# Abstract

This thesis examines the effects of species, rainfall and soil type on tree biomass regressions, as well as the effects of stand dominance and structure on stand biomass regressions in north-east Australian woodlands. This was achieved by examining tree characteristics and biomass relationships for a series of woodland monitoring sites throughout the study area. This study utilised a modified data set from this permanent monitoring site network to provide structural attributes for trees and communities of varying composition in the grazed woodlands. These data were supplemented with environmental data and tree harvest data sets.

Initially, the research reported in this thesis developed allometric and stand biomass regressions for *Callitris glaucophylla* communities. This research also demonstrated that changes in tree-form were not reflected in changes in the environment, nor did such changes reflect changes in tree biomass regressions for three eucalypt species. As a result, a common regression provides a robust estimate of total aboveground biomass of eucalypt trees in the study area. Thus expensive destructive harvesting can generally be avoided for minor eucalypt species. Finally, this study demonstrated a successful methodology that described the stand structure of all the grazed woodland sites based on tree heights. This methodology was developed to allow the expansion of a single stand regression to estimate stand biomass across the entire north-east Australian woodlands.

The findings demonstrated in this study, combined with the long-term data from the permanent monitoring network sites, should enhance the estimation of carbon flux within eucalypt communities of north-east Australia's grazed woodlands.

# Application of tree and stand allometrics to the determination of biomass and its flux in some north-east Australian woodlands.

Tree and stand allometrics

by

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# Declaration of Originality

This thesis reports the original work of the author, except as otherwise stated in the acknowledgements and listing of the associated publications. It has not been presented to this or any other university for the award of another degree.

Madonna B. Hoffmann

# Publications

Data used during the preparation of this thesis also formed part of the contribution made by the candidate as a co-author in the following publications:

Burrows, W.H., Hoffmann, M.B., Compton, J.F., Back, P.V. and Tait, L.J. (2000). Allometric relationships and community biomass estimates for some dominant eucalypts in Central Queensland woodlands. *Australian Journal of Botany*. **48**: 707-714.

Burrows W.H., Hoffmann, M.B. Compton, J.F. and Back, P.V. (2001). Allometric relationships and community biomass stocks in White Cypress Pine (*Callitris glaucophylla*) and associated eucalypts of the Carnarvon area – South central Queensland (with additional data for Scrub Leopardwood – *Flindersia dissosperma*). National Carbon Accounting System Technical Report No. 33. Australian Greenhouse Office: Canberra.

Williams, R.J., Zerihun, A., Montagu, K.D., Hoffmann, M., Hutley, L.B. and Chen, X. (2005). Allometry for estimating aboveground tree biomass in tropical and subtropical eucalypt woodlands: towards general predictive equations. *Australian Journal of Botany*. **53:** 607-619.

Zerihun, A., Montagu, K.D., Hoffmann, M.B. and Bray, S. (in press). Changes in root to shoot ratios of *Eucalyptus populnea* communities of north-east Australia across a rainfall gradient. *Ecosystems*.

# Definition of terms

**MAR** - Mean annual rainfall

**QDPI&F**- Queensland Department of Primary Industries & Fisheries

**DBH, D, DBHOB** - Diameter breast height (1.3m from ground) over bark

**TRAPS** - **T**ransect **R**ecording And **P**rocessing **S**ystem. Each monitoring site consists of 5 belted transects (100 m × 4 m) 25 m apart in a relatively uniform community. Data describing location, species, circumference at 30 cm from ground, height, burn ratings and comments on plant health (dead, sick etc.) were recorded for every plant within the transect belt following the TRAPS methodology. These monitoring sites were established on rural landholdings and represent a range of vegetation communities, dominant species and geographical locations. Full description sites and methodology in Back *et al*. (1997).