Forest Science Research Symposium
12th – 13th June 2006

held in the Rabie Saunders Building,
University of KwaZulu-Natal, Pietermaritzburg
Welcome from the ICFR Director

Welcome to the second Forest Research Science Symposium hosted by the Institute for Commercial Forestry Research. After last year’s inaugural symposium, the delegates agreed that this should become an annual event, at least in the short-term.

This symposium aims to bring together the forest research community to create an awareness of the work being carried out by the various forest organisations, providing an outlet for presentations and facilitating interaction and networking.

We have tried to put together a diverse selection of papers covering research aspects from across the entire forestry supply chain and addressing research at both the specific and “big-picture” level.

I would like to express my thanks to the contributors for their papers. Once again there were many more papers submitted than could be accommodated in the day-and-a-half programme and the editorial team had a tough task selecting the ones presented here.

Thank you also to the delegates attending the symposium. Once again it seems as if we’ll exceed a hundred delegates this year. This is your symposium, where you can share ideas and offer comments on work being done. Have fun!

Colin Dyer
June 2006
### Monday 12th June

**Session 1: Prof Colin Dyer, ICFR**

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<td>Invasive pathogens and pests: An African Perspective.</td>
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<td>The decline of South African provincial road network and its effect on timber transport.</td>
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<td>Self regulation initiative to address heavy vehicle overloading in South Africa.</td>
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<td>FREDD real time vehicle scheduling in the South African Sugar Industry.</td>
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**Session 5: Dr Sascha Beck, ICFR**

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<td>Production of genetically improved seed of sub tropical and temperate <em>Eucalyptus</em> and <em>Pinus</em> species for forest plantations in South Africa.</td>
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<td>14h00 – 14h30</td>
<td>Root physiology and anchorage of young <em>Eucalyptus</em> trees derived from micropropagation, cuttings and seedlings.</td>
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<td>14h30 – 15h00</td>
<td>Comparative study of chlorophyll content in diploid and tetraploid black wattle (<em>Acacia mearnsii</em>).</td>
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**Session 6: Dr Arnulf Kanzler, SAPPI**

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<td>Wood properties and regulation of pulp mill furnish; lessons for tree improvement?</td>
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ICFR Research Symposium 2006
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**Posters will be displayed in the foyer of the Rabie Saunders building from Registration throughout the Symposium.**

**Delegates with posters are requested to be available during tea and lunch times to discuss their work and answer any questions.**
## Session 1
**Chairperson: Prof. Colin Dyer, ICFR**

### Norman W Pammenter

**Professor: School of Biological and Conservation Sciences, University of KwaZulu-Natal**
(pammente@ukzn.ac.za)

**On the hydraulic characteristics of plants.**

Norman was initially trained in chemistry and physics and migrated to the biological sciences at the MSc level. After PhD studies at the University of Leeds he returned to the University of Natal, initially as a technician and then as a member of the teaching staff. Over the years he has been promoted through the ranks from lecturer to senior professor, and has been involved in teaching ranging from biochemistry to aspects of ecology. Over the years he has supervised some 30 Masters and 15 Doctoral students.

He considers himself to be a ‘self-taught’ plant ecophysiologist with interests in water relations, photosynthesis and growth, and the relationships between these phenomena. As a sideline to his involvement in water relations, he has also worked in the field of desiccation tolerance and sensitivity in both vascular plants and seeds. His current major interest is in the hydraulic characteristics of vascular plants, and the influence these characteristics have on physiology and growth. He is a Fellow of the erstwhile University of Natal, and in 2005 was awarded the South African Association of Botanists’ Silver Medal.

### Luke J Esprey

**Research Scientist**
Institute for Commercial Forestry Research
(luke@icfr.unp.ac.za)

**Assessment of a process-based model to predict the growth and yield of Eucalyptus grandis plantations in South Africa.**

Having completed a hydrology and geology degree, Luke began his career at the ICFR in 1997 as the soil water researcher and currently he is a researcher within the Sustainable Forest Productivity Programme. Luke recently completed his PhD from the School of Biological and Conservation Sciences (Durban), under the supervision of Prof. Norman Pammenter. His research interests are varied and are currently focused on the growth and yield modelling of commercial tree species.

### Sasha Naidoo

**CSIR**
(sasha_naidoo@yahoo.com)

**The effect of moisture availability on wood density and vessel characteristics of Eucalyptus grandis in the warm temperate region of South Africa.**

Sasha has an MSc from UKZN, for which she investigated the effects of varying levels of soil salinity on the physiology of selected varieties of sugarcane grown in irrigated areas of South Africa. She is registered for a PhD looking at quantifying and modelling the interactive effects of specific limiting environmental variables (viz. temperature and water availability) on the wood quality of E. grandis in the forestry regions in South Africa. Predictive models of these environmental influences will be the outputs of the proposed study, and utilised as tools to predict the productivity potential of forestry growing areas and rapidly estimating current forest growth.
During transpiration water moves in the liquid phase from the soil, through the plant to the leaf. This flow of water is driven by the hydrostatic pressure difference (estimated as water potential) between the leaf and the soil and encounters resistances in the pathway. The study of plant hydraulics concerns itself with the driving forces, the magnitude and location of the resistances, and the impact these can have on leaf physiology. The Hydraulic Limitation Hypothesis suggests that a high resistance will either give rise to a low flow, or require a large driving force, implying a low leaf water potential. This can lead to stomatal closure and so potentially to low rates of photosynthesis and hence growth. Furthermore, the water flowing through the xylem conduits is under tension, the magnitude of which is influenced by the resistance to flow. Excessive tensions can lead to water column rupture (cavitation events) which will increase resistance to flow, and plants differ in their vulnerability to cavitation events. Thus hydraulic characteristics may influence growth rates, size of large trees, and plant response to water stress. This paper will review some of the current concepts and controversies concerning the hydraulic characteristics of vascular plants and offer some thoughts on their significance.
Assessment of a process-based model to predict the growth and yield of *Eucalyptus grandis* plantations in South Africa.

Luke J Esprey

*Institute for Commercial Forestry Research, P O Box 100281, Scottsville, 3209 (luke@icfr.unp.ac.za)*

It is believed that the process-based model 3-PG (Physiological Principles Predicting Growth; Landsberg and Waring, 1997) can potentially play a useful role within the South African forestry, both as an operational and a strategic tool. Strategic applications may include the prediction of potential productivity on a site-by-site basis; broad-scale productivity estimates based on remote sensing and the spatial application of 3-PG; identification of production constraints; and estimation of carbon fluxes to help address sustainability issues. Operationally, 3-PG could complement empirically-based models or be used in conjunction with them as a hybridised product.

The challenges of this study were therefore to see whether it is possible to adapt 3-PG to predict the growth and yield of *E. grandis* under South African conditions, test that model predictions are consistent with observed growth data and are biologically reasonable, and to assess the practicality of using 3-PG as either a strategic or operational tool. The main emphasis of this study was to understand the internal logic of 3-PG and how physiological processes are represented, and to develop methods to objectively parameterise and initialise the model. Thereafter a detailed model validation study was performed, ending off with selected potential applications of 3-PG within the South African context.

The sensitivity of predicted stand volume (SV) and leaf area index (LAI) to the values of the species-specific parameters in 3-PG was examined. These analyses enabled the development of three distinct parameter sensitivity classes; insensitive parameters (*i.e.* those that can be varied widely without affecting the outputs studied), sensitive parameters (*i.e.* those whose value strongly affects the outputs, and non-linear parameters (*i.e.* those for which the outputs depend in a non-linear manner on the parameter value).

Minimum data requirements for the parameterisation and initialisation of 3-PG are considered in detail. Conventional methods used for the parameterisation of models, specifically 3-PG, are reflected upon. An automated parameter estimation technique was examined and used for the estimation of selected parameters. Species-specific parameters were categorised according to data source estimation and sensitivity classes. Parameters describing allometric and age-dependent relationships were assigned values using observed data from biomass harvests. Critical parameters that could not be directly assigned using observed data were the ratio of foliage to stem allocation (*i.e.* $p_2$ and $p_{20}$), allocation of net primary production (NPP) to roots ($R_x$ and $R_n$), optimum temperature for growth ($T_{opt}$) and maximum canopy quantum efficiency ($\alpha_C$). These were estimated using Parameter ESTimation, by fitting model output to corresponding observed growth data.

As well as species-specific parameter values, mandatory inputs required by 3-PG include weather data, site-specific factors such as site fertility (FR) and physical properties of the soils, and stand initialisation.
data. Objective techniques to determine these site-specific factors and the initial values for the biomass pools were proposed. Most of these data are readily available for sites where experimental trials exist, or where monitoring networks are in place. However, this is the exception rather than the rule, so alternative data and information sources are required. These, together with the need for accurate weather inputs (especially monthly rainfall) and physical properties (especially soil texture, maximum available soil water and FR) of the sites being modelled were explored.

3-PG was validated using four simple tests by comparing predicted versus observed SV. Results showed that 3-PG predictions are relatively consistent with observed stand data. Analyses performed using time-series data showed model predictions accurately tracked observed growth in response to erratic and fluctuating weather conditions. Results from the initial model validation showed production on high and low productivity sites was under- and over-predicted, respectively. Further results presented here show a similar, but less marked trend (i.e. over- and under-predictions are not as extreme), and individual biases are less than those from predictions made using another locally developed parameter set.

The application of 3-PG showed that the model is able to make estimates of tree growth that are consistent with those used within the forestry site classification. This showed the considerable potential 3-PG has for strategic planning by the forest industry (i.e. projected wood supplies etc) and in research planning (refining existing site classifications). The model could be useful in predicting growth in various areas where *E. grandis* is not grown, assisting in future decision making. 3-PG was able to identify growth constraints on a site-by-site basis and distinguish among them, and was able to identify environmental and site limitations to plantation growth, and how they vary in space and time. These results together with predictions of site productivity demonstrate the potential for 3-PG to be used to improve existing forest site classifications. The model comparison study between empirically-based models and 3-PG showed that although the empirical models made accurate predictions of volume under static climatic conditions, under fluctuating weather conditions empirical estimates of volume were less accurate than those made with 3-PG. 3-PG can therefore be used operationally with minimum input data to predict growth using enumeration data. This is useful in saving time and cutting costs.

The use of process-based models (PBMs) in general, and 3-PG in particular, needs to be “championed” to the South African forest industry. This is necessary for two reasons. Firstly, the model and the manner with which it describes physiological processes of growth need to be explained in layman’s terms. This will demonstrate how and why a process-based model can work better in a fluctuating environment than empirically based models. Secondly the comparison between 3-PG and the local empirical models needs to be presented as an example of how 3-PG can be applied on an operational basis. It is accepted that much convincing is still required.
The effect of moisture availability on wood density and vessel characteristics of *E. grandis* in the warm temperate region of South Africa.

Sasha Naidoo¹, ², Fethi Ahmed¹ and Anton Zbonak²

¹University of KwaZulu-Natal, Howard College Campus, Durban 4041, South Africa
²Forestry and Forest Products Research Centre, P O Box 17001, Congella 4013, South Africa
(sasha_naidoo@yahoo.com)

Productivity of forest plantations in South Africa is highly dependant on variation of soil moisture availability; soil moisture availability is often limited and evaporative demand is high. *E. grandis*, planted extensively in South Africa, is highly intolerant of adverse conditions, and shows substantial declines when planted on shallow soils and/or on dry sites.

A study was conducted to assess the effect of moisture availability on the wood density and vessel characteristics of *E. grandis* grown in the warm temperate regions of South Africa using gamma-ray densitometry and image-analysis techniques. This study compared cores taken at breast height from compartments representing varying levels of moisture availability, using combinations of mean annual precipitation (MAP) and estimated soil water storage (SWS).

The paper will highlight variation in density and vessel characteristics across pith to bark profiles, variation between proportions of mature and juvenile wood among compartments, and weighted mean values for each property for each core are also compared. This data could assist in improving efficiency by allowing growers to factor in objectives for wood quality and quantity, and predict the value of increased volumes of wood.

**Key words**: *E. grandis*, wood density, vessel characteristics, moisture availability
Session 2

Chairperson: Dr Colin Smith, ICFR

**Keith M Little**
Programme Manager
Institute for Commercial Forestry Research
(keith@icfr.unp.ac.za)

Results from eucalypt trials linking the onset of weed-induced tree growth suppression with management, physiographic and climatic factors.

Keith Little is currently the Programme Manager for the Re-establishment Research Programme at the ICFR, where he has been employed for 14 years. He has a PhD in Botany from University of Natal. Keith’s field of expertise is in Vegetation and Coppice management as well as in pine and eucalypt regeneration. His current research interests are in the development of intra-specific competition as a function of silviculture.

**Rob Pallett**
Sappi Forests
(rob.pallett@sappi.com)

The role of silviculture in reducing the risk of crop loss and increasing plantation productivity.

Rob has a BSc University of Natal, BSc Honours (UNISA) and a Masters in Business Leadership (UNISA). He started working in forestry site classification for Usutu Pulp Co. in 1989, where he mapped and implemented the concept of forest land types as a first step in developing site specific silvicultural management practice at Usutu. This work was later successfully extended to cover Sappi land holdings throughout Southern Africa. He is currently the Programme leader in the Land Management research programme, based at the Shaw Research Centre, Howick, which involves the deployment of genetic gain from Sappi breeding programmes and provision of “after sales” silvicultural technology in order to maximise yield from improved material and minimise the risk of crop loss.

**Mark Norris-Rogers**
Mondi Business Paper
(mark.norris-rogers@mondibp.com)

Determining areas of high weed growth in plantation forests using resolution satellite imagery.

Originally trained as a Forester, Mark has over 20 years experience in various aspects of forest management including silviculture, harvesting, and tree improvement research and planning. During the last 8 years he has specialised in GIS, and is currently GIS/Remote Sensing Specialist for Mondi Business Paper SA - Forests division. His interests are in the application of GIS and Remote Sensing technologies to answer forest management issues, and recently completed a PhD, on a remote sensing research topic, from the University of KwaZulu-Natal.

**Carol Rolando**
Research Scientist
Institute for Commercial Forestry Research
(carol@icfr.unp.ac.za)

Towards understanding the role of water planting for re-establishment of *Pinus patula*.

Carol completed her Masters at UKZN in 1999 and joined the ICFR shortly thereafter. Initially her research focused on vegetation management in pines, but since 2003 she has also been the project leader for the Pine Regeneration Research Project. Since joining the ICFR she has completed several courses in biometry, agrometeorology and plant physiology. Most of her research is focused on silvicultural management of pines during the establishment phase, including developing an understanding of inter-specific competition in young pine plantations, the effect of micro- and macro-environmental factors, silvicultural practices and seedling quality on early survival and growth of pines. When she grows-up she wants to be a Plant Physiologist! Carol is currently registered for a PhD at UKZN.
Results from eucalypt trials linking the onset of weed-induced tree growth suppression with management, physiographic and climatic factors.

Keith M Little

Institute for Commercial Forestry Research, P O Box 100281, Scottsville, 3209, South Africa
(keith@icfr.unp.ac.za)

One of the greatest difficulties associated with controlling competitive vegetation during the establishment of eucalypts relates to the timing and planning of ‘weeding’ operations. This may be due to large site related variability in terms of vegetation species composition, abundance and growth, local climatic conditions as well as methods of site preparation. As a result, it is difficult to prescribe operational vegetation management standards that can be effectively applied to a wide range of sites, let alone determine the critical time at which the competing vegetation should be controlled. From the early 1990’s 33 eucalypt vegetation management trials were implemented in the summer rainfall region of South Africa. All had a weedy (no vegetation control) and weedfree (all vegetation kept below a sub-competitive level) check. From these trials, optimum tree performance relative to the weedy check was recorded at regular intervals, together with a number of site and climatic variables. Multivariate statistical techniques were used to determine whether any of these site and climatic variables could be related to the time taken for weed-induced tree growth suppression to occur in the weedy check (as determined by divergence in the growth curves). Results of the analyses indicated that environmental factors associated with changes in altitude (soil texture and climate), the method of site preparation (burning versus not burning), and the interaction between these two, were potentially good indicators of early and more competitive vegetation growth, and hence early tree growth suppression. Together, these accounted for 78 % of the variation in the data set. Regardless of the manner in which the site was managed prior to planting, the onset of weed-induced tree growth suppression occurred sooner at lower altitudes, where the vegetation was more diverse and grew more vigorously. At higher altitudes only, burning stimulated the earlier development of vegetation growth, reducing the time to taken for weed-induced tree growth suppression to occur. Results from these trials not only highlight the importance of linking both environmental and site preparation factors with the development of competitive vegetation, but also provide the framework upon which: 1) the scheduling of current vegetation management recommendations in South Africa can be made; and 2) future vegetation management trials can be positioned such that any recommendations obtained will be relevant on a regional scale.

This paper was presented at the 5th International Conference Forest Vegetation Management, Corvallis, Oregon, USA, June 2005.
The role of silviculture in reducing the risk of crop loss and increasing plantation productivity.

Rob Pallett
Sappi Forests Research, P O Box 493, Howick, 3290
(rob.pallett@sappi.com)

Increasing yield per unit area in plantation forests is significant to meeting increased demand for roundwood and maintaining or lowering the unit costs of production. In addition, production levels must be sustained over successive crop rotations. In Southern Africa, multiple stress complexes can significantly reduce plantation productivity, either before canopy closure or during stand development. In plantations grown for pulpwood, inherent site productivity and stand tree density significantly influence final yield. Abiotic factors such as frost, inter-specific competition for moisture, light and nutrients and biotic factors such as small mammal and insect damage or disease prevalence, influence post planting survival and hence stand productivity. In older stands, physical damage to trees due to hail, snow or insect attack, or intra-specific competition for resources, particularly moisture in times of drought, can result in disease development and mortality. Examples of management regimes that integrate species (or genotype) selection and silvicultural practices to avoid stress complexes and minimize crop losses are presented for both pines and eucalypts.

This paper was presented at the XXII IUFRO World Conference, Brisbane, Australia, 8 – 13 August 2005.
Determining areas of high weed growth in plantation forests using high resolution satellite imagery.

Mark Norris-Rogers*; Fethi Ahmed; Pol Coppin; and Jan van Aardt

*Mondi Business Paper, P O Box 39, Pietermaritzburg, 3200
(mark.norris-rogers@mondibp.com)

High resolution remotely sensed imagery offers the opportunity to quantitatively monitor plantation forestry operations. Using a series of QuickBird images of a plantation forestry site in KwaZulu-Natal, South Africa, a combination of textural analysis and classification techniques was tested to quantify weed development in replanted forest stands less than 24 months old. While the multi-spectral bands could identify areas of strong vegetation, crop rows were identifiable on the panchromatic band. By combining these two attributes, areas of high weed growth could be identified. This was achieved by running an unsupervised classification on the multi-spectral bands, and an edge-enhancement on the panchromatic band. Both the resultant datasets were then vectorised, unioned and a matrix derived to determine areas of high weed. By applying a matrix derived from the unioned data, it was possible to identify and quantify areas of weed infestation.

Key words: Remote Sensing; High Resolution Imagery; Weed Infestation; Textural Analysis

This paper was presented at the International Precision Forestry Symposium, Stellenbosch University, 5 - 10 March 2006.
Towards understanding the role of water planting for re-establishment of *Pinus patula*.

Carol Rolando

*Institute for Commercial Forestry Research, P O Box 100281, Scottsville, 3209*  
(carol@icfr.unp.ac.za)

Since the success of plantation establishment is frequently measured in terms of survival, it is important to identify environmental, silvicultural and plant physiological factors that minimise post-planting stress and mortality. Unacceptable (>10%) post-planting mortality of *Pinus patula* continues to be of concern to the South African forestry industry and this has motivated research into possible causes. Planting with water is practiced by some forestry companies “in an attempt” to reduce post-planting water stress and increase survival. However, the primary function of the water, as well as its effect on survival of pines, has not been critically assessed. As water is a scarce resource in South Africa, and use during planting incurs additional re-establishment costs, it is important that the physiological and economical role of water-planting for *P. patula* stands is understood. To this end, a series of empirical, operational, retrospective and process-based studies were initiated. Collectively, the results from these studies have indicated that planting with water does not always increase survival over that where no water is used. However, planting with water has the potential to reduce mortality during early (August-October) and late (March-May) season planting when soil water availability is low and rainfall sporadic, but cannot reduce mortality during prolonged drought periods. Between one to two litres of water has been found to be sufficient provided application is into the planting hole before placing the seedling. The lack of a clear indication as to the benefits of planting *P. patula* with water means that any management decision should be based on an assessment of the minimum increase in survival required to cover the additional costs of using water as well as an assessment of the risk (of mortality) associated with each planting method.
# Programme – Tuesday 13th June

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<th>Chairperson</th>
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<tr>
<td>08h00 – 08h30</td>
<td>TEA &amp; COFFEE in the Rabie Saunders Foyer</td>
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<tr>
<td>08h30 – 09h00</td>
<td><strong>Managing risk in forestry using analogies from the medical, engineering, agricultural and financial fields.</strong></td>
<td>Dr Bernard Janse</td>
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<td>09h00 – 09h30</td>
<td><strong>Interactions between woodwasps, their symbiotic fungi and biological control agents have important implications for Sirex control.</strong></td>
<td>Dr Bernard Slippers</td>
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<tr>
<td>09h30 – 10h00</td>
<td><strong>Invasive pathogens and pests: An African Perspective.</strong></td>
<td>Prof. Jolanda Roux</td>
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<td>10h00 – 10h30</td>
<td>TEA &amp; COFFEE in the Rabie Saunders Foyer</td>
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<td>10h30 – 11h00</td>
<td><strong>The decline of South African provincial road network and its effect on timber transport.</strong></td>
<td>Pierre Ackerman</td>
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<td>11h00 – 11h30</td>
<td><strong>Self regulation initiative to address heavy vehicle overloading in South Africa.</strong></td>
<td>Francois Oberholzer</td>
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<td>11h30 – 12h00</td>
<td><strong>FREDD real time scheduling in the South African Sugar Industry.</strong></td>
<td>Ryan Giles</td>
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<td>12h00 – 12h30</td>
<td><strong>Using effective communication to enhance forestry research.</strong></td>
<td>Sally Upfold</td>
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<td>12h30 – 13h30</td>
<td>LUNCH in the Rabie Saunders Foyer</td>
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<td>13h30 – 14h00</td>
<td><strong>Production of genetically improved seed of sub tropical and temperate Eucalyptus and Pinus species for forest plantations in South Africa.</strong></td>
<td>Wayne Jones</td>
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<td>14h00 – 14h30</td>
<td><strong>Root physiology and anchorage of young Eucalyptus trees derived from micropropagation, cuttings &amp; seedlings.</strong></td>
<td>Oscar Mokotedi</td>
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<td>14h30 – 15h00</td>
<td><strong>Comparative study of chlorophyll content in diploid and tetraploid black wattle (Acacia mearnsii).</strong></td>
<td>Prof. Annabel Fossey</td>
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<td>15h00 – 15h30</td>
<td>TEA &amp; COFFEE in the Rabie Saunders Foyer</td>
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<td>15h30 – 16h00</td>
<td><strong>The different pulping characteristics of E. grandis and E. dunnii, based on a species x site x pulping study.</strong></td>
<td>Marius du Plessis</td>
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<tr>
<td>16h00 – 16h30</td>
<td><strong>The impact of GMOs on the environment in the South African legislative context.</strong></td>
<td>Dr Steve Verryn</td>
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<td>16h30 – 17h00</td>
<td><strong>Wood properties and regulation of pulp mill furnish; lessons for tree improvement?</strong></td>
<td>Dr Andrew Morris</td>
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<tr>
<td>17h00 – 17h15</td>
<td>CLOSURE &amp; THANKS</td>
<td>Prof. Colin Dyer</td>
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Managing risk in forestry using analogies from the medical, engineering, agricultural and financial fields.

Bernard Janse is the Head of the Competence Centre Innovation at Mondi Business Paper South Africa. His interest in this field lies in the appropriate spending of research funds within the context of risk management strategies. As the head of Innovation he is always looking for a different way of doing things and learning out of past mistakes.

Interactions between woodwasps, their symbiotic fungi and biological control agents have important implications for Sirex control.

Bernard recently returned to South Africa after working as a postdoctoral fellow at the Swedish University of Agricultural Sciences (SLU), Uppsala, Sweden for the pest two years. Currently he is a senior lecturer at the University of Pretoria, working in FABI. His research focuses on the phylogeny, taxonomy and population biology of tree pathogenic fungi and forest insects, with a special interest in human caused changes in host-pathogen/pest interactions and resulting diseases or epidemics. Another focus is fungal-insect interactions affecting agriculture and forestry. One of the main current projects deals with the evolutionary and contemporary history of the Sirex (woodwasp) – Amylostereum (fungus) symbiosis. The Sirex-Amylostereum complex is one of a number of accidentally introduced insects and fungi that now have significant negative impacts on commercial and native trees. The knowledge gained on the co-evolution of Sirex, Amylostereum and their parasites, the patterns of distribution and host association of this pest complex across its native northern hemisphere and introduced southern hemisphere ranges, is applied in control programs for the pest complex.

Invasive pathogens and pests: An African Perspective.

Jolanda Roux was born in South Africa where she underwent all her academic training. She obtained her PhD in 1999 from the University of the Free State in Microbiology, with an emphasis on plantation forest pathology. During her post-graduate studies she was appointed as Forest Extension Pathologist in the Tree Protection Co-operative Programme (TCP) by the South African Forestry Industry, a position she still holds. In 1999 she joined the University of Pretoria where she currently holds the position of Associate Professor in the DST/NRF Centre for Tree Health Biotechnology (CTHB) with the Forestry and Agricultural Biotechnology Institute. She is dedicated to tree pathology and mycology and has published a number of articles on the topic in internationally rated journals and presented talks and posters at many international conferences. She has also authored and co-authored a few chapters in books. Jolanda has successfully supervised PhD, MSc and honours students in Forest pathology and microbiology, with her first PhD student now director of Forestry research in his country. She has been awarded a Y1 rating by the NRF in South Africa and received an award as Exceptional Young Scientist by the University of Pretoria. Apart from research into tree pathogens in Africa and extension and diagnostic work for the South African forestry industry, she also acts as guest lecturer in Forest Pathology for universities and technikons.
Managing risk in forestry using analogies from the medical, engineering, agricultural and financial fields.

Bernard Janse\textsuperscript{1}, Colin Smith and Marius du Plessis
\textsuperscript{1}Mondi Business Paper, P O Box 31024, Merebank, 4052
(bernard.janse@mondibp.com)

The continuous threat of new diseases and insects in local forest plantations has elicited several responses by forestry management – those that ignore the threat, those that entertain the threat and those that get stomach ulcers worrying about the threat. In recent history, forest plantations in South Africa have been hit by three threats – two fungal and one insect pest. As a manager, it is always difficult to assess the extent of the threat posed by these diseases. With hindsight the accuracy of perception increases substantially. However, there are no clear tools that allow a manager to address the threat in a proactive way that allows for a reduction in the threat. In a recent talk at FABI, Mike Edwards of Forestry South Africa spoke about the fact that all individuals take out insurance on their prized possessions, and yet the forest industry does not take a similar view on the risks that face them. Personal experience has led to questioning whether this inaction was due to the fact that one doesn’t want to spend money or whether it is due to ones inability to assess the risk and to determine what steps are appropriate to reduce the risk that one faces. This talk will centre on some analogies that have been drawn between forestry and the medical, engineering, agricultural and financial worlds with regards to risk management. A model that integrates “real options” thinking and basic scientific questions will be presented as a proposed framework within which to spend the research dollar in an attempt to reduce risk.
Interactions between woodwasps, their symbiotic fungi and biological control agents have important implications for Sirex control.

Bernard Slippers¹, Brett Hurley¹, Rimvydas Vasiliauskas², Jan Stenlid² and Michael J. Wingfield¹

¹ Tree Protection Co-operative Programme, Forestry and Agricultural Biotechnology Institute, University of Pretoria, Pretoria.
² Department of Forest Mycology and Pathology, Swedish University of Agricultural Sciences, Uppsala, Sweden (bernard.slippers@fabi.unp.ac.za)

The woodwasp *Sirex noctilio* and its *Amylostereum areolatum* fungal symbiont provides an apt example of a complex interaction of biological agents, which have been introduced into the Southern Hemisphere and have resulted in significant damage. We used molecular and phenotypic markers to analyse populations of different woodwasps and their fungi to better understand the interaction between these organisms, the diversity and structure of native populations, and the potential origin of introductions. In some areas, populations of *A. areolatum* are dominated by extensive dispersive clones that arise from wasp dispersal and associated asexual reproductions. This is especially true in Southern Hemisphere pine plantations. In contrast, populations of both *A. chailletii* and *A. areolatum* in some native areas clearly arise from sexually produced basidiospores. The data have shown that a specific genotype of the fungus can be carried by different wasp species, can occur on different tree genera and can fruit in nature. Wasps thus appear to acquire fungal symbionts both vertically and horizontally. The data, furthermore, suggest that there has been more than one introduction of *S. noctilio* into different Southern Hemisphere countries, but there has clearly also been some movement of wasps between these countries. These findings are important, because interactions between biocontrol agents and genotypes of the wasp or fungus have been shown to be highly specific. The distinct populations of wasps and fungi in different geographic areas thus need to be more carefully considered in local *S. noctilio* control programmes. New introductions might also negatively affect successfully implemented biocontrol efforts. Our current work builds on data from the present study and aims to characterise the interaction between specific biocontrol agents and hosts at a local population level.
Invasive Pathogens and Pests: An African Perspective

Jolanda Roux and Michael J. Wingfield

DST/NRF Centre of Excellence in Tree Health Biotechnology, Tree Protection Co-operative Programme (TPCP), Forestry and Agricultural Biotechnology Institute (FABI), University of Pretoria, Pretoria. (jolanda.roux@fabi.up.ac.za).

Trees are crucially important to the people of Africa who use them for many purposes such as for construction, fuel and food production. The utilisation of trees has, however, placed huge pressure on native resources in many parts of Africa. This has necessitated the importation and planting of fast growing, non-native tree species. In some situations these non-native trees form the basis of multi-million dollar paper and pulp industries, providing employment for substantial numbers of people. The increased movement of people and products between continents and countries, and the importation of products from non-native trees and plants has substantially promoted the world-wide spread of pests and diseases. This movement of tree pathogens and pests presents a great threat to native tree species in the importing countries. It also seriously threatens plantations of non-native species in these countries. This is especially true in areas where large monocultures, derived from narrow genetic stock, have been established. Similarly, native pathogens and pests in Africa are adapting to attack non-native plants and these now present a threat to the non-natives in their countries of origin.

Knowledge pertaining to tree pests and diseases is generally lacking in Africa. Where forest entomology and pathology programmes have been established, they have often been interrupted or terminated due to political instability or lack of funding. During the course of the last ten years, with a resurgence of interest in plantation forestry in especially East Africa, many new studies have been initiated to deal with tree pests and diseases on the continent. This has resulted in the identification of numerous previously unreported diseases and pests, as well as in the description of new fungal species from native and non-native trees in Africa. For example, various Ceratocystis spp., not known from other continents have been described from Africa during the course of the last decade. Thus, Ceratocystis albifundus has been described after it was identified as the cause of a serious wilt and canker disease of non-native plantation grown Acacia mearnsii trees in South Africa. More recent studies strongly suggest that C. albifundus is native to Africa as it has a high genetic diversity and a broad host range on native African tree species. This pathogen could result in large-scale mortality of A. mearnsii and other native Australian plant species, including Proteaceae, if it were introduced into Australia. Sirex noctilio, a wasp of Eurasian origin, is different in representing a pest that has recently been introduced into South Africa and is now considered the most serious constraint to pine propagation in Southern Africa. This exotic pest and its fungal symbiont Amylostereum areolatum, is moving northwards from its original point of introduction and it is only a matter of time before it spreads throughout South Africa and to this country’s neighbours.

There are many challenges that face efforts to prevent pests and pathogens from spreading between continents and countries. Once an incursion has occurred, there is little hope of stopping it from spreading locally. This is especially true in Africa where local quarantine procedures are enormously difficult due to funding constraints and relatively open borders between many countries on the continent. We thus recommend, as a first line of defence, that Africa as a continent protects itself against incursions...
from other continents. Together with this, specific regions on the continent need to be identified to act together forming a secondary barrier to the spread of exotic pests and pathogens. These measures and efforts of individual countries to protect themselves from the incursion of forest pests and diseases should greatly improve the currently threatening situation. While such efforts are being promoted actively, they are commonly hampered by a lack of trained staff, infrastructure, funding and a lack of knowledge regarding the pests and pathogens already on the continent. This emphasises the need to enhance collaboration and sharing of knowledge between African countries and those in other parts of the world to prevent large scale losses of forestry resources on the continent.
Session 4
Chairperson: Prof Peter Lyne, SASRI

Pierre Ackerman
Dept of Forest and Wood Science, Forest Engineering University of Stellenbosch (packer@sun.ac.za)
The decline of South African provincial road network and its effect on timber transport.
Pierre is currently the head of Forest Engineering in the Department of Forest and Wood Science, and also Chairman of the Department at Stellenbosch University. He has an MSc in Forestry. Prior to joining the University in 1994, Pierre worked as a forester for the Department of Forestry at various places throughout the country.

Francois Oberholzer
Programme Manager Institute for Commercial Forestry Research (francois@icfr.unp.ac.za)
Self regulation initiative to address heavy vehicle overloading in South Africa.
Francois obtained his BSc Forestry degree at the University of Stellenbosch in 1995. In 1996 he joined Sappi Forests where he was appointed as Marketing Forester, and later Management Forester. In 1997 he was seconded to the University of Stellenbosch where he studied for a BSc Honours degree in Forest Engineering, and assisted with research and teaching. In 1999 he went to the USA where he did his Masters degree in Forest Engineering at Oregon State University. In 2000, he took a year of from his studies to teach several courses at Humboldt State University in California. He finished his studies in Oregon in September 2001, and joined Forest Engineering Southern Africa (FESA) in October 2001 as Development Manager. In 2005, FESA was incorporated into the ICFR, and he became Programme Manager of the Forest Engineering programme.

Ryan Giles
Crickmay & Assoc (ryan@crickmay.co.za)
FREDD real time scheduling in the SA Sugar Industry.
Ryan has a BSc Engineering (Bio Resources/ Agricultural), from UKZN and is currently registered for an MSc, looking at vehicle scheduling in the Sugar Industry. He started his career as a designer for Hill Equipment designing primary extraction equipment for the timber industry. Presently he is working at Crickmay and Associates in PMB as an engineer and Logistics consultant, where he runs the Sugar Logistics Improvement Program SLIP providing strategic and management information to nine of the South African and Swaziland sugar mills. He also runs the FREDD vehicle scheduling project, involved in marketing and negotiations, technical aspects such as software customisation, support and maintenance, vehicle onboard computer integration, and scheduling system implementation.

Sally Upfold
Communications Manager Institute for Commercial Forestry Research (sally@icfr.unp.ac.za)
Using effective communication to enhance forestry research
Sally is currently Communications Manager at the ICFR where she has been for nearly four years. Prior to this she was based at the (then) University of Natal working in Public Relations and Schools Liaison. Sally has an MSc in Plant Physiology from the University of Natal, and spent a number of years as a Plant Physiology Researcher in the Department of Botany. Her current research interests lie in looking for new and innovative ways to communicate research.
The effect of South African provincial road condition on secondary roundwood timber transport.

Stephen Nicholls¹, Reino Pulkki² and Pierre Ackerman¹

¹ Department of Forest and Wood Science, Stellenbosch University
² Faculty of Forestry and the Forest Environment, Lakehead University
Ontario, Canada

The study originated from declining provincial road condition, due to insufficient government funding of road maintenance and its effect on secondary roundwood timber transport in South Africa. A survey was conducted to determine the current status of provincial roads used for secondary roundwood transport. The questionnaire concluded that provincial roads are in a poor condition, and that this status varies considerably between seasons. A modified Dijkstra’s network analysis algorithm was used to quantify the effect of road condition on the efficiency of secondary roundwood transport allowing foresters to identify critical roads for management attention and make tentative estimates of possible reductions to total cost by altering the road condition and routing. Foresters will also be able to test the sensitivity of their decisions to certain variables. The study revealed that forest managers can respond to the poor provincial road network by conducting \textit{ad hoc} maintenance to these roads to prevent them becoming completely impassable or to rebuild them to their design state and maintain them at that state. The road network model (developed and presented as a decision support tool) determined that, for the study area, a unilateral decision to rebuild and maintain all roads would result in a net increase in transport costs of R 2 million/year. By improving only 31% of the provincial road surface generates 75% of the reduction in total cost. Consequently, by improving selected roads (20% of the total provincial road network for the area) it is possible to generate a net cost R 2.9 million lower than if the roads were left as they are. Holistically it is estimated that poor provincial road management, costs the industry R 26 million or R 1.52/m³/year.

\textbf{Key words:} Secondary roundwood transport, network analysis, road condition, transport efficiency

\textit{This paper was presented at the IUFRO Conference held in the Ukraine in 2004.}
Self regulation initiative to address heavy vehicle overloading in South Africa.

Francois Oberholzer
Institute for Commercial Forestry Research, P O Box 100281, Scottsville, 3209
francois@icfr.unp.ac.za

Heavy vehicle overloading and road safety continue to be major problems in South Africa notwithstanding efforts at more effective enforcement by the road and traffic authorities. Overloading causes premature road deterioration and, together with inadequate vehicle maintenance, driver fatigue and poor driver health, contributes significantly to South Africa’s poor road safety record. The Heavy Vehicle Accreditation Scheme (LAP) is an initiative to introduce self-regulation, as opposed to legal enforcement, in the heavy vehicle transport industry, and aims to promote professionalism in heavy vehicle transport. In line with the Department of Transport’s National Overload Control Strategy, its aim is to encourage heavy vehicle operators, consignees and consignors to take more responsibility for ensuring that their loads are transported legally.

A pilot project commenced in August 2003 to establish such a self-regulation system in the forestry transport industry. The overall aim of the initiative is to promote transport efficiency within the legal framework by creating awareness with transport operator management. The main focus is thus the management of vehicle loading, load securement, vehicle maintenance and driver wellness and training. Although the pilot project was initiated in forestry, the project has been executed keeping the broader heavy vehicle transport industry in mind. During the past 12 months similar initiatives have started in other industries including coal, asphalt, aggregate and sand, pulp, paper and board and sugar.

Incentives also play a role to encourage operators to participate in the scheme. These include “Weigh-less” and the introduction of Performance-Based Standards (PBS) vehicles to increase payload efficiency without compromising vehicle safety and infrastructure protection.

This presentation will include the following: Background of LAP and the way forward; Practicalities of making LAP work; Concessions: Performance Based Standards and Weigh-Less.
FREDD Real-Time Vehicle Scheduling in the South African Sugar Industry

Ryan Giles
Crickmay & Associates, P O Box 1165, Pietermaritzburg, 3200
(ryan@crickmay.co.za)

Relative to world leading producers of high quality, low cost sugar, the South African sugarcane supply chain is significantly more inefficient. High offloading queuing delays, unnecessarily long loading times, non rateable mill arrival rate, high no-cane-stops, overfleeting, high transport rates, and questionable haulier profitability are all symptoms of the inefficient system. In a global environment typified by continual improvement, ways to increase efficiencies and reduce costs, solutions need to be sought if the industry is to remain competitive and sustainable.

As part of the SLIP programme, and in collaboration with SASRI, SACGA and New South Wales Sugar Milling Cooperative of Australia, FREDD, a vehicle scheduling programme, designed by the Australians, was introduced as a pilot project at Darnall Mill in late 2005. The project aims were to customise FREDD to the South African environment, use it to reduce the delays incurred by the vehicles thereby reducing the required fleet, maximising individual vehicle utilisation and to match the vehicle arrival rate to the crush rate. This would ultimately aid in increasing overall industry sustainability by reducing haulage rates, increasing profitability of haulage, and increasing milling efficiencies.

The project pilot has proved that vehicle scheduling can work under South African conditions but also highlighted how coordinating the sugarcane supply chain from a central location has a profound effect on addressing the inefficiencies surrounding the initiative. In addition, the need for buy-in and cooperation from all parties, good system measurement and system visibility are vital in realising the significant cost savings available.
Using effective communication to enhance forestry research.

Sally Upfold
Institute for Commercial Forestry Research, P O Box 100281, Scottsville, 3209

The success of every applied research initiative is measured by its acceptance and implementation. Communication is a critical step in the research process, linking the new knowledge generated with the innovation. The value and relevance of the innovation is measured almost exclusively by the way it is communicated to the target audience. This means that the success or failure of your research could depend on how well you tell someone about it! However, an excellent researcher may not always be a good communicator…. This paper looks at scientific communication and the role it plays in research.

Society today has become more demanding with respect to science. The potential investor wants a tangible return on his scientific research investment. Research needs to be directed and researchers are challenged to communicate the relevance of their work. In addition, factors influencing communication today are very different to those of the past. There is an over-abundance of information, and a move from a paper-based system to an electronic environment. Relevant information must be easily and quickly accessible.

The value that effective communication brings to research, and the stage in the research process at which it needs to be implemented are explored. Communication is a dialogue, an integral component of the partnership between all key stakeholders in a research project, and understanding the various roles and responsibilities of the people involved are critical.

Understanding the needs of the target audience and developing an appropriate communication strategy with a detailed plan is also essential. The tools that can be used as well as some of the constraints to communicating research are considered and illustrated by case studies from the Institute for Commercial Forestry Research.
Wayne Jones
Sappi Forests
(wayne.jones@sappi.com)

Production of genetically improved seed of sub tropical and temperate *Eucalyptus* and *Pinus* species for forest plantations in South Africa.

Wayne has a Diploma in Forestry (Saasveld), a National Diploma in Parks and Recreation Management (Technikon RSA), a BSc (UNISA) and an MSc (*Cum Laude*) University of Natal, Pietermaritzburg. In addition he has completed an International Short Course in Forest Genetics and Tree Improvement (North Carolina State University USA. Wayne began his career as a Silviculture Forester at Welgevonden and Mariepskop plantations for the Dept of Environmental Affairs, from January 1985 - December 1987. He moved to SAFRI as a Tree Breeding Research Forester in January 1988, and nearly two years later he joined the ICFR as a Nursery Research Forester. Wayne was employed by SAPPI in 1991, as a Tree Breeding Research Officer and is currently SAPPI's Seed Orchards Programme Leader. His expertise is in the breeding and development of temperate and cold tolerant eucalypt species for traits of economic importance, as well as in seed production of both temperate and sub-tropical pine and eucalypt species for commercial deployment.

Oscar Mokotedi
School of Biological and Conservation Sciences,
University of KwaZulu-Natal
(mokotedio@ukzn.ac.za)

Root physiology and anchorage of young *Eucalyptus* trees derived from micro-propagation, cuttings and seedlings.

Oscar is currently completing his PhD thesis which will be submitted within 2 months, supervised by Professors Norman Pammenter and Paula Watt on the "Influence of propagation methods on growth and physiology of *Eucalyptus grandis* x *nitens*." The research has been done in collaboration with Mondi Business Paper, who has been generous with their resources that enabled the work to succeed. Oscar is also a lecturer in the School of Biological and Conservation Sciences.

Annabel Fossey
School of Biochemistry, Genetics, Microbiology and Plant Pathology
University of KwaZulu-Natal
Pietermaritzburg
(fosseya@ukzn.ac.za)

Comparative study of chlorophyll content in diploid and tetraploid black wattle (*Acacia mearnsii*).

Annabel has a DSc Genetics University of Pretoria, and is currently Professor in Genetics in the School of Biochemistry, Genetics, Microbiology and Plant Pathology at the University of KwaZulu-Natal. Her research interests include many aspects of genetics, chromosome behaviour, molecular population genetics, animal breeding and plant breeding. Over the past few years she has focussed largely on forestry genetics addressing mainly breeding, tissue culture and diversity analyses. Annabel has 18 post graduate (6 PhD and 12 MSc) students mostly in forestry genetics, but also animal genetics and human genetics. Her other interests are writing books on adult based learning (34 books to date), reading and bird watching.
Production of genetically improved seed of sub tropical and temperate *Eucalyptus* and *Pinus* species for forest plantations in South Africa.

Wayne Jones  
*Sappi Forests Research, P O Box 493, Howick, 3290*  
wayne.jones@sappi.com

Production of commercial quantities of genetically improved seed is a key step in translating breeding and development into realised gains in field operations for the traits of interest. Commercial seed utilised in the forestry industry has over many years been derived from collections in natural stands, suitable provenances through to seed from elite orchards with full pedigree control. Seed orchards are developed to perform specific functions and produce specific products. These include *Land race orchards, Breeding seedling seed orchards, Seedling seed orchards* and *Clonal seed orchards*. Seed orchards are based on a number of selected trees from a range of families within a number of provenances. These groups of diverse individuals often exhibit a range of flowering periodicity that influences out-crossing rates and results in a combination of full-sib, half-sib and selfed progeny due to a lack of control of the male pedigrees. If there is a high degree of variation for general combining ability among males this could lead to inbreeding depression and will reduce expected gains.

The breeding systems within each genus will dictate the management strategy to produce high value commercial quantities of genetically improved seed. *Eucalyptus* species are mostly insect pollinated (*entomophily*) with preferential out-crossing, which is reinforced by a gene-controlled incompatibility mechanism that impedes or prevents selfing. *Pinus* species on the other hand are wind pollinated (*anemophily*) with sufficient degrees of asynchronous flowering between male and female reproductive structures to favour outcrossing. Orchard production is quantified by what is known as an efficiency factor (*ef*) for *Eucalyptus* species (*ef = x*(x+y)× 100 where x=clean seed; y=chaff*) and for *Pinus* species (*ef = x*× 1000 where x=clean seed; z=number of cones). The efficiency factor is a measure of successful ovule conversion into viable seed. The complex interaction between environmental factors such as altitude, rainfall, and site together with species, breeding value and flowering periodicity contribute to the ultimate recovery of viable seed with a particular genetic worth.

*This paper was presented at the 6th Plant Breeding Symposium, Club Mykonos, Western Cape, 13 – 16 March 2006*
Root physiology and anchorage of young *Eucalyptus* trees derived from micro-propagation, cuttings and seedlings.

Oscar Mokotedi, Norman Pammenter and Paula Watt

*School of Biological and Conservation Sciences, University of KwaZulu-Natal, Durban, 4041*  
(mokotedio@ukzn.ac.za)

Micropropagation has improved rooting rates of numerous recalcitrant cold-tolerant hybrid clones of *Eucalyptus* species. However, *ex vitro* growth and physiology as well as root properties of those plants have received very little attention. Using a clone of *E. grandis* × *nitens*, we found no significant differences between micro- and macropropagated saplings and trees with respect to photosynthesis and leaf hydraulic characteristics. However, differences in root structure and anchorage efficiency were significant. At least 50% of the uprooted macropropagated trees produced a root system similar and equivalent in resistance to the tap roots of seed propagated *E. grandis* and *E. nitens*. However, none of the micropropagated trees produced equivalents of tap roots. Root abnormalities such as spiralling, kinked roots forming a ‘ball-and-socket’ at the root-shoot junction were common, and in addition, some micropropagated trees produced horizontal and vertical stems. Vegetatively propagated trees generally produced a shallower root system compared with seed propagated trees, which reduced uprooting resistance and led to trees being toppled by wind loading. The former produced fewer and thicker I-beam shaped roots, whereas the later produced T-beam shaped roots. The number of roots as well as root cross sectional area had a significant effect on the maximum force required to vertically extract roots. We found that for micropropagated trees, roots more efficient in anchorage developed after nearly two years of field-growth, which might be too late if saplings are to be planted in areas with strong winds. We conclude therefore, that the quality and handling of micropropagated saplings before and during planting are important in the production of an efficient root system. Planting micropropagated saplings at a higher density than macropropagated trees might also improve anchorage by facilitating root ground cover.
Comparative study of chlorophyll content in diploid and tetraploid black wattle (Acacia mearnsii).

Annabel Fossey1, Sadhna Mathura and Sascha Beck

1 School of Biochemistry, Genetics, Microbiology and Plant Pathology, University of KwaZulu-Natal, Pietermaritzburg 3200
(fosseya@ukzn.ac.za)

The effects of the number of chromosome sets on chlorophyll content in diploid and tetraploid black wattle were assessed through chlorophyll absorbance. Seedlings of approximately eight months of age, one-year-old trees in polybags and two year-old field material were selected for this investigation. Three families per ploidy level comprising of ten half-sibs per family were used in the analysis. An analysis of variance (ANOVA) revealed significant differences (p<0.05) in chlorophyll absorbance between diploid and tetraploid material (\( \bar{A} = 0.37526 \) and \( \bar{A} = 0.65309 \), respectively). Significant differences (p<0.05) between treatments (seedling, bagged material and field material), within each ploidy level were recorded, where chlorophyll absorbance increased for diploid bagged trees (\( \bar{A} = 0.34300 \)) to seedlings (\( \bar{A} = 0.37463 \)) to field trees (\( \bar{A} = 0.40816 \)). Similar significant increases were recorded for the tetraploid seedlings (\( \bar{A} = 0.62878 \)) to bagged trees (\( \bar{A} = 0.64410 \)) to field trees (\( \bar{A} = 0.68640 \)). Significant differences (p<0.05) were also recorded between genetic lines within both ploidy levels. However, when comparing families within each ploidy level, with respect to treatment differences, in most cases two of the three families showed no significant differences (p>0.05). Within each family, significant differences (p<0.05) were recorded between each of the three treatments tested, with the field material consistently having significantly (p<0.05) greater amounts of chlorophyll.
### Session 6

**Chairperson:** Dr Anulf Kanzler, Sappi

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<th>Speaker</th>
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<td>Marius du Plessis</td>
<td>The different pulping characteristics of <em>Eucalyptus grandis</em> and <em>Eucalyptus dunnii</em>, based on a species x site x pulping study.</td>
<td>Marius du Plessis has a Saasveld Diploma, a BSc Forestry and an MSc Agriculture (Forestry). Research interests include the chemical Kraft pulp processes, genetic improvement of species used in the pulping processes, the contribution and influence of individual species and site to process and pulp quality, laboratory and pilot scale standards setting, testing methods and having some fun making paper. Marius is married to Eureka, and has 3 sons. When he is not making paper, he enjoys caravanning, camping, DVD-ing and Googling.</td>
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<td>Steve Verryn</td>
<td>The impact of GMOs on the environment in the South African legislative context.</td>
<td>Dr Steve Verryn is a Quantitative Geneticist and Tree Breeder. Steve obtained his PhD in 1994 at the University of Pretoria for his work on Improving on Best Linear Prediction for Tree Breeding. He has worked in forestry research since 1990 and is currently the senior research specialist and the Research Group Manager for the Tree Improvement Research Group at the CSIR. He has served as Chairperson/Vice Chairperson for the Gauteng branch of the S.A. Forestry Institute and for the S.A. Genetics Society. Steve has directed and co-presented a series of international courses in tree improvement, involving over 200 participants from over 20 countries. He is a NRF C-2 rated scientist and author and co-author of over 30 publications and conference papers, including 7 keynote/invited papers at overseas conferences in recent years.</td>
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<td>Andrew Morris</td>
<td>Wood properties and regulation of pulp mill furnish; lessons for tree improvement?</td>
<td>Andrew was born in the UK and remains a life-long West Ham United supporter. He graduated with a BSc Hons in Soil Science (1976), from the University of Reading. From 1979 to 1997 he worked for Usutu Pulp Company in forest research. In 1986, he obtained PhD from University of Reading, and he moved to Sappi Forests Research at Tweedie in 1997. Andrew is married to Belcy and has two daughters. He enjoys all aspects of his work that still allow him to interact with fellow forest scientists.</td>
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The different pulping characteristics of *Eucalyptus grandis* and *Eucalyptus dunnii*, based on a species x site x pulping study.

Marius du Plessis

*Mondi Business Paper, P O Box 39, Pietermaritzburg, 3200*

*(marius.duplessis@mondibp.com)*

This paper describes data and trends as generated from a site by species, by pulping experiment conducted in Mondi Business Paper. Descriptive and analytical statistics are used to establish trends of *E. grandis* and *E. dunnii* with regards to Rate of Delignification (ROD), Screened Pulp Yield (SPY) and Total Pulp Yield (TPY). A predictive model to predict TPY from explanatory variables such as ROD, basic wood density, cooking time, etc. is presented. The predictive ability of this model was found to be acceptable.

This experiment was initiated when it was first recognised that *MondiBP Forest Operations* needed to re-evaluate the “volume and density are the main criterion for species selection”- strategy in a tree breeding program. It was recognised that as a value chain, maximum economic return could be achieved if the approach of maximum volume growth was to be reassessed in the light of other contributing factors related to process and quality. It is envisaged that fibres from different species have a high diversity which may allow for specific pulping regimes or process specificity depending on product specification. If the variance is understood and this variance can be utilised in a processing environment; additional return can be expected on paper machines.

A process-based optimisation model was developed; taking cognisance of three main processing variables namely, *wood density, total pulp yield and rate of delignification*. This optimisation model could be applied not only to tree breeding principles, but also to the utilisation of landholdings of Mondi Business Paper SA (MBPSA) by converting to suitable species and by balancing the timing of delivery (quantity) and supply (quality).
The impact of GMOs on the environment in the South African legislative context.

Steve Verryn
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The rapid development of genetic modification (GM) technology, and the deployment of its products, has posed challenges to countries around the world. South Africa has responded relatively rapidly to the challenge, opportunities and implications, particularly from a legislative perspective, and in 2001, a National Biotechnology Strategy for South Africa was adopted. This legislative and policy environment has resulted in rapid and extensive deployment of GM technology in South Africa, which has in turn raised concerns as to the level of knowledge with respect to the ecological impact of the deployment of GMOs in the South African context.

The evolution of GMO-related legislation in South Africa has been followed by the practical roll-out of the policies and procedures, which have grown increasingly sophisticated. Against this backdrop, the National Environmental Management Biodiversity Act 10 of 2004 has been passed, which includes Section 78, effectively requiring risk assessments for the introduction of GMOs in the event that it is deemed that the release poses a potential threat to the rich South African biodiversity.

There is a global need to gain a better understanding of the risks which the introduction of various classes of GMOs carry, with respect to the environment. The main areas of consideration are gene pollution of indigenous species, invasiveness of GM organisms, the environmental effects of specific genes, and the effect of changed management practices. A Framework is in the process of being developed to serve as guidelines as to assessing and managing the relative risks which GMOs may carry with respect to the environment.
Wood properties are important to the end user and can often have a marked financial impact in a forests products business. If not fit-for-purpose a wood source can be rejected in a particular market. The importance of wood properties has been receiving increasing attention in tree improvement programmes. Establishing the economic importance of specific wood properties is critical to effective tree improvement. Using pulpwood as an example some aspects of this objective is explored. It is argued that, as an inherently variable resource, wood properties must be considered in the context of the entire mill furnish rather than on a situation by situation basis. Deciding what to plant requires input from both the grower and the processor.