant driver of carbon CO2 cycling and an important source of greenhouse gases. As above ground biomass (AGB) is approximately 48% carbon, there is a clear need for techniques to efficiently and reliably quantify 3D above ground biomass structure and biomass changes related to changes in fire regime (frequency, timing and intensity of fires). In recent years, there has been an increasing emphasis to use active sensors like Radar and airborne laser scanning (LiDAR) systems to estimate various 3D characteristics of vegetation structure such as crown biomass, bulk density and height. Laser scanning, combined with up-to-date advanced data processing methods, has the potential to overcome the disadvantages and weak points of passive sensors to deliver very precise and reliable full 3D biomass structure information, which can be used to estimate carbon storage.

This research will:

a) develop a methodology to estimate vegetation biomass using an existing airborne LiDAR dataset collected by the AusCover facility of the Terrestrial Ecosystem Research Network (TERN) in Litchfield National Park in 2013.
b) relate the LiDAR derived biomass estimates to different fire regimes.
c) utilise the LiDAR derived biomass estimates to develop a methodology to estimate vegetation biomass from low or medium resolution satellite imagery (e.g. MODIS, Landsat).
d) apply the methodology developed in c) to derive large area estimate of vegetation biomass in Australian savannas from low or medium resolution satellite imagery and relate these to different fire regimes.

The PhD candidate undertaking this research, Grigorijs Goldbergs, has received BSc, Engineering and MSc degrees from Riga Technical University, Latvia. He has worked for government institutions and companies in Latvia and Denmark where he gained extensive experience in extraction of 3D information from imagery and LiDAR data. He provided evidence of this expertise by advising CDU staff on processing of above mentioned LiDAR and other datasets. This expertise has proven to be difficult to find in Australia.

Until recently he was employed by the University of Twenty, Netherlands as lecturer in photogrammetry and remote sensing. He therefore does not only have the expertise required to undertake this project. He has also shown the ability to transfer it to others.

Related News
### Publications

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<td>Delivering effective savanna fire management for defined biodiversity conservation outcomes: an Angham Land case study [15]. International Journal of Wildland Fire</td>
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<td>Limitations of high resolution satellite stereo imagery for estimating canopy height in Australian tropical savannas</td>
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<td>Efficiency of Individual Tree Detection Approaches Based on Light-Weight and Low-Cost UAS Imagery in Australian Savannas</td>
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<td>Hierarchical integration of individual tree and area-based approaches for savanna biomass uncertainty estimation from airborne LiDAR</td>
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### Posters

1. **Measuring trees and fire in the Top End**  
   FIRE SEVERITY, NORTHERN AUSTRALIA
   - 25 FEB 2016
   - Remote Sensing of Tree Structure and Biomass in north Australian Mesic Savanna
     - Northern Australia [1], Remote Sensing [2]
     - This PhD research aims to develop and assess methods, using stereo satellite imagery and laser scanning data...

2. **Remote sensing of tree structure and biomass in north Australian mesic savanna**  
   Remote Sensing [2], Savanna Grasslands [37]
   - 18 AUG 2015
   - Remote sensing of tree structure and biomass in north Australian mesic savanna
     - Remote Sensing [2], Savanna Grasslands [37]
     - This PhD research aims to develop and assess methods, using stereo satellite imagery and laser scanning data...

3. **Remote sensing of tree structure and biomass in north Australian mesic savanna**  
   Remote Sensing [2], Savanna Grasslands [37]
   - 14 AUG 2016
   - Remote sensing of tree structure and biomass in north Australian mesic savanna
     - Remote Sensing [2], Savanna Grasslands [37]
     - This PhD research aims to develop and assess methods, using stereo satellite imagery and laser scanning data...

4. **Remote sensing of tree structure and biomass in north Australian mesic savanna**  
   Remote Sensing [2], Savanna Grasslands [37]
   - 29 JUN 2017
   - Remote sensing of tree structure and biomass in north Australian mesic savanna
     - Northern Australia [1], Remote Sensing [2]
     - The main goal of this study is to determine the optimal procedure for the estimation of above-ground biomass...
Remote sensing of tree structure and biomass in North Australian mesic savanna

This PhD research aims to develop and assess methods using stereo imagery and laser scanning data, to extract...

Linked Projects

Tools supporting fire management in northern Australia

PRESCRIBED BURNING AND CATCHMENT MANAGEMENT

Adj Prof Jeremy Russell-Smith
Charles Darwin University