



Institute for Commercial Forestry Research (ICFR)

Providing excellence in applied forestry research and technology for the South African Forest Industry

Post-Graduate Student (MSc and PhD) Research Opportunities at the ICFR 2015

The ICFR provides applied forestry research expertise in areas of forest management, risk mitigation, site potential and hardwood breeding, generating knowledge and technology outcomes which support a sustainable and competitive South African forestry sector. Through integrated and multidisciplinary projects, we generate research and development outcomes in the form of relevant and applicable technical solutions, products and services.

Forestry is one of the strategic economic sectors in South Africa, with a significant contribution towards economic growth and job creation in the country. It is estimated that around 63 000 people are directly employed in forestry in South Africa, working for an industry that strives

to produce timber-based products from a renewable source, cost-effectively and sustainably. Research is essential to support innovation and the development of new technologies, ensuring our industry is globally competitive

In support of national imperatives for skills development, and to meet increasing sector demand for relevant expertise, the ICFR offers a number of postgraduate study opportunities from 2015. Successful candidates will form part of integrated research teams at the ICFR, working with leading South African Universities including the Universities of Cape Town, Free State, Pretoria, KwaZulu-Natal and Stellenbosch.



Postgraduate Opportunities Offered for 2015:

Nr	Opportunity	Discipline or Research Area	Project Title	Project Description
1	PhD	Soil Science and Plant Nutrition	Weatherable mineral nutrient supply potential from deep rooting into the regolith under plantation forests	<p>The capability of diverse commercial forestry site types to sustain optimal nutrient supply over multiple rotations is poorly understood, resulting in risk and uncertainty over future sustainable wood supply and the continued competitiveness of the forest sector. Assessing nutrient supply differences across our main forest sites will provide a comparative estimate of the relative importance of deep rooting to access weatherable mineral reserves, with that resulting from a gradual reduction in organic reserves, as a result of forestry practices during re-establishment.</p> <p>Co-supervised by ICFR and academic staff at one of the Universities of Cape Town, Stellenbosch or KwaZulu-Natal, this project will focus on characterising the mineralogy of deep profiles at landscape positions that represent levels of weathering. This is aimed at providing the industry with understanding of the long-term nutrient supply potential from deep regolith layers to deeply rooted plantation trees.</p>
2	MSc	Soil Science and Plant Nutrition	Effects of plantation forest organic matter management on labile and non-labile soil carbon pools	<p>Linking to project 1, this study, co-supervised by ICFR and academic staff at one of the Universities of Cape Town, Stellenbosch or KwaZulu-Natal, aims to characterise carbon pools and carbon fractions of the soil and deep regolith layers of a number of key forestry sites. A key outcome will be to understand interactions between tree deep rooting, soil carbon pools and nutrient availability.</p>
3	MSc	Plant physiology and reproductive biology	Pollinator x seed orchard environment studies	<p>Seed crop production of commercial temperate eucalypts is currently hampered by a lack of knowledge of the trees' reproductive biology and interactions with local pollinators in different environments.</p> <p>Co-supervised by ICFR and academic staff of the University of KwaZulu-Natal, this project will explore the reproductive biology of two key eucalypt species, to assess the effectiveness of local pollinators for the trees and how local environments surrounding the eucalypt orchards influence the assemblage of potential pollinators. Outcomes include the development of management plans to optimise pollination of trees and a management tool for identifying optimum temperate eucalypt seed orchard production sites applicable across the sector.</p>
4	MSc	Plant nutrition and reproductive biology	Manipulation of seed crop retention and development in temperate eucalypts through nutrient application	<p>Linking to project 3, and co-supervised by ICFR and academic staff of the University of Stellenbosch, this project will focus on developing an understanding of the role of nutrients in seed crop retention in temperate eucalypt species. Knowledge will be used to formulate nutrient application regimes for sustainable seed crop production in temperate eucalypt orchards. Outcomes include understanding of the role of nutrients in improving seed crop retention, and provide nutrient application recommendations for this, applicable across temperate sites.</p>

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5	PhD (to commence in 2015/6?)	Hydrology (Hydrological modelling with components of stand productivity modelling)	Developing and refining a water balance model that accounts for deep regolith water supply into a process based site productivity model such as 3PG	<p>Research is needed into the importance of deep rooting by forest plantation trees in South Africa, into regolith profiles, in terms of its impact on water supply, a key factor influencing production potential and drought risk. Through a novel combination of soil science, geophysics, forest physiology and spatial technologies, this will provide understanding of the importance of regolith water supply characteristics to stand productivity, which can be integrated into drought risk mapping, to improve site-specific forestry practice.</p> <p>Co-supervised by ICFR and academic staff at one of the Universities of KwaZulu-Natal or Free State, this project aims to characterise the water balance of deep profiles that includes weathered parent materials and associated profile characteristics, through identifying and adapting a suitable vadose zone hydrological or water balance model to describe deep water access by eucalypt tree crops. A key outcome will be a process-based productivity model that integrates a more robust water model accounting for the deep regolith water supply. The revised model can be used in conjunction with spatial models to improve drought risk mapping and productivity prediction for forestry in South Africa.</p>
6	MSc	Plant physiology, water use and natural isotope tracers	Characterisation of the isotope signatures of eucalypt stands grown across a catena with the aim of understanding both water source and usage by that stand.	<p>Production potential and drought risk associated with South African forest plantation sites is dominated by water supply. It is known that tree roots extend into, and obtain water from, the deeper regolith, and this is an important component of water supply to forests. An understanding of differences in the water source and extent of water utilisation of eucalypt stands across a catena, will support this process.</p> <p>Linking to project 5, and co-supervised by ICFR and academic staff of the University of Stellenbosch, this project will look at characterising tree component carbon and oxygen isotope signatures from stands planted across a catena, and relating the isotopic signatures to known drought events for the study area. This information will be used to refine and verify productivity predictions from process-based models in the larger study.</p>
7	MSc	Spatial technologies (remote sensing)	Remote sensing for wattle rust in commercial and non-commercial wattle plantations	<p>The escalating impact of pests and pathogens is a major threat to the competitiveness and sustainability of the forestry sector in South Africa. Monitoring and surveillance of pest and pathogen outbreaks together with risk assessment of the potential impact of existing and new threats is an essential part of an effective forest protection management strategy. A recent new threat is the wattle rust pathogen which is seriously impacting wattle stands of varying ages. New generation, moderate resolution space-borne imagery provide an inexpensive, effective technology for the mapping, monitoring and risk assessment of this pathogen.</p> <p>Co-supervised by ICFR and academic staff of the University of KwaZulu-Natal, this project will undertake an evaluation of the effectiveness of vegetation indices derived from new generation Landsat 8 multispectral imagery in detecting wattle rust-induced damage in black wattle stands at different spatial scales. Based on this, the aim is to develop a methodology for mapping and monitoring black wattle in commercial and non-commercial (small-scale stands, woodlots, escapees) compartments using Landsat 8 multispectral imagery. Outcomes include a remote sensing based system for detecting and monitoring wattle rust in commercial and non-commercial wattle stands.</p>

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8	MSc	Spatial technologies and ecological modelling	Development of ecological niche models for wattle rust	Linking to project 7, and co-supervised by ICFR and academic staff of the University of KwaZulu-Natal, this project will involve the application of geospatial and machine learning techniques for the development of an ecological niche model for wattle rust with the objective of producing a risk model with scenario capability for the wattle rust for the evaluation of the potential threat of this pathogen to the wattle industry.
9	MSc	Spatial technologies and ecological modelling	Development of ecological niche models for <i>Leptocybe invasa</i>	<p>The escalating impact of pests and pathogens is a major threat to the competitiveness and sustainability of the forestry sector in South Africa. Monitoring and surveillance of pest and pathogen outbreaks together with risk assessment of the potential impact of existing and new threats is an essential part of an effective forest protection management strategy. A recent new threat is the gall wasp, <i>Leptocybe invasa</i>, which is attacking a broad range of commercial eucalypt species across the country. New generation, moderate resolution space-borne imagery provide an inexpensive, effective technology for the mapping, monitoring and risk assessment of <i>L. invasa</i>.</p> <p>Co-supervised by ICFR and academic staff of the University of KwaZulu-Natal, this project will look at applying geospatial and machine learning techniques for refining the <i>Leptocybe invasa</i> risk model based on more detailed and representative biological and environmental parameters. Outcomes include a risk model with scenario capability <i>L. invasa</i> for the evaluation of the potential threat of this pathogen to the eucalypt industry.</p>

If you are interested in any of these projects, please submit a short letter indicating your expression of interest, together with an abbreviated CV, to Karin Nagel, at the ICFR (Karin.nagel@icfr.ukzn.ac.za) or 033-3862314 by 19 December 2014