Silviculture





Plantation Silviculture
Forest Eco-physiology
Forest Soils and Nutrition
Tree Crops for Bio-energy
Sustainability & Fire Management

Forest soils and nutrition

During 2015/16, the silviculture research group completed a series of fertilizer experiments on mid-rotation *Pinus radiata*. The most exciting finding was that higher levels (up to 100 kg ha^{-1}) of nitrogen (N), and phosphorus (P) greatly improved responses, when compared to earlier responses that had been obtained with lower levels of application. Figure 1 shows a stratified sample of tree diameter classes from each of the control and fertilized treatments. The fertilizer treatment boosted the periodic annual volume increment (PAI) with between 6.9 to 7.7 m^3 ha^{-1} yr^{-1} over the 6-year monitoring period. This represents an average increase of 44 to 72 % in PAI across the three major site groups. The optimal N:P ratios are fairly site-specific, depending on the pre-fertilization canopy N content (which ranges from approximately 50 – 125 kg N ha^{-1} across our sites). A second fertilizer trial series, this time targeting *Pinus elliottii* in the Tsitsikamma, was implemented during 2015 in collaboration with PhD student GP Scheepers. He will be focussing on indices of soil N and P supply, to improve our predictive ability for stand response to fertilization.

The effect of repeated use of prescribed burning under pines

MSc student Christoff Gresse implemented a chronosequence of once and twice burned plots in Mpumalanga. He showed that (2 to 4) burns will be necessary to decrease the burnable fuel to safe levels. There appears to be minimal damage to trees and no significant short term response in diameter increment after repeated prescribed burns. The effect on nutrient dynamics in the system is modest and non-significant in most cases.

Carbon sequestration and ecosystem services in natural and planted forests

The silviculture research unit and its collaborators, (Thomas Seifert, Steven Dovey and MSc student Philip Muyambo) completed a review of locally available data sources on carbon sequestration in South African plantations. We also developed a simple spreadsheet tool to estimate carbon storage in above- and below ground biomass, as well as forest litter layers and soils of the major plantation genera. The following conclusions could be drawn from this project: (a) The below-ground biomass and carbon storage will be slightly underestimated if default IPCC values are used instead of the algorithms that we developed. The reason for this is the fact that many South African plantations are situated on moderately dry sites by world standards resulting in elevated fractions of carbon being allocated to below-ground biomass. (b) It could be demonstrated that, on average, the forest litter layer plus soil is a net sink for carbon following the afforestation of natural veld (fynbos or grassland). (c) The existing algorithms for the accurate estimation of above-ground biomass of South Africa's plantations are currently not covering all species. Ongoing research in this domain aims to fill in the gaps in our current knowledge base. MSc student Martin Kambayi has collected data on biomass and carbon storage in the above-ground parts of the *Cryptosepalum* forest of North-west Zambia, and will be publishing the results during 2016. PhD student Sylvanus Mensah prepared publications on biomass and carbon in the Northern Mistbelt forest, as well as an evaluation of the ecosystem services provided by natural forests and plantations in a case study in Limpopo province.