

Laporan Tahunan 2003 Annual Report

Laporan Tahunan

2003

Annual Report



**Institut Penyelidikan Perhutanan Malaysia**  
Forest Research Institute Malaysia

**Lembaga Penyelidikan dan Pembangunan Perhutanan Malaysia**  
Malaysian Forestry Research and Development Board

**Kementerian Perusahaan Utama Malaysia**  
Ministry of Primary Industries Malaysia



**FOREST RESEARCH INSTITUTE MALAYSIA**  
Kepong, 52109 Kuala Lumpur  
Website: <http://www.frim.gov.my>



### Rasional Kulit Depan

Kuning simbol warna diraja dan hutan di Malaysia merupakan "raja". Tumbuhan di tengah-tengahnya melambangkan potensi bagi penemuan baru, ubatan baru serta kegunaan baru yang akan dapat memberi manfaat kepada generasi yang akan datang. Biru melambangkan ketenangan dan kedamaian. Jutaan rakyat Malaysia telah merasai suasana kedamaian dan ketenteraman ketika berada di dalam hutan.

### *Cover Page Rationale*

*Yellow signifies royalty and the Malaysian forest is King. Plants in the centre of the page reveals the potential of new discoveries, new drugs and new uses which will benefit generations to come. Blue signifies calmness and peace. Malaysians by the millions have experienced the peace and tranquility of the forest.*

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Laporan Tahunan 2003

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*Finance and Establishment Committee*

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LEMBAGA PENYELIDIKAN  
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Institut Penyelidikan Perhutanan Malaysia  
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INSTITUT PENYELIDIKAN  
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FOREST RESEARCH  
INSTITUTE MALAYSIA



# LAPORAN KETUA PENGARAH DIRECTOR GENERAL'S REPORT

Penubuhan Pusat Teknologi Herba FRIM dan Pusat Penyelidikan Proteomik FRIM merupakan satu perkembangan yang penting di FRIM pada tahun 2003. Pusat Teknologi Herba FRIM menghasilkan ekstrak herba yang standard menggunakan teknologi moden dalam pengisaran, pengekstrakan, pemekatan dan pembuatan serbuk untuk pengkapsulan. Peningkatan kualiti, pembungkusan dan kecekapan produk herba merupakan usaha ke arah menyediakan Pusat Teknologi Herba FRIM sebagai pusat rujukan bagi industri herba tempatan. Pusat Penyelidikan Proteomik merupakan satu-satunya pusat yang menyediakan kemudahan penyelidikan proteomik di rantau ini yang ditempatkan di agensi penyelidikan kerajaan. Sejalan dengan hasrat kerajaan untuk menjadikan bioteknologi sebagai satu sektor utama dalam ekonomi negara, Pusat Penyelidikan Proteomik ditubuhkan untuk menjalankan penyelidikan dan pembinaan kemahiran dalam kajian saintifik bidang biodiversiti. Ditempatkan di FRIM, Pusat Penyelidikan Proteomik dilengkapi sistem peralatan dan maklumat yang terkini; peralatan kromatografi dan elektroforesis cecair berprestasi tinggi, sistem pengesanan sertamerta berautomasi, alatan spektrometri jisim dan sistem maklumat berprestasi tinggi.

Pada tahun 2003, FRIM membantu Jabatan Perhutanan Negeri Pahang untuk menangani isu pembalakan haram. Memandangkan pepadanan spesies balak yang dibawa keluar dengan tunggul kayu tidak cukup untuk dijadikan sebagai bukti pembalakan haram, FRIM telah menghasilkan satu pendekatan baru yang menggunakan kaedah forensik perhutanan, iaitu satu istilah yang masih asing dalam bidang sains forensik. Melalui pensampelan kayu daripada tunggul kayu dan juga daripada balak yang dibawa keluar secara haram, pepadanan identiti dibuat melalui profil DNA. Teknik ini dibangunkan menggunakan DNA polimorf diperganda secara rawak dan polimorfisme panjang fragmen diperganda. Teknik ini digunakan di



*A significant development in 2003 was the establishment of the FRIM Herbal Technology Centre (HTC) and the Centre for Proteomic Research (CPR) at FRIM. The HTC will be producing standardised herbal extracts using modern technology of grinding, extracting, concentrating and powdering for encapsulation. By enhancing the quality, packaging and efficacy of herbal products, the HTC is poised to become a national referral centre for the local herbal industry. In line with the Government's objective of fostering biotechnology as a key sector of the nation's economy, the CPR has been set up to conduct research and skill development in the area of scientific exploration of biodiversity. The CPR is equipped with state-of-the-art instrumentation and information systems; housing high performance liquid chromatography (HPLC) and electrophoresis instruments, automated spot detection systems, mass spectrometry instruments and high performance information systems.*

*In 2003, FRIM was approached by the Pahang State Forestry Department to assist in solving an illegal logging issue. As species matching of logs taken out and tree stumps is inadequate proof for illegal logging, FRIM initiated an ingenious approach in addressing the problem using forensic forestry, a terminology unheard of in forensic sciences. By sampling wood from*

mahkamah undang-undang dalam menyelesaikan kes jenayah manusia tetapi tidak pernah digunakan dalam masalah jenayah hutan.

Tahun ini juga menghasilkan beberapa penemuan botani yang menakjubkan. Satu spesies dipterokarpa baru yang dinamai *Vatica yeechongii* ditemui di Selangor dan Negeri Sembilan manakala catatan baru bagi *Dryobalanops beccarii* yang kali pertama dijumpai dan dicatat di Borneo, telah ditemui di Johor.

FRIM telah menganjurkan persidangan dua tahun sekali iaitu *Conference on Forestry and Forest Products Research (CFFPR) 2003*. Persidangan yang bertema "Forestry for Society" diadakan di Hotel Crown Princess, Kuala Lumpur dari 6 hingga 8 Oktober 2003. Lebih daripada 300 peserta menghadiri persidangan tersebut. Sebanyak 42 kertas kerja dan 46 buah poster dibentangkan. Dua ucapan bertajuk "Restoration, rehabilitation and management of second growth and degraded forests" dan "Malaysian timber industries in the 21st century" telah disampaikan oleh Prof. Don Koo Lee dari Seoul National University, Korea, dan En. Barney Chan dari Persatuan Kayu-Kayan Sarawak.

Pada tahun ini juga, usaha-usaha dijalankan untuk membangun dan meningkatkan sistem teknologi maklumat untuk pengurusan institut dengan lebih baik serta menyediakan perkhidmatan kepada masyarakat dengan lebih cekap. Antara sistem yang dibangunkan ialah laman web FRIM yang baru, cakera padat video korporat FRIM, Sistem Pengurusan Maklumat Penyelidikan dan Sistem Perakaunan Winintegra.

Lima projek EAR dan dua projek PR memperoleh pembiayaan IRPA berjumlah RM 1.5 juta. Empat projek yang dihantar kepada IRPA sedang menunggu kelulusan manakala dua projek telah dihantar kepada Jawatankuasa Herba Kebangsaan untuk pengesahan.

*tree stumps and from logs illegally taken out of the forest, it is possible to match their identity with high certainty through DNA profiling. Techniques are being developed using randomly amplified polymorphic DNA (RAPD) and amplified fragment length polymorphism (AFLP). These techniques have been used in the court of law in solving human crimes but never before in solving forest crimes.*

*The year saw some remarkable botanical discoveries. A new dipterocarp species named Vatica yeechongii was found in Selangor and Negeri Sembilan while a new record of Dryobalanops beccarii, first described and recorded in Borneo, was found in Johor.*

*FRIM organised the Biennial Conference on Forestry and Forest Products Research (CFFPR 2003) during the year. With the theme, "Forestry for Society" the conference was held at the Crown Princess Hotel in Kuala Lumpur from 6 to 8 October 2003. More than 300 participants attended the Conference where a total of 42 oral papers and 46 posters were presented. Two keynote papers entitled, "Restoration, rehabilitation and management of second growth and degraded forests" and "Malaysian timber industries in the 21st Century" were presented by Prof. Don Koo Lee of the Seoul National University and Mr. Barney Chan of the Sarawak Timber Association.*

*Throughout the year, much effort had been made to develop new and improved IT systems for better management of the institute and more efficient extension of services to the public. Among the systems developed were a new FRIM Website, Corporate Video of FRIM in CD format, Research Information Management System and Winintegra Accounting System.*

*Five EAR and two PR projects obtained IRPA funding amounting to a total of RM1.5 million. Four EAR projects have been submitted to IRPA awaiting approval while another two projects have been*

## AHLI DIREKTORAT DIRECTORATE MEMBERS

Hingga 30 September *Until 30 September*

Pelan Strategik FRIM 2004-2013 telah pun siap dan ia merupakan sambungan kepada Pelan Strategik 1991-2000. FRIM merupakan organisasi penyelidikan pertama di negara ini yang mempunyai pelan strategik jangka panjang. Dengan mendokong aspirasi yang sama, pelan terbaharu ini menyediakan perspektif dan hala tuju yang lebih jelas, melalui pelan tindakan tahunan bagi lima tahun pertama ke arah memperkukuh peranan FRIM dalam pembangunan negara dalam sektor pembangunan bagi lima tahun akan datang.

Pada bulan Julai 2003, Dato' Zul Mukshar Dato' Hj. Md. Shaari dilantik sebagai Penasihat kepada Menteri di Kementerian Perusahaan Utama Malaysia bagi tempoh dua tahun. Pejabat beliau ditempatkan di FRIM dan tugas utama beliau adalah untuk mewujudkan kerjasama yang lebih erat antara FRIM dengan Jabatan Perhutanan.



**DATO' DR. ABDUL RAZAK MOHD. ALI**  
DIMP, JMN, FMIC  
Ketua Pengarah FRIM  
*Director General FRIM*

*submitted to the National Herbal Committee for its endorsement.*

*The FRIM Strategic Plan 2004-2013 was finalised. It is a continuation of the earlier Strategic Plan 1991-2000. FRIM is the first research organisation in the country to have long-term strategic plans. Advocating similar aspirations, the present plan provides clear perspectives and directions with annual action plans drawn up in the first five years for reinforcing FRIM's role towards nation building in the forestry sector for the next ten years.*

*In July 2003, Dato' Zul Mukshar Dato' Hj. Md. Shaari took up a two-year tenure as Advisor to the Minister of Primary Industries Malaysia. Working from an office in FRIM, his primary task is to foster closer collaboration between FRIM and the Forestry Department.*

### Pengerusi *Chairman*

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Pegarah Program Pemprosesan dan Teknologi Kayu  
*Director Timber Processing and Technology Program*

## AHLI DIREKTORAT DIRECTORATE MEMBERS



Berdiri (dari kiri) *Standing (from left)*

En. Mohd. Zamshari Abd. Rahman  
Dr. Abdul Rashid Hj. Abd. Malik  
Dr. Chan Hung Tuck  
Dr. Woon Weng Chuen  
Dr. Mohd. Nor Mohd. Yusoff  
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Dr. Baskaran Krishnapillay  
Dr. Shamsudin Ibrahim  
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Dr. Abd. Latif Mohmod  
Y. Bhg. Dato' Dr. Abdul Razak Mohd. Ali  
Dr. Hoi Why Kong  
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FRIM bertanggungjawab memajukan pengetahuan dan teknologi yang sesuai bagi pemuliharaan, pengurusan, pembangunan dan penggunaan sumber-sumber hutan, dan akan mencapai kecemerlangan dalam penyelidikan saintifik, pembangunan dan pengembangan dalam sektor perhutanan

- Menjana pengetahuan dan membangunkan teknologi yang sesuai bagi pemuliharaan, pengurusan, pembangunan dan penggunaan sumber hutan
- Menyediakan perkhidmatan berasaskan penyelidikan yang memenuhi keperluan pelanggan
- Memperdagangkan hasil-hasil penyelidikan dan pembangunan
- Memperoleh dan menyebarkan maklumat
- Meningkatkan kesedaran terhadap peranan alam sekitar dan pemuliharaan hutan
- Mencapai kecemerlangan dan memperoleh kepimpinan dalam penyelidikan perhutanan tropika

## MISI

## MISSION

*FRIM shall develop appropriate knowledge and technology for the conservation, management, development and utilisation of forestry resources; and shall pursue excellence in scientific research, development and technology transfer in the forestry sector*

## OBJEKTIF

## OBJECTIVES

- *To generate knowledge and develop appropriate technology for the conservation, management, development and utilisation of forestry resources*
- *To provide research-based services to meet the needs of clients*
- *To commercialise R&D results*
- *To acquire and disseminate information*
- *To create awareness on the environmental and conservation roles of forestry*
- *To pursue excellence and attain leadership in tropical forestry research*

Fungsi dan aktiviti utama FRIM adalah:

- Untuk menjalan dan menganjurkan penyelidikan mengenai pembangunan sektor perhutanan dan pemuliharaan sumber hutan
- Untuk memperoleh dan menyebarkan maklumat berkaitan dengan pengurusan dan pembangunan perhutanan, hasil hutan dan penggunaan hasil hutan
- Untuk menyelaraskan penyelidikan berhubung dengan perhutanan dan penggunaan sumber hutan di dalam Malaysia dan mengadakan hubungan kerjasama dengan badan-badan di luar Malaysia berkaitan dengan perkara-perkara tersebut

## FUNGSI

## FUNCTIONS

*The primary functions and activities of FRIM are:*

- *To conduct and advance research towards development of the forest and forestry industries sector*
- *To obtain and disseminate information regarding the management and development of forestry, forestry products and their utilisation*
- *To co-ordinate research activities related to forestry and utilisation of forestry resources in Malaysia, and to facilitate co-operation and linkages with organisations outside Malaysia for the above matters*

## Kami berjanji

untuk berusaha membangun dan menggalakkan penggunaan sumber dan hasil hutan secara berkekalan melalui penyelidikan, pengembangan dan penggunaannya. Bagi tujuan ini, kami memberi jaminan seperti berikut:

- Menyediakan penyelesaian praktikal kepada masalah berkaitan pengurusan dan penggunaan sumber dan hasil hutan dengan tepat, jimat dan mengikut jadual
- Menyediakan satu program pembangunan sumber manusia bagi mewujudkan golongan saintis yang berkebolehan dan berwibawa
- Menyebarkan hasil teknologi, penyelidikan serta memberi perkhidmatan nasihat dan teknikal yang tepat dengan cepat secara profesional dan mudah difaham kepada setiap peringkat pengguna
- Menjamin untuk memberi kemudahan dan perkhidmatan profesional dalam meningkatkan kesedaran awam terhadap alam sekitar
- Menyediakan suasana kerja yang tidak birokratik bagi menggalakkan cetusan idea di kalangan saintis dan perhubungan lebih rapat dengan pelanggan

## PIAGAM PELANGGAN

## CLIENTS' CHARTER

### *We pledge*

*to develop and enhance the utilisation of forestry resources and produce on a sustainable basis through research, development and application. For this purpose, we ensure the following:*

- *Make available reliable, economical and timely solutions to problems related to management and utilisation of forestry resources and forestry produce*
- *Prepare a human resource development programme to create a core of dedicated scientists of calibre and ability*
- *Disseminate speedily appropriate and reliable scientific and technological information in a professional and easily accessible manner to all levels of clients and users through consultation and advice*
- *Provide professional advice to the public to ensure that public awareness on the environment is heightened*
- *Provide a conducive working environment to encourage creativity among scientists, and to maintain a close rapport with clients*

## PENYELIDIKAN DAN PEMBANGUNAN RESEARCH AND DEVELOPMENT

### Kami

bertanggungjawab untuk mencapai kecemerlangan dalam penyelidikan saintifik dan pembangunan dalam usaha pengembangan sektor perhutanan dan juga menghasilkan inovasi yang sesuai bagi semua pelanggan. Kami akan pastikan semua yang bekerja dengan kami bersama-sama bertanggungjawab dan mematuhi standard kualiti yang telah ditetapkan

## DASAR KUALITI QUALITY POLICY

### We

are committed to achieving excellence in scientific research and development in the efforts to develop the forestry industries sector and also to derive innovations for the benefit of the clients. We shall ensure that those working together with us shall be committed and adhere to the quality standards that have been identified

“Kualiti teras kecemerlangan  
Inovasi kunci keunggulan”

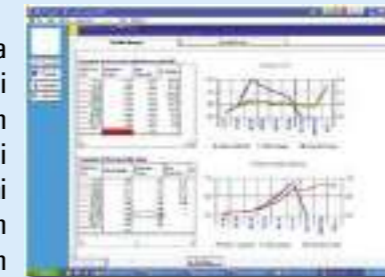
## SLOGAN KUALITI QUALITY SLOGAN

“Quality is the pillar for excellence  
Innovation is the key to preeminence”

### PENILAIAN STOK PERTUMBUHAN HUTAN DIPTEROKARPA CAMPUR

Satu sistem didirikan untuk mereka bentuk dan menilai keadaan dirian untuk hutan dipterokarpa campur primer melalui manipulasi dirian hutan. Sistem ini berasaskan konsep pengubahsuaian saiz-kepadatan maksimum. Dalam mereka bentuk dirian, sistem ini mengambil kira kerosakan yang mungkin berlaku kepada dirian baki semasa pembalakan, tahap penstockan, saiz tumbuhan dan spesies utama. Pilihan bagi kaedah had diameter minimum juga dimasukkan. Sistem reka bentuk keadaan dirian yang diperlukan dan perancangan pertumbuhan stok menggunakan teknik perancangan jadual dirian yang mudah bagi kumpulan spesies utama agar pengurus hutan dapat menilai implikasi keputusan mereka untuk mencapai objektif pengurusan.

Sistem ini dibangunkan berdasarkan dua petak hutan campur primer enam hektar di H.S. Pasoh dan H.S. Semangkok. Konsep dan pendekatan minimum diamalkan sekarang di hutan dipterokarpa di Asia Tenggara. Sistem ini turut mengambil kira keupayaan pertumbuhan maksimum dirian tersebut; menyediakan kefleksibelan untuk mencapai objektif pengurusan yang berbeza melalui manipulasi penstockan, struktur saiz dan kandungan spesies; menyediakan lebih banyak pilihan untuk membantu pengurus hutan dalam membuat keputusan yang mencapai objektif pengurusan; memeriksa keadaan dirian sebelum menentukan regim pembalakan; dan membolehkan penggunaan kaedah tebangan memilih.



Output komputer menunjukkan bahagian pertumbuhan stok yang ingin dkekalkan selepas tebangan  
Computer output showing the proportion of growing stock to be retained after harvesting

### ASSESSMENT OF GROWING STOCK FOR MIXED DIPTEROCARP FOREST

A system to design and assess desired stand condition for primary mixed dipterocarp forest through a manipulation of forest stand was developed. The system was based on the modification of the maximum size-density concept. In designing the stand conditions, the system considered potential damage to the residual stand during timber harvesting, level of stocking, size structure and major species. An option for minimum diameter limit method was also included in the system. The system allowed for designing desired stand conditions and projecting growing stock using a simple stand table projection technique for major species group so that forest managers can assess implication of their decision to meet desired management objectives.

The system was developed based on two 6-ha primary mixed dipterocarp forest plot at the Pasoh F.R. and the Semangkok F.R. The concept and approach have many advantages over the minimum diameter limit approach currently practised in many dipterocarp forest of South East Asia. Among others, the system considers maximum growing capacity of the stand; provides flexibility to meet a variety of management objectives through manipulation of stocking, size-structure and species composition; provides more options to aid forest managers in making decisions to meet management objectives; examine stand condition before deciding on the cutting regime; and allows application of selection and/or selective cutting methods.

### SISTEM ANALISIS PERTUMBUHAN DAN HASIL

Maklumat tentang pertumbuhan dan hasil dapat digunakan untuk menilai keberkesanan amalan pengurusan hutan pada masa kini. Sehingga sekarang, Jabatan Perhutanan Semenanjung Malaysia telah memantau 13 petak pertumbuhan dan hasil secara tetap. Sejak penubuhannya, penyelenggaraan dan pengukuran petak dijalankan secara tetap mengikut jadual. Petak ini diukur pada selang yang berbeza, dianalisis secara berbeza dan beberapa hasil telah diterbitkan. Data sebelumnya dianalisis secara berbeza oleh orang yang berbeza. Tiada format piawai yang digunakan dalam analisis tersebut. Bagi mendapatkan hasil yang lebih bermakna terutama untuk mencapai objektif pengurusan hutan secara

### GROWTH AND YIELD ANALYTICAL TOOLS

Information on growth and yield can be used to gauge the effectiveness of present forest management practices. To date, the Forestry Department Peninsular Malaysia has monitored 13 growth and yield plots on a regular basis. Since their establishment, maintenance and re-measurements of the plots have been carried regularly according to prescribed schedules. They have been measured at different intervals, variably analysed and some of the results have been published. The previous data were analysed differently by different people. No standard format had been used in the analysis. In order to make the results more meaningful especially in achieving the objectives of sustainable forest

maman, data dari petak yang berbeza perlu disusun semula dan dianalisis untuk menjawab soalan yang berkaitan dengan pertumbuhan di dirian baki.

Oleh yang demikian, FRIM telah membangunkan satu sistem untuk menganalisis data pertumbuhan dan hasil yang diperoleh daripada petak pertumbuhan dan hasil di seluruh Semenanjung Malaysia. Sistem ini membolehkan pengguna menganalisis data secara seragam untuk pertumbuhan diameter, pertumbuhan isipadu, pertumbuhan luas pangkal, kematian tahunan dan penokokan bagi mana-mana petak pertumbuhan dan hasil yang telah dibangunkan. Pengguna berhak untuk menentukan hasil yang diperoleh, contohnya tambahan diameter sama ada melalui kumpulan spesies atau melalui kelas diameter. Dalam menganalisis data, sistem ini mengambil kira tahun penubuhan, rawatan yang dilakukan ke atas petak dan susun atur petak. Satu jadual dirian yang mudah bagi kumpulan spesies utama dapat juga dihasilkan oleh sistem ini, supaya pengurus hutan mendapat idea yang pantas dan umum tentang keadaan hutan.

Berdasarkan analisis yang dijalankan di 10 petak, didapati hutan kita tumbuh lebih perlahan daripada yang dikehendaki di bawah Sistem Pengurusan Memilih. Pertumbuhan diameter hanyalah kira-kira 0.4-0.7 cm setahun manakala pertambahan isipadu hanyalah 1-1.5 m<sup>3</sup>/ha/tahun. Analisis juga menunjukkan tiada perbezaan bererti dalam pertambahan diameter antara rawatan (contohnya had tebanan yang berbeza dan kaedah tebanan yang berbeza). Kematian yang tinggi lebih daripada 5% dicatatkan 1-3 tahun selepas pembalakan akibat daripada kerosakan pokok semasa operasi tebanan. Kadar kematian stabil kira-kira 2% di petak yang dibalak 15 tahun yang lalu. Hasil analisis juga menunjukkan penokokan yang lebih tinggi iaitu kira-kira 2% di hampir semua petak. Bagaimanapun, penokokan yang tinggi ini tidak memadai untuk kehilangan ofset isipadu dirian akibat kematian. Unjuran isipadu mudah yang dilakukan menunjukkan untuk mencapai isipadu asal memerlukan lebih kurang 120 tahun jika hutan tersebut diurus menggunakan sistem pengurusan monosiklik tetapi tidak penting untuk sistem pengurusan polisiklik. Untuk mencapai kemampunan, kitaran tebanan mestilah dipanjangkan kepada 40-60 tahun.

## PROSPEK PASARAN JATI

Kajian ini adalah atas permintaan Lembaga Urusan dan Tabung Haji (LUTH) dengan objektif utama untuk menilai prospek pasaran jati (*Tectona grandis*) yang ditanam di Malaysia. Fokus kajian pasaran ialah jati yang ditanam di Semenanjung Malaysia dan Sabah, khususnya jati yang ditanam di tiga anak syarikat LUTH. Di samping memberikan penekanan kepada kos dan keuntungan menanam jati di peringkat nasional, perhatian khusus juga diberikan

*management, the data from different plots need to be restructured and re-analysed to answer many questions related to the growth of residual stand.*

*Therefore, FRIM has developed a tool to analyse growth and yield data obtained from growth and yield plots throughout Peninsular Malaysia. The system allows users to analyse the data uniformly for diameter growth, volume growth, basal area growth, annual mortality and annual in-growth for any growth and yield plots established. Users have a right to choose how the results will appear, for example, diameter increment either by species group or by diameter class. In analysing the data, the system considers the years of establishment, treatment done to the plots and layout of the plot. A simple stand table for major species group can also be produced by the system, so that forest managers can have a general and quick overview on the condition of the forest.*

*Based on analysis done on 10 plots, it was found that our forests are growing slower than what has been anticipated under the Selective Management System (SMS). The diameter growth is only about 0.4-0.7 cm/year while volume increment is only about 1-1.5 m<sup>3</sup>/ha/year. Analysis also showed that there is no significant difference in diameter increment between treatments (i.e. different cutting limits and different logging method). High mortality of more than 5% was recorded 1-3 year after logging due to tree damage during harvesting operations. Rate of mortality stabilised at about 2% in plots logged 15 years ago. Results of analysis also indicated that higher in-growth of about 2% resulted in almost all plots. However, this high in-growth is not sufficient to offset lost of stand volume due to mortality. Simple volume projection done showed that to reach original volume, about 120 years is required if the forest is to be managed on a monocyclic management system but this is not really important for a polycyclic management system. It is preliminary recommended that to attain sustainability the cutting cycle may have to be lengthened to about 40-60 years.*

## MARKET PROSPECTS OF TEAK

*This is a study requested by the Lembaga Urusan dan Tabung Haji (LUTH), with the main objective to assess the market prospects of teak (*Tectona grandis*) planted in Malaysia. The focus of the market study was on teak planted in Peninsular Malaysia and Sabah, particularly teak planted by the three LUTH subsidiaries. Besides highlighting costs and benefits of planting teak at the national level, special attention also was given to the prospects of locally planted*

kepada prospek jati yang ditanam di dalam negeri yang dikaitkan dengan penawaran dan permintaan daripada pengeluar utama dunia yang lain seperti Myanmar, Indonesia dan India.

Analisis kewangan yang dijalankan ke atas tiga anak syarikat LUTH mendapati projek jati ialah satu pelaburan yang baik. Nilai NPV dan IRR bagi satu hektar tanaman jati dengan pusingan 15 tahun ialah RM14,311 dan 17.1%, sementara dengan pusingan 20 tahun, nilainya ialah RM10,667 dan 14.5%. Walau bagaimanapun, nilai NPV dan IRR jatuh kepada RM7,006 dan 12.8% apabila jangka masa pusingan dilanjutkan kepada 25 tahun. Nilai IRR 12.8% adalah setanding dengan 11% yang diperoleh daripada perladangan jati di Costa Rica dengan kadar pusingan yang sama. Dalam masa yang sama, sekiranya jati ditanam bersama-sama getah, nilai IRR ialah 17.1%. Nilai IRR yang munasabah sebanyak 17.1% yang menyamai penanaman jati secara tanaman tunggal patut digunakan untuk menggalakkan lagi penglibatan aktif pekebun-pekebun kecil dalam penanaman jati. Analisis sensitiviti yang dijalankan mendapati walaupun projek berada dalam keadaan ekstrem, sebagai contohnya, 20% perubahan positif dan negatif dalam kos dan harga, nilai IRR ialah 12.8% melebihi kadar diskaun 10% yang biasanya dikenakan oleh bank-bank komersial.

Skala operasi juga mempengaruhi keberuntungan sesuatu projek. Contohnya, nilai IRR telah meningkat daripada 17.2% kepada 18.1% apabila skala projek jati ditambah kepada 1000 ha. Pada keseluruhannya, projek jati didapati lebih menarik dari segi pulangan modal dan nilai IRR berbanding sentang (14.7%), *Acacia mangium* (14.5%), serta getah dan sentang (16.1%). Dari perspektif pertumbuhan, jati yang tumbuh di Malaysia didapati mempunyai ciri pertumbuhan yang sama sebagaimana jati yang ditanam di tempat-tempat lain di dunia. Contohnya, jati berumur sembilan tahun yang ditanam dengan kelapa sawit di Semenanjung Malaysia mempunyai diameter aras dada 17 cm manakala jati berumur 10 tahun yang ditanam di India dan Thailand mempunyai diameter aras dada 14.7 cm dan 15 cm.

Secara umumnya, permintaan dunia terhadap kayu dijangka akan meningkat. Contohnya, permintaan kayu bagi industri dijangka akan meningkat daripada 1.49 bilion m<sup>3</sup> pada tahun 1996 kepada 1.87 bilion m<sup>3</sup> pada tahun 2010.

*teak in relation to the supply and demand of other major world producers such as Myanmar, Indonesia, and India.*

*The financial analyses carried out for the three LUTH subsidiaries indicated that the teak project is a viable venture. NPV and IRR values based on one hectare of teak with a 15-year rotation were RM14,311 and 17.2%, respectively, whereas with a 20-year rotation, the values were RM10,667 and 14.6%. However, NPV and IRR values decreased to RM7,006 and 12.8% when the rotation period was extended to 25 years. The IRR value of 12.8% is comparable to that of 11% derived from a teak plantation in Costa Rica, with a similar rotation. On the other hand, when teak was intercropped with rubber, the IRR value was 17.1%. A reasonable IRR value of 17.1%, which is equivalent to that for planting teak as a monocrop, should be used to further encourage smallholders active participation in planting teak. Sensitivity analysis carried out indicated that even though the project was subjected to the most extreme situations, i.e., 20% positive and negative changes in cost and price, the IRR value was 12.8%, well above the discount rate of 10% commonly charged by local commercial banks.*

*The scale of operation also influenced the project's viability. For instance, it was discovered that IRR values improved from 17.2% to 18.1% when the scale of the teak project was extended to 1,000 ha. Above all, the teak project was more attractive in terms of return on investment and IRR values as compared with sentang (14.7%), *Acacia mangium* (14.5), and rubber and sentang (16.1%). From the perspective of overall performance, teak grown in Malaysia seems to perform as well as teak planted in other parts of the world. For example, 9-year-old teak planted together with oil palm in the Peninsula had a dbh of 17 cm, whereas 10-year-old teak planted in India and Thailand had a dbh of 14.7 cm and 15 cm, respectively.*



Pokok jati yang ditanam oleh pekebun kecil  
Rows of young teak planted by smallholders

Disebabkan sumber kayu yang semakin berkurangan dari hutan asli dan hutan asli dianggap memainkan peranan penting dalam alam sekitar di samping menyediakan kayu dan hasil bukan kayu, jati dari hutan ladang dijangka akan memainkan peranan yang lebih penting pada masa hadapan. Statistik terdahulu menunjukkan harga kedua-dua kayu balak jati dan kayu gergaji meningkat dalam dekad sebelumnya.

Berdasarkan beberapa analisis yang dijalankan dalam kajian ini dan penemuan utama yang menarik tentang pengurusan dan potensi pasaran untuk jati, Malaysia harus bertindak secepat mungkin sebagai sebuah negara yang berpotensi dalam perdagangan kayu antarabangsa. Cadangan-cadangan yang berikut hendaklah dilaksanakan seberapa segera.

- Tambahkan keluasan kawasan peladangan jati
- Galakkan lebih ramai pekebun kecil menanam jati
- Lanjutkan kitaran giliran
- Tubuhkan bank data jati kebangsaan
- Tawarkan pakej kewangan yang istimewa bagi jati
- Sentiasa mengemaskini data penyelidikan dan pembangunan (R&D) jati
- Wujudkan hubungan yang erat dengan negara-negara pengeluar jati yang lain

Sebagai sebuah negara yang baru dalam bidang penanaman jati secara komersial, Malaysia harus mewujudkan hubungan yang rapat dengan negara-negara pengeluar yang lain seperti Indonesia, Myanmar dan India. Mempelajari daripada pengalaman negara-negara tersebut dalam penanaman jati akan membantu Malaysia mencari tapak dalam satu perdagangan yang semakin mendapat perhatian di rantau ini.



Pokok jati yang ditanam di Mata Ayer, Perlis  
A row of teak trees planted in Mata Ayer, Perlis

*In general, the global demand for wood is expected to increase. For instance, the demand for industrial wood is expected to rise from 1.49 billion m<sup>3</sup> in 1996 to 1.87 billion m<sup>3</sup> in 2010. Because of the dwindling source of timber from natural forests and because natural forests are expected to perform other environmental functions in addition to providing timber and non-timber products, teak from forest plantations is expected to play a much more prominent role in the future. Past statistics also have shown that the prices of both teak logs and sawn timber have increased in the last decade.*

*Resulting from various analyses carried out in this study, the following recommendations need to be implemented.*

- Expand the area under teak plantation
- Encourage more smallholders to plant teak
- Extend the rotation cycle
- Set up a national data bank on teak
- Offer a special financial package for teak
- Keep up to date on R&D on teak
- Establish close rapport with other teak-producing countries

*As a beginner in planting of teak on a commercial basis, Malaysia should establish close rapport with other producing countries, such as Indonesia, Myanmar, and India. Learning from these countries' long working experience in teak would help Malaysia gain a foothold in one of the most exciting trades in the region.*

## PEMBANGUNAN PANEL KOMPOSIT SIMEN RINGAN YANG DIPERKUKUH DENGAN GENTIAN KELAPA SAWIT

Campuran gentian kayu di dalam konkrit akan menghasilkan bahan komposit. Bahan komposit ini mestilah mengandungi sekurang-kurangnya simen hidraulik, air dan gentian kayu dalam bentuk tatal kayu, serpai kayu ringan atau partikel kayu dengan kadar tertentu. Campuran gentian kayu di dalam konkrit dijangka dapat meningkatkan lengkung pemasangan beban dan kekuatan tegangan bahan-bahan komposit simen. Kajian ini menekankan tentang penyelidikan pembangunan komposit simen yang diperkukuh dengan gentian kelapa sawit ringan, untuk penyekat dinding gelas tanpa beban dalam pembinaan rumah.



Bahan binaan daripada komposit simen  
Building materials made of cement composites

Komposit ini menggunakan gentian kelapa sawit (batang dan tandan kosong) yang diambil dari ladang kelapa sawit atau kilang kelapa sawit. Kajian sebelum ini menunjukkan gentian batang kelapa sawit mengandungi kekuatan tegangan yang tinggi, setanding gentian asli yang lain seperti jut, sisal dan sabut kelapa sawit. Ia juga berpotensi untuk digunakan sebagai bahan pengukuh dalam pengeluaran komposit yang diperkukuh dengan gentian asli. Pengukuhan gentian kelapa sawit antara 2 hingga 50% (berdasarkan berat simen) ke dalam campuran air dan simen menunjukkan kepadatan kurang daripada 1000 kg/m<sup>3</sup> selepas 14 hari pematangan pada suhu bilik (cuaca di Malaysia). Dimensi komposit yang dihasilkan ialah 390 mm (l) x 190 mm (h) x 90 mm (t), tetapi saiz dapat diubah bergantung kepada acuan yang digunakan.

Antara kebaikan produk ini berbanding bata biasa seperti bata pasir atau bata tanah liat ialah penambahbaikan bahan rapuh komposit simen, ringan secara relatif lebih daripada 40% bata tanah liat, permukaan yang licin, mematuhi piawai dua jam integrasi dan tebatan bagi

## DEVELOPMENT OF LIGHTWEIGHT OIL PALM FIBRE REINFORCED CEMENT COMPOSITE

*The incorporation of wood fibres in concrete will result in a composite material. This composite material must contain at least hydraulic cement, water and wood fibres in the form of wood wool, lightweight woodchips or wood particles of certain ratios. The incorporation of wood fibres in concrete is expected to enhance the load-deflection curve and tensile strength of cement composite materials. This study highlights our research on the development of lightweight oil palm fibre reinforced cement composite, targeted for non-load bearing wall partition in housing construction.*

*This composite utilises oil palm fibres (both trunk and empty fruit bunch fibres), which is normally discarded from oil palm plantations and mills. Previous study indicated that trunk fibres possess high tensile strength that is comparable to other natural fibres such as jute, sisal and coconut coir. They also have great potential as reinforced material. The incorporation of oil palm fibre in a range between 2 and 50% (based on cement weight) into cement-water admixtures gave a density of less than 1000 kg/m<sup>3</sup> after 14 days of curing at room temperature. The dimensions of composite produced were 390 mm (l) by 190 mm (h) by 90 mm (t), but the sizes can be changed accordingly, depending on the mould used.*

*Among the advantages of this product compared to conventional bricks are improvement in the brittle-fracture of cement composite, relatively lightweight by more than 40% of clay brick, smooth surface, compliance to two*



Bangunan yang dibina daripada komposit simen  
Building constructed with cement composites

ujian ketahanan api untuk gelas tanpa beban dalam unsur binaan (BS 476: Bahagian 22: 1987) dan meningkatkan kehilangan transmisi bunyi lebih daripada 50%. Di samping itu, produk ini juga mempunyai kebolehkerjaan yang baik untuk pemotongan, penyekeruan dan kerja ubahsuai yang diperlukan, menggunakan peralatan kerja yang biasa.

Penggunaan produk ini akan menggalakkan konsep binaan yang lebih cepat dan kering pada masa akan datang. Kebaikan yang telah dinyatakan dijangka akan menjadikan produk ini satu pilihan yang tepat pada masa hadapan dalam industri komponen sistem binaan untuk perumahan atau kompleks.

### E-SISA KELAPA SAWIT

E-OPR (Sisa Kelapa Sawit) merupakan sebuah projek yang menggabungkan teknologi maklumat dan multimedia sebagai alat penyebaran hasil R&D tentang penggunaan sisa kelapa sawit. Peneroka FELDA di Mempaga, Pahang telah dipilih untuk menerima manfaat daripada kajian ini melalui penubuhan industri hiliran di premis mereka. Untuk mencapai matlamat ini, satu program kesedaran terhadap kepentingan dan penggunaan ICT, pendedahan dan latihan untuk menghasilkan produk yang bernilai-tambah daripada OPR telah dijalankan di Kompleks Mempaga. Di samping itu, bantuan teknikal akan diberikan kepada peneroka tentang penubuhan industri hiliran yang sebenarnya. Kesimpulannya, portal web E-OPR yang mengandungi maklumat yang mesra-pengguna, menyeluruh dan dinamik akan memberi manfaat kepada peneroka FELDA untuk meningkatkan ekonomi mereka. Mereka dapat menggunakan OPR untuk menghasilkan produk komersial yang berguna untuk menjana pendapatan tambahan kepada komuniti di FELDA.



Kakitangan FRIM menunjukkan penggunaan glu untuk membuat tikar sungkupan  
FRIM staff demonstrating the application of glue in making mulch

*hours integration and insulation of fire testing for non-load bearing element of construction (BS 476: Part 22: 1987) and improvement in sound transmission loss by more than 50%. In addition, this product also has good workability for cutting, nailing, screwing and renovation work as required, using common woodworking tools.*

*The utilisation of this product will promote the dry and faster construction concept in the near future. The above advantages are expected to place this product as a logical choice for future industrial building system component for housing or commercial complex construction.*

### E-OIL PALM RESIDUES (E-OPR)

*This project is an application to demonstrate the use of IT and multimedia in disseminating R&D findings on the utilisation of oil palm residues (OPR). Oil palm FELDA settlers at Mempaga in Pahang were chosen as the principal beneficiary towards eventual establishment of a cottage industry at their premise. To achieve this goal, a comprehensive awareness programme on the importance and application of ICT and training on technical know-how to convert OPR into value-added products will be carried out at the Mempaga Complex. Further, technical assistance will be extended to the settlers towards the actual industry establishment. All in all, the E-OPR web portal that houses an array of user-friendly, comprehensive and dynamic information will benefit the FELDA settlers to improve their economy. They can convert OPR into useful commercial products that can generate additional income to the FELDA community.*



Mereka yang memperoleh manfaat daripada program E-OPR  
Beneficiaries of the E-OPR program

### KOMPOS GENTIAN KELAPA SAWIT

Kompos kini semakin menjadi pilihan sebagai bahan berasaskan organik untuk memperbaiki struktur tanah terutamanya kepada pengusaha tapak semaian dan landskap. Bahan ini dihasilkan daripada pelbagai bahan organik yang telah melalui proses pengkomposan. Di Malaysia, sisa pepejal industri kelapa sawit daripada kilang dan ladang didapati sesuai untuk dijadikan bahan asas untuk penghasilan kompos. Di samping itu, sisa cecair kilang kelapa sawit sesuai sebagai bahan tambahan kerana ia mengandungi nutrien penting tumbuhan dan pelbagai jenis mikroorganisma yang boleh membantu proses pengkomposan. Kajian yang dijalankan oleh FRIM menunjukkan biojisim kelapa sawit (contohnya gentian mesokarpa, tandan kosong kelapa sawit dan batang yang telah dilerai) merupakan bahan utama dalam proses pengkomposan. Kompos yang terhasil amat sesuai untuk kegunaan dalam bidang pertanian dan perhutanan.



Proses pereputan dengan gentian kelapa sawit  
The composting process using palm fibres

### PEMASARAN HERBA DAN PRODUK HERBA

Kajian secara kerjasama dengan MARDI ini dijalankan dari tahun 2002 hingga 2003. Objektif kajian adalah untuk mendapatkan maklumat secara menyeluruh tentang sumber-sumber yang digunakan dalam pemasaran herba dan produk herba dan menentukan nilai pasaran industri herba di Malaysia. Kajian dijalankan di lima wilayah iaitu Wilayah Utara (Perlis, Kedah, Pulau Pinang), Wilayah Tengah (Perak, Selangor, Kuala Lumpur), Wilayah Selatan (Negeri Sembilan, Melaka, Johor), Wilayah Timur (Kelantan, Terengganu, Pahang) dan Sabah, bagi menggambarkan taburan geografi pemain peranan utama dalam industri herba. Responden yang ditemu bual terdiri daripada pengeluar, peruncit bagi perubatan Cina (sinseh), peruncit perubatan moden dan herba (farmasi) dan kumpulan penjagaan diri.

#### Kumpulan Sinseh

Penyelidik telah menemu bual seramai 147 responden. Kebanyakan responden yang berpengalaman terdapat di

### COMPOST FROM OIL PALM FIBRES

*Compost is becoming increasingly popular as an organic-based soil amendment material, particularly to plant nursery and landscape operators, and growers. The material is produced from various organic materials, which have undergone certain degree of decomposition. In Malaysia, oil palm solid residues from mills and plantations are found to be suitable as feedstock for compost production. In addition, liquid residues from the industry are suitable as compost additive since they contain valuable plant nutrients and microorganisms useful for the composting process. Based on research carried out by FRIM, it can be concluded that oil palm biomass (e.g. mesocarp fibres, shredded empty fruit bunches and trunk fibres) is excellent feedstock for compost production. Compost produced is suitable for application in horticulture and forestry.*

### MARKETING OF HERBS AND HERBAL PRODUCTS

*This collaborative study with MARDI was carried from 2002 to 2003. Objectives of the study are to obtain comprehensive information on resources used in the marketing of herbs and herbal products and to determine the market value of herbal industry in Malaysia. Surveys were conducted in five regions namely, North Region (Perlis, Kedah and Penang), Central Region (Perak, Selangor and Kuala Lumpur), South Region (Negeri Sembilan, Melaka, and Johor), East Region (Kelantan, Terengganu and Pahang) and Sabah, to reflect the geographic distribution of players in herbal industry. The respondents interviewed comprised of manufacturers, retailers of Chinese medicine (Sinseh), retailers of modern and herbal medicine (pharmacies) and the personal care group.*

#### Sinseh Group

*A total of 147 respondents were interviewed. Most experienced respondents are located in the North Region with an average number of 30 years in business while*



Wilayah Utara dengan purata 30 tahun dalam perniagaan tersebut sementara responden yang berada di Sabah kurang berpengalaman iaitu 15 tahun. Produk perubatan tradisional Cina merupakan produk utama yang dijual di kedai sinseh. Secara purata, sebanyak 1,276 produk perubatan tradisional Cina diperagakan, diikuti oleh produk makanan kesihatan sebanyak 680 unit, produk makanan tambahan sebanyak 405 unit dan produk penjagaan diri sebanyak 258 unit. Kebanyakan produk dipasarkan di pasaran tempatan. Purata jualan tahunan produk perubatan tradisional Cina juga mencatatkan jualan juga mencatatkan jualan sebanyak RM77,226, diikuti produk makanan kesihatan sebanyak RM29,997, produk makanan tambahan sebanyak RM14,057 dan produk penjagaan diri sebanyak RM8,004. Secara keseluruhannya, purata nilai pusingan jualan tahunan ialah RM129,284 iaitu produk perubatan tradisional menyumbang 60% daripada nilai pasaran. Dengan mengambil kira jumlah populasi kedai sebanyak 5,000 unit di Malaysia, nilai pusingan jualan tahunan dianggarkan sebanyak RM646 juta dengan produk perubatan tradisional Cina menyumbang sebanyak RM386 juta.

#### Farmasi

Penyelidik hanya mengenal pasti dan membuat janji temu dengan hanya 108 farmasi. Secara purata, farmasi tersebut telah terlibat dengan industri herba selama 6.6 tahun. Sumber produk farmasi adalah daripada pengedar, pengimport dan pengeluar. Produk yang dijual ialah sama ada produk tempatan atau diimport. Bagi produk tempatan, purata jumlah produk tertinggi yang dipamerkan ialah produk farmaseutikal, diikuti oleh produk perubatan tradisional, produk penjagaan diri dan produk makanan tambahan. Untuk produk import pula, produk perubatan tradisional merupakan kategori produk tertinggi yang dijual; diikuti oleh produk farmaseutikal, produk penjagaan diri dan produk makanan tambahan. Purata jualan tahunan bagi produk farmaseutikal di farmasi adalah yang tertinggi dengan RM16,822, diikuti oleh produk perubatan tradisional sebanyak RM31,140, produk penjagaan diri dengan RM26,204 dan produk makanan tambahan sebanyak RM19,114. Purata nilai pusingan jualan tahunan untuk setiap farmasi ialah RM193,280 dengan produk farmaseutikal menyumbang sebanyak 60% manakala produk perubatan tradisional hanya sebanyak 16%. Purata nilai pusingan jualan tahunan ialah RM386 juta iaitu produk farmaseutikal menyumbang sebanyak RM232 juta sementara produk perubatan tradisional sebanyak RM62 juta.

*the least experienced of 15 years were located in Sabah. Chinese traditional medicine products were the major products sold in the shops. About an average of 1,276 Chinese traditional medicine products was displayed followed by health food products at 680, food supplement products at 405 and personal care products at 258. The products are marketed locally. Average annual sales for Chinese traditional medicine products were estimated at RM77,226, followed by health food products at RM29,997, food supplement products at RM14,057 and personal care products at RM8,004. Average annual sales turnover per shop were RM129,284 with Chinese traditional medicine products contributing 60% to the market value. By taking into account the 5,000 shops in Malaysia, the average annual sales turnover was estimated at RM646 million with Chinese traditional medicine contributing about RM386 million.*

#### Pharmacies

*Only 108 pharmacies had been identified and approached. On average, they have been involved in the herbal industry for 6.6 years. They get their products mainly from distributors, importers and manufacturers. Products sold are either local or imported. For local products, the highest number displayed was pharmaceutical products followed by traditional medicinal products, personal care products and food supplement products. For imported products, traditional medicinal products formed the highest category followed by pharmaceutical products, personal care products and food supplement products. The average annual sales of pharmaceutical products are the highest at RM16,822, followed by traditional medicinal products at RM31,140, personal care products at RM26,204 and food supplement products at RM19,114. Average annual sales turnover per pharmacy was RM193,280 with pharmaceutical products contributing 60% while traditional medicinal products contributed 16%. Average annual sales turnover were estimated at RM386 million with pharmaceutical products contributing RM232 million and traditional medicinal products contributing RM62 million.*

#### Personal Care Group

*Only 51 respondents were interviewed. Most of them are new in the industry averaging at 2.66 years of business involvement. Besides selling personal care products in the market, respondents also provide*

#### Kumpulan Penjagaan Diri

Penyelidik telah menemu bual hanya 51 responden. Kebanyakan responden masih baru dalam industri, iaitu hanya 2.66 tahun. Di samping menjual produk di pasaran, responden juga menyediakan perkhidmatan (contohnya penjagaan kecantikan) kepada pelanggan. Purata pendapatan yang diperoleh ialah sebanyak RM71,345. Purata jualan produk penjagaan diri ialah RM144,535 setahun. Sebanyak 92% jualan dari kumpulan penjagaan diri datangnya daripada produk kosmetik, 6% daripada produk makanan dan minuman, 1.5% daripada produk perubatan tradisional dan 0.5% daripada produk farmaseutikal.

#### Pengeluar

Hanya 62 responden terlibat dalam kajian. Secara purata, mereka telah melibatkan diri dalam industri selama 18.7 tahun. Jumlah jualan pasaran secara purata ialah RM1.5 juta setahun, produk makanan dan minuman ialah RM1.3 juta manakala produk kosmetik menyumbang kira-kira RM474,800. Nilai runcit tahunan berjumlah RM2 bilion. Nilai runcit keseluruhan produk perubatan tradisional ialah RM857 juta (43.4%), produk makanan dan minuman bernilai RM712 juta, produk kosmetik ialah RM270 juta manakala produk farmaseutikal ialah RM137 juta.

#### PUSAT PENYELIDIKAN PROTEOMIK

Pusat Penyelidikan Proteomik yang ditempatkan di FRIM merupakan usahasama FRIM dan Life Sciences Academy Sdn. Bhd. Ia ditubuhkan untuk pengkatalogan bersistem bagi spesies baru, pengenalpastian terapeutik baru, dan penentusahan sebatian berubat. Pangkalan data kebangsaan bagi produk asli ini akan disokong oleh bank maklumat tentang asal dan ciri-ciri tumbuhan, kulat, mikrob tanah, serangga dan inventori sumber hutan yang lain yang mempunyai pati mentah. Dengan kerjasama rimbawan, ahli botani dan zoologi di dalam negara, kakitangan Pusat Penyelidikan Proteomik akan menganalisis sampel untuk profil seperti struktur molekul 3-D dan fungsi kimianya.

*services (e.g. beauty care) to customers. The average annual revenue was RM71,345. Average sales of personal care products was about RM144,535 per year. About 92% of sales in personal care came from cosmetic products, 6% from food and beverages products, 1.5% from traditional medicinal products and 0.5% from pharmaceutical products.*

#### Manufacturers

*Only 62 respondents were involved in the survey. They had been involved in the industry for an average of 18.7 years. Annual market sales of traditional medicinal products averaged RM1.5 million, food and beverages products averaged RM1.3 million, cosmetic products averaged RM474,800. The total annual retail value was estimated at RM2 billion. The total retail value for traditional medicinal products was estimated at RM857 million (43.4%), food and beverages products at RM712 million, cosmetic products at RM270 million and pharmaceutical products at RM137 million.*

#### CENTRE FOR PROTEOMICS RESEARCH

*Located in FRIM, the Centre for Proteomics Research (CPR) is a collaborative effort of FRIM and Life Sciences Academy Sdn. Bhd. It was set up for systematic cataloguing of new species, identification of new therapeutics and verification of drug lead compounds. This national database of natural products will be backed by a parallel bank of information on the origins and characteristics of plants, fungi, soil microbes, insects and other inventories of forest resources from which the crude extracts have been obtained. Working hand in hand with foresters, botanists, zoologists in the country, CPR staff will analyse in-coming samples for profiles such as 3-D molecular structure and chemical functionality.*



Alat SEP BOX mengasingkan ekstrak tumbuhan ubatan kepada sebatian  
The SEP BOX equipment separates medicinal plant extracts into their constituents

### Kelebihan Peralatan

Pusat ini dilengkapi peralatan yang moden dan terkini. Peralatan yang berkaitan dengan spektrometri jisim, kromatografi cecair, elektroforesis, dan sistem pengesanan berautomasi digabung dan dihubungkan bersama-sama. Analisis sampel dapat dipercepatkan. Jika selama ini ia memakan masa selama bertahun-tahun, kini dapat dikurangkan dalam masa beberapa minggu sahaja.



AXIMA-CFR menganalisis berat molekul sebatian ekstrak tumbuhan ubatan  
The AXIMA-CFR analyses molecular weights of the medicinal plant extracts

### Data Spektrometri

Dijangka pangkalan data ini dapat merangkumi sumber-sumber dari hutan luar negeri memandangkan akan terdapat kerjasama yang lebih aktif antara FRIM dan institusi penyelidikan serantau dan di dunia. Sumbangan Pusat ini kepada pangkalan data akan menyediakan pelbagai data spektrometri gentian, di samping ciri-ciri yang telah sedia diketahui. Nilai pusat penyimpanan maklumat ini menjadi kian ketara memandangkan tuan rumah hasil asli tidak dibongkar dalam proses kutipan dan analisis data.

### Pengeluaran Sintetik

Untuk menggalakkan komponen biodiversiti secara mampan, pelanggan yang berminat untuk menukar hasil-asli ini ke dalam bentuk ubatan serta hasil lain dapat dinasihat untuk melakukannya dalam pelbagai cara, selain daripada menceroth hutan. Pengeluaran sintetik melalui bioreaktor DNA, contohnya, menggunakan bakteria untuk menggandakan sel dengan banyaknya daripada pati yang disasarkan boleh ditebang.

### Proteom dan Petunjuk Penyakit Manusia

Pusat ini akan memulakan operasinya dengan membantu kerja yang dijalankan oleh Program Tumbuhan Ubatan di FRIM. Bagaimanapun, Pusat ini mempunyai rancangan penyelidikannya sendiri. Ini termasuklah kerja petunjuk pangkalan data proteom tumbuhan dan penyakit manusia.

### Instrumental Advantage

The centre is equipped with an array of state-of-the-art instruments. Instruments dealing with mass spectrometry, liquid chromatography, electrophoresis, and automated spot detection systems are all integrated and linked together. Sample analysis is greatly speeded up. What used to take years can now be done in weeks.

### Spectrometric Data

It is envisioned that the database would encompass resources from forests overseas since there will be increasing active collaborations between FRIM and other regional and global research institutions. CPR's contribution to the database will be providing the various spectrometric data of the compounds, besides their already known characteristics. The value of this information storehouse becomes more apparent as a host of unknown natural products are unearthed in the process of data collection and analysis. The systematic cataloguing of new species, identification of new therapeutics and verification of drug lead compounds become easily available. This is where discovery-driven research will supersede mere hypothesis-confirming studies.



Protein yang diasingkan oleh jel 2D elektroforesis  
Proteins separated by 2D gel electrophoresis

### Synthetic Production

To promote sustainable use of biodiversity components, clients interested to convert these natural products into drugs and other useful products can be directed to several means of doing so, apart from raiding the forests. Synthetic production via DNA bioreactors, for example, using bacteria to mass replicate cells from which the targeted extracts can be harvested.

### Proteomes and Human Disease Markers

CPR will begin its operations by supporting work carried out by the Medicinal Plants Programme at FRIM. However, the Centre will have its own research agenda as well. It

Proteomik pula merupakan tahap analisis lain iaitu satu set protein yang dihasilkan daripada spesies yang diberi seperti yang dienkod oleh genomnya, dan seperti yang diterangkan dalam masa yang diberi dan di bawah keadaan tertentu, dikaji. Protein dalam keadaan sihat lawan keadaan sakit juga akan dikaji.

### PENYELESAIAN PARADOKS ANAI-ANAI DI ASIA TENGGARA

Di seluruh dunia, genus *Coptotermes* mempunyai beberapa spesies yang terkenal sebagai perosak. Keupayaannya bersarang di kayu yang lembap dan membentuk sarang yang baru dari serpihan koloni tersebut membolehkannya untuk terus hidup sebagai "penumpang haram" di atas papan kapal yang merebakkannya ke kawasan geografi yang baru. Bagaimanapun, sudah berabad-abad lamanya, sehingga kini, wujud satu paradoks dalam status serangga dari spesies anai-anai ini. *Coptotermes havilandi*, sejenis perosak asing yang serius di Selatan dan Utara Amerika, dikatakan berasal dari Asia Tenggara. Di negara asal haiwan perosak tersebut, ia belum lagi dikira sebagai perosak. Di sebaliknya, spesies perosak dikenali di rantau tersebut sebagai *C. gestroi* dan *C. travians*.



Tentera dan pekerja *Coptotermes gestroi*  
*Coptotermes gestroi* soldiers and workers

Melalui kajian tentang tahap kelainan kasta bagi individu dan populasi anai-anai di Malaysia dan negara-negara jiran, FRIM telah membuktikan bahawa *C. havilandi* dan *C. gestroi* sebenarnya adalah spesies yang sama. Oleh itu, spesies yang diperkenalkan kepada Amerika sepatutnya dipanggil *C. gestroi*, bukannya *C. havilandi*. Dibuktikan juga bahawa *C. travians* yang sebenar bukanlah perosak yang memasuki bangunan tetapi, spesies dari hutan tersebut yang tersalah dipanggil *C. travians* di Malaysia dan di negara-negara jiran sebenarnya ialah *C. gestroi*. Oleh itu, di Asia Tenggara, sebenarnya terdapat satu spesies perosak, *C. gestroi* yang telah diperkenalkan di seluruh dunia, termasuk di Amerika dan pulau-pulau di Laut Caribbean dan Lautan Pasifik dan Lautan Hindi.

includes working on a database of plant proteomes and human disease markers. Proteomics is yet another level of analysis where full sets of proteins, produced by a given species as encoded by its genome, and as expressed at a given time and under specific conditions, are studied. Proteins as expressed in a healthy versus diseased state will also be studied.

### RESOLVING THE TERMITE PARADOX IN SOUTHEAST ASIA

Worldwide, the genus *Coptotermes* has a few species that are notorious as pests on an international scale. Their ability to nest in pieces of moist timber and form new nests from fragments of the colony enables them to survive as stowaways on board ships that spread them to new geographical areas. However, there has been for many decades, till recently, a paradox in the pest status of these species of termites. *Coptotermes havilandi*, which is a serious alien pest in parts of South and North America, is thought to have been introduced from Southeast Asia. Yet in countries in its supposed area of origin, it has never been accorded much importance as a pest. Instead, the pest species known to the region were said to be primarily *C. gestroi* and *C. travians*.

By studying the degree of variation in castes, individuals and populations in Malaysia and neighbouring countries, FRIM was recently able to show that *C. havilandi* and *C. gestroi* were in fact the same species. Thus, the alien species introduced to the Americas should be known as *C. gestroi* instead of *C. havilandi*. It was also shown that the true *C. travians* was not a pest that enters buildings but, rather, a species of the forest, and that what was wrongly called *C. travians* in Malaysia and neighbouring countries was in fact *C. gestroi*. Thus, in Southeast Asia there is, in fact, a single pest species, *C. gestroi*, that was introduced to various parts of the world, including the Americas and islands in the Caribbean Sea and Pacific and Indian oceans.

Artikel tentang penemuan ini telah diterbitkan dalam *Sociobiology* bertajuk, "The taxonomic status of pest species of *Coptotermes* in South East Asia: Resolving the paradox in the pest status of the termites, *Coptotermes gestroi*, *C. havilandi* and *C. travians* (Isoptera: Rhinotermitidae)". Dari segi status *C. gestroi* sebagai spesies perosak di peringkat antarabangsa, ia dinamakan dengan nama biasa, Anai-anai Bawah Tanah Asia.

Penyelesaian paradoks ini membolehkan penyusunan semula dan pengumpulan maklumat saintifik dari pelbagai negara yang akan memudahkan perkembangan strategi pengurusan perosak bersama. Kajian ini merupakan satu contoh bagaimana penyelidikan taksonomi asas dapat memberikan impak yang besar ke atas sains dan industri di seluruh dunia.

#### PENCEGAH PACAT SEMULA JADI : CITRIDIOL

Pacat tanah merupakan satu gangguan kepada pelawat di destinasi ekopelancongan yang popular. Walaupun ia tidak membawa penyakit, kebanyakan orang geli-geleman dengan pacat berbanding organisma menggigit yang lain seperti nyamuk. Ini mungkin disebabkan gigitannya yang menyebabkan pendarahan yang lambat berhenti, menyebabkan ia luka dan gatal, menjadi radang dan mungkin juga menyebabkan jangkitan. Stoking pacat merupakan satu cara untuk melindungi diri daripada pacat, tetapi ia tidak dijual dengan meluas dan mempunyai banyak kelemahan. Contohnya, ia boleh menyebabkan pacat naik lebih tinggi ke bahagian peha untuk mencari bahagian badan yang mudah diserang. Walaupun pencegah pacat telah diuji oleh tentera semasa dan selepas Perang Dunia Kedua, sangat sedikit bahan kimia yang diuji itu masih berdaftar untuk penggunaan sendiri dalam pencegahan serangga, dan kebanyakan pencegah serangga untuk penggunaan sendiri ini tidak mempunyai label yang mengesyorkan penggunaannya untuk melindungi diri dari gigitan serangga. Kekosongan ini jelas daripada fakta bahawa sesetengah pelanggan yang telah menggunakan pencegah serangga yang didaftarkan memilih untuk menyalahgunakan racun serangga yang terdapat di pasaran untuk mengelakkan gigitan pacat. Bagaimanapun, penggunaan racun serangga ini berbahaya kepada kesihatan.

Memandangkan terlalu sedikit pilihan yang ada untuk melindungi diri daripada gigitan pacat, FRIM telah mengadakan kajian kerjasama dengan Mosi-guard International dan Germax (Malaysia) untuk menguji

*These discoveries were recently published in an article in Sociobiology, entitled, "The taxonomic status of pest species of Coptotermes in Southeast Asia: Resolving the paradox in the pest status of the termites, Coptotermes gestroi, C. havilandi and C. travians (Isoptera: Rhinotermitidae). In view of the status of C. gestroi as a pest species of international concern, it was given a common name, the Asian Subterranean Termite.*

*The resolution of this paradox will enable the re-organisation and pooling of scientific information from different countries, which, in turn, will facilitate the development of common pest management strategies. The study that enabled this is one example of how fundamental taxonomic research can have far reaching impacts on science and industry across the world.*

#### A NATURAL LEECH REPELLENT: CITRIDIOL

*Land leeches are a nuisance to visitors in many popular ecotourism destinations. Although they are not known to spread any diseases, most people have a stronger aversion to them than to other biting organisms such as mosquitoes. This is probably because their bites cause bleeding that is slow to stop, and result in wounds that may itch, become inflamed or even infected. Leech socks are a physical form of protection against leeches, but they are not widely sold and have various drawbacks. For example, they can cause leeches to move higher up the leg to seek out other vulnerable parts of the body. Although leech repellents were tested by the military during and after the Second World War, very few of the chemicals that were tested*



*Haemadipsa picta*, sejenis pacat panjang  
*Haemadipsa picta*, a climbing leech

keberkesanan Citriodiol, iaitu pati asli daun limau *Eucalyptus* yang dikomersialkan sebagai pencegah pacat. Dalam ujian makmal dan lapangan, terbukti Citriodiol merupakan pencegah yang berkesan untuk melawan pacat. Semburan yang kuat dan sederhana ke atas kasut dan kaki seluar (yang dimasukkan ke dalam stoking memberikan perlindungan sepenuhnya daripada gigitan dua spesies pacat, *Haemadipsa sylvestris* dan *H. picta*). Kedua-dua tahap semburan cukup untuk mencegah pacat daripada melekat kepada kasut. Tambahan pula, Citriodiol dapat bertahan lebih enam jam tempoh ujian di lapangan, tanpa mengurangkan keberkesanannya. Hasil kajian menunjukkan bahawa Citriodiol dapat digunakan dengan berkesan di lapangan untuk mencegah gigitan pacat. Saintis FRIM telah dinamakan sebagai pereka cipta bersama dalam permohonan paten, yang dimiliki oleh Mosi-guard International, untuk menggunakan Citriodiol sebagai pencegah gigitan pacat.

*are still registered for use as personal insect repellents, and most of the currently used personal insect repellents do not generally have a label recommendation for use to protect against leeches. This void is apparent from the fact that some consumers who have ready access to registered personal insect repellents resort to the misuse of a commercially available insecticide to prevent leech bites. However, the use of insecticides to prevent leech bites clearly jeopardises health.*

*In view of the few effective options available for protection against leeches, FRIM embarked on a collaborative study with Mosi-guard International and Germax (Malaysia) to test the effectiveness of Citriodiol, a natural and commercially available extract of the leaves of the Lemon Eucalyptus, as a repellent against leeches. In both laboratory and field tests, Citriodiol proved to be a very effective repellent against leeches. Heavy and moderate spray levels on footwear and trouser legs (tucked into socks) gave complete protection against bites by two leech species, *Haemadipsa sylvestris* and *H. picta*. Both spray levels were also sufficiently repellent to virtually prevent leeches from attaching themselves to footwear. Furthermore, the repellency of Citriodiol persisted over a six-hour test period in the field, without any decline in its effectiveness. The results of the study show that Citriodiol can be effectively used to prevent leech bites in the field. FRIM's scientist has been named as a joint inventor in the application for the patent, owned by Mosi-guard International, for the use of Citriodiol as a repellent against leeches.*

## PETUNJUK PRESTASI UTAMA KEY PERFORMANCE INDICATORS

## PETUNJUK PRESTASI UTAMA KEY PERFORMANCE INDICATORS

OBJEKTIF	OBJECTIVES
<ul style="list-style-type: none"> <li>Menjana pengetahuan dan membangunkan teknologi yang bersesuaian untuk pemuliharaan, pengurusan, pembangunan dan penggunaan sumber-sumber hutan</li> <li>Menyediakan perkhidmatan berasaskan penyelidikan yang memenuhi keperluan pelanggan</li> <li>Mengkomersialkan hasil-hasil penyelidikan dan pembangunan</li> <li>Memperoleh serta menyebarkan maklumat</li> <li>Meningkatkan kesedaran terhadap peranan alam sekitar dan pemuliharaan hutan</li> <li>Mencapai kecemerlangan dan memperoleh kepimpinan dalam penyelidikan hutan tropika</li> </ul>	<ul style="list-style-type: none"> <li>To acquire knowledge and to develop technology that is pertinent to the conservation, management, development and utilisation of forestry resources</li> <li>To meet the needs of clients through extension of services based on research</li> <li>To commercialise R&amp;D findings</li> <li>To obtain and disseminate knowledge</li> <li>To promote awareness on the role of environment and forestry conservation</li> <li>To achieve excellence and to gain leadership in tropical forestry research</li> </ul>
PETUNJUK PRESTASI UTAMA	KEY PERFORMANCE INDICATORS
<ul style="list-style-type: none"> <li>Pemindahan teknologi kepada industri perhutanan melalui seminar, kursus dan bengkel</li> <li>Peningkatan perkhidmatan teknikal kepada industri perhutanan untuk menghasilkan produk yang berkualiti</li> <li>Pengkomersialan hasil penyelidikan melalui khidmat perundingan dan projek kerjasama</li> <li>Perkhidmatan dan projek kerjasama</li> <li>Penggalakan kesedaran peranan hutan dan kepentingan pemeliharaan hutan</li> <li>Peningkatan prestasi dan kecekapan kakitangan melalui program pembangunan sumber manusia yang berterusan</li> </ul>	<ul style="list-style-type: none"> <li>Technology transfer to forestry based industries through seminars, courses and workshops</li> <li>Extension of technical services to enable the manufacture of quality products by the forestry based industries</li> <li>Commercialisation of research findings through consultancy</li> <li>Services and collaborative projects</li> <li>Promotion of awareness on the role of forests and the importance of forestry conservation</li> <li>Improvement of staff performance and efficiency through continuous human resource development</li> </ul>

Pencapaian <i>Achievement</i>	2001	2002	2003
Jumlah projek penyelidikan IRPA <i>Total number of IRPA projects</i>	75	61	79
Jumlah penerbitan yang dihasilkan <i>Total number of publications</i>	416	426	563
Tesis <i>Theses</i>	12	1	2
Dialog dengan industri <i>Dialogues with the industries</i>	0		0
Seminar dan bengkel <i>Seminars and workshops</i>	15	10	33
Bilangan kilang perusahaan kecil yang menerima faedah daripada R&D <i>Number of factories SMI's that benefited from R&amp;D</i>	12	64	31
Bilangan kilang yang menggunakan mesin atau teknologi FRIM <i>Number of factories that used FRIM's equipment or technology</i>	19	25	6
Ladang hutan yang ditubuhkan dengan khidmat nasihat FRIM <i>Forest plantations established using FRIM's advisory services</i>	6	5	12
Kuantiti biji benih spesies hutan yang dikutip (kg) <i>Quantity of forest tree seeds collected (kg)</i>	803		500
Latihan teknikal yang dianjurkan <i>Number of technical training organised</i>	21	15	26
Bilangan paten dan inovasi <i>Number of patents and innovations</i>	1	3	3
<b>Bilangan ujian yang dijalankan</b> <i>Number of tests conducted</i>			
- Pintu rintangan api <i>Fire doors</i>	12	4	15
- Perabot <i>Furniture</i>	160	264	250
- Awetan kayu <i>Wood preservation</i>	1,544	1,581	1,771
- Ujian keteguhan kayu <i>Plywood testing</i>			39
- Kenal pasti kayu <i>Wood Identification</i>			2,025
Khidmat perundingan <i>Consultancy services</i>	13	17	14
Bilangan projek penyelidikan dengan agensi luar <i>Number of research projects with external agencies</i>	18	20	28
Pameran <i>Exhibitions</i>	2	9	10
Jumlah pelawat ke FRIM <i>Total number of FRIM visitors</i>	79,918	85,000	70,000

# ANUGERAH DAN PELANTIKAN AWARDS AND APPOINTMENTS

Anugerah yang dimenangi oleh FRIM dan kakitangannya pada tahun tersebut ialah:

## ANUGERAH INOVASI

Sekumpulan saintis yang terdiri daripada Dr. Rahim Sudin, Puad Elham, Habibah Mohamad, Jalali Hj. Salleh dan Nordin Puteh dari Bahagian Kimia Kayu, FRIM bersama-sama rakan sejawat mereka,

Ir. Gan Tian Leong dan Wang Joo Soon dari Brunfield IBS Sdn. Bhd. dan Ir. Phoon Wai Weng IJM Corporation Bhd. telah mencapai kejayaan yang cemerlang dengan memenangi tiga anugerah inovasi pada tahun ini.



Sijil anugerah Medal Emas I.TEX 2003  
Certificate of the I.TEX 2003 Gold Medal award

Projek yang melibatkan pembangunan komposit simen diikat dengan gentian kelapa sawit ringan memenangi Pingat Emas Reka Cipta, Inovasi dan Teknologi Reka Bentuk Industri I.TEX 2003, Pingat Emas Ekspo Sains dan Teknologi 2003 dan Anugerah Inovasi Khidmat Awam 2003 bagi kategori "Anugerah Inovasi Penyelidikan Kerjasama antara Sektor Awam dan Swasta".



Sijil Anugerah Inovasi Perkhidmatan Awam 2003  
Certificate of the 2003 Public Service Innovation Award

Awards won by FRIM and its staff members for the year were:



Kumpulan dari Bahagian Kimia Kayu yang memenangi anugerah Pingat Emas I.TEX 2003 bagi Reka Cipta, Inovasi dan Teknologi Reka Bentuk Industri  
The Wood Chemistry Division team that won the I.TEX 2003 Gold Medal Award for Invention, Innovation and Industrial Design Technology

## INNOVATION AWARDS

A team of scientists comprising Dr. Rahim Sudin, Puad Elham, Habibah Mohamad, Jalali Hj. Salleh and Nordin Puteh from the Wood Chemistry Division of FRIM together with their counterparts Ir. Gan Tian Leong and Wang Joo Soon from Brunfield IBS Sdn. Bhd. and Ir. Phoon Wai Weng IJM Corporation Bhd. gained outstanding fame by winning three innovation awards during the year.



Sijil Anugerah Pingat Emas Ekspo Sains dan Teknologi 2003  
Certificate of the Expo Science and Technology 2003 Gold Medal Award

Their project involving the development of lightweight oil palm fibre reinforced cement composite won the Invention, Innovation and Industrial Design Technology I.TEX 2003 Gold Medal, the Expo Science and Technology 2003 Gold Medal and the 2003 Public Service Innovation Award under the category "Collaborative Research Innovation Award between the Public and Private Sector".

## ANUGERAH KUALITI

### Anugerah Kualiti IKM 2003

Makmal Analisis Awetan Kayu dari Bahagian Kimia Kayu sekali lagi telah memenangi Anugerah Cemerlang bagi Makmal Kimia IKM 2003. FRIM telah memenangi anugerah ini selama lapan tahun berturut-turut sejak tahun 1996. Merangkumi tiga aspek analisis awetan, anugerah ini mengiktiraf amalan makmal baik dari segi keselamatan, persekitaran, pengendalian bahan kimia dan bahan buangan termasuklah penyimpanan rekod yang sistematik dan terkini.

### Sijil Akreditasi MS ISO/IEC 17025:2001

Pada Disember 2003, Makmal Perlindungan Api, FRIM dianugerahkan sijil akreditasi MS MS ISO/IEC 17025:2001 oleh Skim Akreditasi Makmal Malaysia (SAMM).

### Peraduan Mengarang Esei

Pada bulan Disember 2003, Sarifah Kunju Ahmad telah memenangi hadiah pertama Peraduan Mengarang Esei Sektor Badan Berkanun anjuran Dewan Bahasa dan Pustaka. Tajuk karangan beliau ialah "Sains dan Teknologi sebagai Pengukur Negara Maju". Zainon Abu Samah memenangi hadiah sagu hati dengan karangan beliau yang bertajuk "Industri Pertanian dalam Kemajuan Ekonomi Negara".

## QUALITY AWARDS

### IKM Quality Award 2003

The Wood Preservative Analytical Laboratory of the Wood Chemistry Division has again been awarded the IKM Excellence Award for Chemical Laboratories 2003. This represented the eighth consecutive year since 1996 that the laboratory had won the award. Covering three aspects of preservative analysis, the award recognises good laboratory practices in terms of safety, environment, chemical handling and disposal including systematic and updated record keeping.



Sijil MS ISO 17025:2001 akreditasi untuk makmal Perlindungan Api  
MS ISO 17025:2001 Certificate of Accreditation for the Fire Protection Laboratory

### MS ISO/IEC 17025:2001 Certificate of Accreditation

In December 2003, the Fire Protection Laboratory of FRIM was awarded the MS ISO/IEC 17025:2001 certificate of accreditation by Skim Akreditasi Makmal Malaysia (SAMM).

### Essay Writing Competition

In December 2003, Sarifah Kunju Ahmad won the first prize for an essay writing competition organised by the Dewan Bahasa dan Pustaka. The title of the essay was "Sains dan Teknologi sebagai Pengukur Negara Maju". Zainon Abu Samah received a consolation prize for the essay "Industri Pertanian dalam Kemajuan Ekonomi Negara".



Tempat pertama yang dimenangi oleh Sarifah Kunju Ahmad.  
First prize won by Sarifah Kunju Ahmad

# PEMINDAHAN TEKNOLOGI TECHNOLOGY TRANSFER

Pada tahun ini, FRIM terus menumpukan usaha dalam pemindahan teknologi. Selaras dengan objektif institut, maklumat tentang pengurusan dan pembangunan perhutanan, hasil hutan dan penggunaannya disebarkan melalui kursus, seminar, bengkel, persidangan, simposium, dan pameran.

Aktiviti pemindahan teknologi ini dianjurkan oleh FRIM ataupun anjuran secara kerjasama dengan agensi lain termasuklah organisasi kerajaan dan bukan-kerajaan. FRIM juga banyak terlibat dalam program yang dikendalikan oleh agensi lain.

*During the year, FRIM continued to focus its efforts in technology transfer. In line with the objectives of the institute, information regarding the management and development of forestry, forest products and their utilisation was disseminated through Training Courses, Seminars, Workshops, Conferences, Symposia and Exhibitions.*

*Many of these activities for technology transfer were either organised solely by FRIM or jointly with other collaborative agencies comprising government and non-government organisations. In some cases, FRIM also participated in events organised by other agencies.*

## Kursus Latihan *Training Course*

- Training on Inventory of Secondary Forest, 9 January to 9 February, Tekam Forest Reserve, Jengka, Pahang
- Kursus Pendek Kontraktor Bumiputera Siri 2, 6-10 April, Hotel Seri Malaysia, Bagan Lalang, Selangor
- Certificate Course on Timber Drying, 7-26 April, FRIM
- Kursus Landskap dan Penyenggaraan Pokok, 14-18 April, FRIM
- Course on Wood Anatomy, 16-18 April, Batu Kantonmen, Tentera Di Raja Malaysia
- Course on Insect Collection and Preservation, 24 May, FRIM
- Course on Wood Anatomy, 9-12 June, FRIM
- Kursus Asas Lanskap, 26 Jun, Malaysia Airlines Academy, Kuala Lumpur
- Kursus Landskap Modul Asas, 5 Julai, Pusat Latihan UKM, Tanjung Karang, Selangor
- International Field Biology Course, 17 July to 18 August, Pasoh Field Research Station, Negeri Sembilan
- Course on Classification and Identification of Insects, 19 July, Pasoh Field Research Station, Negeri Sembilan
- Kursus Pendek Kontraktor Bumiputera, 20-24 Julai, Awana Country and Golf Resort, Genting Highlands
- Kursus Asas Landskap untuk Kakitangan MARA, 28-29 Julai, FRIM
- Kursus Asas Kontraktor Landskap, 3-6 Ogos, Gem Beach Resort, Kuala Trengganu, Trengganu
- Kursus Landskap dan Penyenggaraan Pokok, 11-15 Ogos, FRIM
- Kursus Penyelenggaraan dan Daya Ketahanan Landskap, 18-23 Ogos, Bukit Kiara, Kuala Lumpur
- Kursus Pendek Kontraktor Bumiputera Siri 4, 29 September hingga 3 Oktober, MINT Hotel, Kuala Lumpur
- Kursus Pembangunan Produk Projek E-OPR, 3-9 Oktober, FRIM
- Kursus Asas Kontraktor Landskap, 20-24 Oktober, Hotel Grand Blue Wave, Johor Bahru, Johor
- Kursus-kerja Penggunaan dan Penyelenggaraan Mesin-Mesin Kerja Kayu, 21-24 Oktober, FRIM
- Course on Design of Timber Structures (MS 544: 2001), 11 December, Bangunan IEM, Petaling Jaya

## Seminar, Bengkel, Persidangan dan Simposium *Seminar, Workshop, Conferences and Symposia*

- Lauraceae Workshop I, 12-25 January, FRIM
- Tree Planting for River Corridor Establishment, 22 February, FELDA Pasoh 2, Negeri Sembilan
- Seminar on the Use of Prefabricated Timber Roof Truss in Construction, 25 February, Puteri Pan-Pacific Hotel, Johor Bharu
- Remote Sensing Workshop: The Application of Remote Sensing Technique for Forest Mapping & Classification, 11-13 March, FRIM
- Monitoring of Planted Corridor of Sg. Kroh by Primary School Students of Sekolah Kebangsaan Kepong, 12 March, Rumah Melaka, FRIM
- Introduction to Biodiversity Workshop for Teachers, 13 March, FRIM
- BRAHMS Workshop, 20-21 March, Kuching, Sarawak
- Introduction to Biodiversity Workshop for Secondary Schools, 25 March, FRIM
- Seminar on Construction Waste Management, 26 March, Renaissance Palm Garden Hotel, Putrajaya
- Introduction to Biodiversity Workshop for Primary Schools, 27 March, FRIM
- Nature Education Workshop for Teachers and Students, 3 April, FRIM
- Workshop on Treatment of Timber with Boron Preservatives, 8 April, FRIM
- Seminar on the Use of Prefabricated Timber Roof Truss in Construction, 16 April, Grand Continental Hotel, Kuala Terengganu
- Nature Education Visit for Biodiversity Programme, 28-30 April, FRIM
- Seminar Harta Intelek Untuk Penyelidik, 6-8 May, FRIM
- Second Growth Workshop, 21-22 May, Swiss Garden Hotel, Kuantan, Pahang
- Seminar E-Oil Palm Residues (E-OPR): Potential from Locally Developed Technologies, 22 May, FELDA Mempaga 3, Pahang
- Bengkel Piawaian Tumbuhan Ubatan, 10-12 Jun 2003, FRIM
- Seminar on the Use of Prefabricated Timber Roof Truss in Construction, 10 June, Sunway Hotel, Pulau Pinang
- National Mangrove Workshop: New Insights on the Management and Silviculture of Mangrove, 15-17 July, Legend Inn, Taiping, Perak
- Seminar on Ecological Research in Tropical Rain Forests: Commemorating over 30 years of research at the Pasoh Forest Reserve, Negeri Sembilan, 19-21 August, FRIM
- Workshop on Timber Roof Truss: Highlighting Quality Assurance, 9 September, FRIM
- Workshop on Nature Education as an Approach to Resource Management in Recreation Areas, 30 September to 1 October, Legend Hotel, Kuala Lumpur
- Conference on Forestry and Forest Products 2003 (CFFPR 2003): Forestry For Society, FRIM, 6-8 October, Crown Princess Hotel, Kuala Lumpur
- Lauraceae Workshop II, 9-10 October, FRIM
- Kursus Asas Pemesinan Buluh, 13-18 Oktober, FELDA Mempaga 3, Pahang



Majlis perasmian Seminar Harta Intelek Untuk Penyelidik oleh Y. Bhg. Tan Sri Samsudin Osman, Ketua Setiausaha Negara  
*Opening ceremony of the Seminar Harta Intelek Untuk Penyelidik by Y. Bhg. Tan Sri Samsudin Osman, the Chief Secretary of the Government of Malaysia*



Ketua Pengarah menyampaikan cenderahati kepada Y. Bhg. Dato' Dr. Abdullah Mohd. Tahir dari Kementerian Perusahaan Utama Malaysia  
*The Director General presenting a souvenir gift to Y. Bhg. Dato' Dr. Abdullah Mohd. Tahir of the Ministry of Primary Industries Malaysia*

## KHIDMAT PERUNDINGAN CONSULTANCY SERVICES

- Urban Forestry Workshop: Assessing the Need for Sustainable Landscape in a Changing Society, 14-15 October, Dynasty Hotel, Kuala Lumpur
- Workshop on Value Engineering for School Furniture, 21 October, Kota Kinabalu, Sabah
- Workshop on Value Engineering for School Furniture, 23 October, Kuching, Sarawak
- Seminar Kebangsaan Rekabentuk Perabot: Ke arah Aliran Rekabentuk Perabot Semasa, 11-12 Disember, FRIM
- Seminar on the Use of Timber in Construction: What professionals need to know? 13 December, MTIB, Kuala Lumpur
- Sixth National Seminar on Oil Palm Tree Utilisation: Development of Oil Palm Biomass Industry, 15-17 December, Hotel Nikko, Kuala Lumpur
- Workshop on Wood Waste Minimisation and Recycling Potential in Construction Sites, 18 December, Crown Princess Hotel, Kuala Lumpur



Y. Bhg. Dato' Suboh Mohd. Yassin, Timbalan Ketua Setiausaha Kementerian Perusahaan Utama Malaysia menyampaikan ucapan perasmian Bengkel Hutan Bandar  
Y. Bhg. Dato' Suboh Mohd. Yassin, the Deputy Secretary General of the Ministry of Primary Industries Malaysia delivering the opening speech at the Urban Forestry Workshop



Dr. Baskaran Krishnapillay menyampaikan kata alu-aluan di Bengkel Piawaian Tumbuhan Ubatan  
Dr. Baskaran Krishnapillay delivering the opening address of the Bengkel Piawaian Tumbuhan Ubatan

### Pameran Exhibitions

- Malaysian International Furniture Fair (MIFF 2003), 4-8 March, PWTC, Kuala Lumpur
- Pameran Asia Pacific Natural Products Expo 2003, 10-12 April, PWTC, Kuala Lumpur
- Pameran Herba Malaysia, 26 April to 4 May, Pusat Sains Negara, Kuala Lumpur
- Pameran Sains dan Teknologi, 7-9 Ogos, PWTC, Kuala Lumpur
- Pameran Mesyuarat AMAF, 17-22 Ogos, Hotel Renaissance, Kuala Lumpur
- Pameran Sempena Lawatan Panel Penilai Anugerah Kualiti Perdana Menteri 2003, FRIM
- Pameran Sempena Persidangan OIC, 14-19 Oktober, Pusat Konvensyen, Putrajaya

Pada tahun 2003, FRIM mengendalikan sebanyak 25 perundingan yang bernilai RM345,300. Daripada perundingan ini, FRIM menerima sebanyak RM133,150 sebagai bayaran pengurusan dan pentadbiran.

*In 2003, FRIM conducted 25 consultancies worth RM345,300. From these consultancies, RM133,150 were due to FRIM as charges for management and administration.*

Bidang <i>Field of Work</i>	Pengurus <i>Project Manager</i>	Pelanggan <i>Client</i>
Timber species used in construction at Langkawi Lagoon	Lim Seng Choon	Tema Teladan Sdn. Bhd.
Production of charcoal briquettes	Hoi Why Kong	Cipta Briquettes Sdn. Bhd.
Technical advisory service	Dr. Ang Lai Hoe	Rembang Pincak Sdn. Bhd.
Establishment of nature trails at the Tropical Island Resort	Dr. Noor Azlin Yahya	Tropical Island Resort Sdn. Bhd.
Field tests on the efficacy of treated timber and termite attack	Roszaini Kadir	Protim Solignum Osmose
Technical advice on tree planting	Adnan Mohammad	Juteras Sdn. Bhd.
Technical advice on landscaping and designing	Adnan Mohammad	Zoo Negara, Ulu Kelang
Ecological survey for EIA	Dr. Shamsudin Ibrahim	Satang Environmental Sdn. Bhd.
Identification of timber species used in construction	Lim Seng Choon	Tema Teladan Sdn. Bhd.
Projek ITTO - Regeneration of Natural Forest	Lim Hin Fui	Fakulti Perhutanan, UPM
EIA - Socio Economic Study	Lim Hin Fui	Satang Environmental Sdn. Bhd.
Computer software system for income tax and pension	Wan Zahiri Hj. Wan Yaakob	Institut Penyelidikan dan Kemajuan Pertanian Malaysia
Assessment of forest management practices	Dr. Wan Razali Wan Mohd.	Golden Hope Plantation Bhd. Melaka
Survey on the flora at Hutan Simpan Mersing, Johor	Dr. Shamsudin Ibrahim	Erinco Sdn. Bhd.
Assessment of forest management practices	Dato' Dr. Wan Razali Wan Mohd.	KPKKT, Terengganu
Landscaping and tree maintenance at Istana DYMM Sultan Selangor, Shah Alam	Dr. Zakaria Ibrahim	JKR Shah Alam, Selangor
Feasibility study on inter-planting of Oil Palm with teak	Dr. Ab. Rasip Ab. Ghani	AUSTRAL Enterprise Bhd.
Computer software system for management of salaries	Wan Zahiri Hj. Wan Yaakob	Lembaga Minyak Sawit Selangor
Site suitability study for planting of herbs	Dr. Mohd. Ilham	Polens (M) Sdn. Bhd.
Site suitability study for planting of Khaya and Dukung	Dr. Ab. Rasip Ab. Ghani	Kumpulan FIMA Bhd.

# PERJAWATAN ESTABLISHMENT

## PELANTIKAN

Pada tahun 2003, skim perkhidmatan Sistem Saraan Malaysia (SSM) telah dilaksanakan. Sejumlah 12 orang Pegawai Penyelidik, di bawah Kategori Pengurusan dan Profesional, dilantik di bawah skim baru ini. Tujuh orang pegawai kontrak telah dilantik, enam daripada mereka dilantik di bawah Q41, seorang lagi di bawah Q47. Selebihnya, empat orang merupakan lantikan baru di bawah Q41 dan seorang dinaikkan pangkat daripada Penolong Pegawai Penyelidik. Pada tahun ini, 21 orang kakitangan dari Kumpulan Sokongan juga telah dilantik. Tujuh orang daripada mereka merupakan lantikan baru manakala selebihnya ialah lantikan baru melalui kenaikan pangkat.

Bil No.	Pegawai Penyelidik <i>Research Officers</i>
1	Nor Asmah Hassan (Contract to Q41)
2	Mohd. Farid Ahmad (Contract to Q41)
3	Serafina Christine Fletcher (Contract to Q41)
4	Grace Tabitha Lim (Contract to Q41)
5	Zamree Md. Shah (Contract to Q41)
6	Norul Maslissa Ahmad (Contract to Q41)
7	Khairul Awang (Q41)
8	Nik Zanariah Nik Mahmood (ARO to Q41)
9	Tan Sek Aun (Q41)
10	Mohd. Khairun Anwar Uyup (Q41)
11	Mohamad Jani Saad (Q41)
12	Dr. Gary William Theseira (Contract to Q47)

## KENAIKAN PANGKAT

Hasil daripada penyusunan semula organisasi secara besar-besaran pada tahun ini, Dato' Dr. Abdul Razak Mohd. Ali, Ketua Pengarah FRIM telah dinaikkan pangkat kepada Gred Utama A, VU 5, Dato' Dr. Wan Razali Wan Mohd., Timbalan Ketua Pengarah FRIM dinaikkan pangkat kepada Gred Utama B, VU 6, dan Dr. Abdul Latif Mohmod, dinaikkan pangkat kepada Gred Utama B, VU 6, sebagai Pengarah Kanan 1 (Operasi). Empat Pengarah Bahagian, iaitu Dr. Abdul Rahim Nik, Dr. Hoi Why Kong, Dr. Abdul Rashid Hj. Abd. Malek dan Dr. Baskaran Krishnapillay dinaikkan pangkat kepada Gred Utama C, VU 7.

## APPOINTMENTS

*In 2003, the new Sistem Saraan Malaysia (SSM) service scheme was implemented. A total of 12 new Research Officers, under the Management and Professional Category, were appointed under the new scheme. Seven contract officers were appointed, six of which were appointed as Q41 and one other appointed as Q47. The rest comprised four new appointments to Q41 and one promoted from Assistant Research Officer (ARO). During the year, 21 staff members from the Supporting Group were also appointed. Seven of these were new appointments while the rest were new appointments via promotions.*

## PROMOTIONS

*Resulting from a major re-organisation during the year, Dato' Dr. Abdul Razak Mohd. Ali, the General Director of FRIM, was promoted to Gred Utama A, VU 5, Dato' Dr. Wan Razali Wan Mohd., the Deputy General Director of FRIM was promoted to Gred Utama B, VU 6, and Dr. Abdul Latif Mohmod, was promoted to Gred Utama B, VU 6, as Senior Director 1 (Operations). Four Division Directors, namely, Dr. Abdul Rahim Nik, Dr. Hoi Why Kong, Dr. Abdul Rashid Hj. Abd. Malek and Dr. Baskaran Krishnapillay were promoted to Gred Utama C, VU 7.*

Empat orang Pegawai Penyelidik dinaikkan pangkat daripada Q48 kepada Q54 manakala tiga pegawai baru dinaikkan pangkat daripada Q3 kepada Q48. Seramai 23 orang kakitangan dari Kumpulan Sokongan juga telah dinaikkan pangkat.

*Four Research Officers were promoted from Q48 to Q54 while three new Officers were promoted from Q3 to Q48. 23 staff members from the Supporting Group were also promoted.*

Bil No.	Pegawai Penyelidik <i>Research Officers</i>
1	<b>Ketua Pengarah Gred Utama A, VU 5</b> Dato' Dr. Abdul Razak Mohd. Ali
2	<b>Timbalan Ketua Pengarah Gred Utama B, VU 6</b> Dato' Dr. Wan Razali Wan Mohd.
3	<b>Pengarah Kanan 1 Gred Utama B, VU 6</b> Dr. Abdul Latif Mohmod
4	<b>Pegawai Penyelidik Gred Utama C, VU 7 (memangku mulai 1 Disember)</b> Dr. Abdul Rahim Nik
5	Dr. Hoi Why Kong
6	Dr. Abdul Rashid Hj. Abd. Malek
7	Dr. Baskaran Krishnapillay
8	<b>Pegawai Penyelidik Gred (Q48 to Q54)</b> Dr. Ang Lai Hoe
9	Dr. Norini Harun
10	Dr. Ab. Rasip Ab. Ghani
11	Dr. Rasadah Mat Ali
12	<b>Pegawai Penyelidik Gred (Q3 to Q48)</b> Dr. Chang Yu Shyun
13	Mastura Mohtar
14	Nor Azah Mohd. Ali



## LATIHAN TRAINING

### PELETAKAN JAWATAN

Pada tahun 2003, dua orang Pegawai Penyelidik dan empat orang kakitangan telah meletak jawatan.

### RESIGNATIONS

In 2003, two Research Officers and four staff members resigned from the Institute.

Kakitangan Staff	Tarikh peletakan jawatan Date of resignation
Dr. Azmy Mohamed	1 Julai
En. Mohd. Nor Jamalullail Mohd. Dasuki	1 Julai
En. Mohd. Zanuri Razali	1 Julai
En. Mohd. Sukri Sukarman	1 Julai
Dr. Razak Wahab	2 September
Puan Majidah Ariffin	16 Disember

### PERSARAAN

Empat orang kakitangan dari Kumpulan Sokongan telah bersara. Tiada kakitangan yang bersara pilihan.

### RETIREMENT

Four staff members of the Supporting Group retired. There were no optional retirements.

Persaraan wajib Mandatory retirement	Tarikh Date
Saleh Pendek	18 Mac
Sulaiman Mohd. Zain	28 Mac
Abu Said Ahmad	26 Jun
Saad Shafie	8 Ogos

### LATIHAN AKADEMIK

Pada tahun ini, tiga orang pegawai berjaya menamatkan pengajian masing-masing dari universiti tempatan dan luar negeri. Ijazah yang diperolehi termasuklah satu ijazah kedoktoran dan dua ijazah sarjana. Bidang pengajian ialah Tumbuhan Ubatan, Entomologi dan Komunikasi Korporat. Sementara itu, sejumlah 45 orang pegawai mendaftar untuk pengajian ijazah lanjutan pada tahun 2003 berbanding 36 orang pada tahun sebelumnya. Ini merupakan peningkatan sebanyak 25% pegawai yang melanjutkan pelajaran.

### ACADEMIC TRAINING

During the year, three officers successfully completed their academic training from local or overseas universities. The degrees included one Ph. D. and two M. Sc. The areas of study were in Medicinal Plants, Entomology and Corporate Communications respectively. Meanwhile, a total of 45 officers registered for post-graduate studies in 2003 compared with 36 in the previous year. This represented an increase of 25% undergoing academic training.

Nama Name	Ijazah Degree	Bidang Field	Universiti University
Ling Sui Kiong	Ph. D.	Medicinal Plants	Nagasaki University, Japan
Grace Tabitha Lim	M. Sc.	Entomology	Universiti Putra Malaysia
Nik Zanariah Nik Mahmood	M. Sc.	Corporate Communications	Universiti Putra Malaysia

Latihan Akademik Academic Training	Luar Negeri Overseas		Dalam Negeri Local		Jumlah Total	
	2002	2003	2002	2003	2002	2003
Ph. D.	11	11	12	18	23	29
M. Sc.	-	-	12	16	12	16
B. Sc.	-	-	1	-	1	-
Jumlah Total	11	11	25	34	36	45

### LATIHAN BUKAN AKADEMIK

Tahun 2003 menyaksikan sedikit pertambahan iaitu kira-kira 7% kepada 1226 dari segi bilangan pegawai yang menjalani latihan bukan-akademik. Kebanyakan kursus dijalankan di dalam negeri.

### NON-ACADEMIC TRAINING

The year 2003 saw a slight increase of about 7% to 1226 in the number of officers undergoing non-academic training. Most of the courses attended were held locally.

Latihan Bukan Akademik Non-Academic Training	Pengurusan & Profesional Management & Professional		Kumpulan Sokongsan Supporting Group		Jumlah Total	
	2002	2003	2002	2003	2002	2003
Kursus Course						
Luar Negeri Overseas	12	6	2	1	14	7
Tempatan Local	52	127	95	420	150	547
Persidangan Conference						
Luar Negeri Overseas	74	82	-	-	74	82
Tempatan Local	786	567	122	23	908	590
Jumlah Total	924	782	219	444	1146	1226

# HARI ANUGERAH DAN ULANG TAHUN KE-18 FRIM FRIM'S AWARDS DAY AND 18TH ANNIVERSARY

Hari Anugerah dan Ulang Tahun FRIM ke-18 telah diadakan di Dewan Alwy, Unit Latihan Perhutanan pada 11 Oktober 2003. Y. Bhg. Dato' Dr. Abdul Razak Mohd. Ali, Ketua Pengarah FRIM, telah merasmikan majlis tersebut. Acara penting pada majlis tersebut termasuklah penyampaian anugerah khidmat cemerlang (individu dan berkumpulan), khidmat masyarakat, khidmat lama, dan penerbitan terbaik. Pada tahun ini, tiada penerima yang layak untuk anugerah tesis terbaik dan anugerah penyelidikan terbaik. Kakitangan FRIM yang layak juga turut menerima Moody International Certification for Lead Auditors selepas memenuhi syarat-syarat Pendaftar Antarabangsa Juruaudit Bertauliah bagi ISO 9001:2001. Anugerah Khidmat Masyarakat diberikan kepada Y. Bhg. Dato' Dr. Haji Wan Razali Wan Mohd., Timbalan Ketua Pengarah FRIM yang telah banyak menyumbangkan khidmat beliau dalam aktiviti kemasyarakatan.

*FRIM's Awards Day and 18th Anniversary were held at Dewan Alwy, Unit Latihan Perhutanan on 11 October 2003. Y. Bhg. Dato' Dr. Abdul Razak Mohd. Ali, the General Director of FRIM, officiated the occasion. Highlights of the event included presentations of awards for excellent service (individual and group), community service, long service, and outstanding publications. There were no awardees for best thesis and best research awards for the year. Qualified FRIM staff members also received the Moody International Certification for Lead Auditors after fulfilling the requirements of the International Register of Certificated Auditors for ISO 9001:2001. Y. Bhg. Dato' Dr. Haji Abdul Razak Mohd. Ali, the Director General of FRIM, was honoured the Long Service Award after serving more than 25 years. Y. Bhg. Dato' Dr. Haji Wan Razali Wan Mohd., the Deputy Director General of FRIM won the Community Service Award for his outstanding service to the community.*



Perasmian Hari Anugerah dan Ulang Tahun ke-18 FRIM oleh Ketua Pengarah  
*Opening ceremony of FRIM's Awards Day and 18th Anniversary by the Director General*



Y. Bhg. Dato' Dr. Wan Razali Wan Mohd. menerima Anugerah Khidmat Masyarakat  
*Y. Bhg. Dato' Dr. Wan Razali Wan Mohd. being awarded the Community Service Award*

## ANUGERAH KHIDMAT CEMERLANG EXCELLENT SERVICE AWARDS

### Individu Individual

#### Penerima Awardees

Abd. Karim Mohd. Nasir  
Abdul Molok Ab. Ghani  
Ahmad Awang  
Amir Sabri Baharom  
Ann Bernadette Jackson  
Azman Ahmad  
Fatimah Ab. Rahman  
Md. Azimi Abu Bakar  
Mohd. Zaki Hj. Abdullah  
Mohd. Azmi Muhammed Idris  
Mohd. Hasan Buang  
Dr. Mohd. Ilham Adenan  
Mohd. Radzi Ahmad  
Naemah Hashim  
Nor Rizan Mohammad  
Norhara Hussein  
Norihan Mohd. Salih  
Norsham Suhaina Yaakob  
Dr. Norwati Muhammad  
Nur Hajar Zamah Shari  
Nurhanan Murni Yunos

Hasan Mahmud  
Jamal Abdul Razak  
Jamaluddin Abdullah  
Dr. Lim Hin Fui  
Mahat Mijan  
Maizura Ishak  
Mastura Buang  
Paiman Nasirun  
Puad Elham  
Rashidah Abd. Razak  
Rosman Ibrahim  
Sahadan Mohamad  
Saifulhazlin Abd. Rahim  
Siti Salmi Abdul Rafae  
Suffian Misran  
Teresa Ong  
Zainab Salim  
Zainol Abu  
Zainon Abu Samah  
Zuriati Ahmadin

### Kumpulan Group

#### ICT FRIM FRIM ICT

Asmar Hassan  
Maizura Ishak  
Nurul Hilal Hj. Ahmad Tarmizi  
Salamah Alias  
Wan Zahiri Wan Yaacob  
Yusni Idris  
Zahari Othman  
Zainab Bakar

#### Makmal Teknologi Biji Benih Seed Technology Laboratory

Ang Khoon Cheng  
Fadzlinah Zollpatah  
Hamsinah Hashim  
Herman Hempit  
Jayanthi Nadarajan  
Dr. Marzalina Mansor  
Nashatul Zaimah Noor Azman  
Nor Asmah Hassan  
Ramli Abdullah  
Siti Hasanah Mat Said  
Zaiton Saleh

**Khidmat Lama**  
*Long Service*

**Penerima Awardees**

Y. Bhg. Dato' Dr. Abdul Razak Mohd. Ali	Mohd. Rosdy Mohd. Taher
Ahmad Ismail	Mohd. Sahrie Mohd. Som
Arshad Omar	Muhammad Deraman
Hamidon Ahmad	Ng Tian Peng
Hashim Kamal Mahadi	Tekoh Sulaiman

**ANUGERAH PENERBITAN**  
*PUBLICATION AWARDS*

Anugerah ini diberikan kepada pegawai penyelidik yang menghasilkan penerbitan yang terbaik bagi tahun tersebut. Pemenang bagi pelbagai kategori penerbitan tahun 2003 ialah:

*These awards were conferred to research officers for their outstanding publications for the year. Winners of the various categories of publications in 2003 were as follows:*

**Penerbitan Teknikal *Technical Papers***

**Pertama *First***

Statistical reliability in SMS's pre-felling inventory: Inferences and implications for sampling tree density, basal area and volume  
Wan Mohd. Shukri Wan Ahmad & Wan Razali Wan Mohd.

**Kedua *Second***

Effects of selective logging on the genetic diversity of *Scaphium macropodum*

Lee Chai Ting, Wickneswari, R., Mahani, M.C. & Zakri, A.H.

**Ketiga *Third***

Sustainable forest utilization and net carbon emission in the Malaysian forest sector  
Ismariah Ahmad

Wan Mohd. Shukri Wan Ahmad menerima anugerah penerbitan teknikal terbaik  
*Wan Mohd. Shukri Wan Ahmad receiving the award for best technical paper*



**Penerbitan Separa/Bukan Teknikal *Semi/Non-Technical Papers***

**Pertama *First***

Market prospects of fast-growing timber plantation species in Peninsular Malaysia  
Norini Haron, Lim Hin Fui & Woon Weng Chuen

**Kedua *Second***

Socio-economic aspects of private forest plantations in Peninsular Malaysia  
Lim Hin Fui, Norini Haron, Woon Weng Chuen & Baskaran Krishnapillay

**Ketiga *Third***

Renewable energy in Malaysia: A policy analysis  
Koh Mok Poh & Hoi Why Kong

**Buku *Book***

A Dictionary of Malaysian Timbers (2nd Edition)  
*Lim Seng Choon & Richard Chung Cheng Kong*

Dr. Richard Chung menerima anugerah buku terbaik  
*Dr. Richard Chung receiving the best book award*



**SIJIL-SIJIL ISO LEAD AUDITORS**  
*ISO CERTIFICATES FOR LEAD AUDITORS*

Pegawai-pegawai yang berikut dianugerahkan sijil Moody International Certification for Lead Auditors apabila mereka telah memenuhi syarat-syarat Pendaftar Antarabangsa Juruaudit Bertauliah bagi ISO 9001:2001.

*The following officers were awarded the Moody International Certification for Lead Auditors when they fulfilled the requirements of the International Register of Certificated Auditors for ISO 9001:2001.*

**Penerima Awardees**

Abdullah Abd. Rahman Shah  
Boon Kok San  
Grace Tabitha Lim Wui Oi  
How Seok Sean  
Dr. Ismariah Ahmad  
Mohd. Arshad Saru  
Puad Elham  
Rafeadah Rusli  
Safiah Yusmah Muhd. Yusoff  
Salamah Selamat  
Samsudin Musa  
Shahrudin Hashim  
Sharmiza Adnan  
Vimala Subramaniam  
Zaihan Jalaludin



Vimala Subramaniam menerima Sijil Moody International Certification for Lead Auditors  
*Vimala Subramaniam receiving the Moody International Certification for Lead Auditors*

## PERISTIWA LAIN OTHER EVENTS

### PERSIDANGAN PENYELIDIKAN PERHUTANAN DAN KELUARAN HUTAN (CFFPR 2003)

Persidangan Penyelidikan Perhutanan dan Keluaran Hutan 2003 anjuran FRIM telah diadakan pada 6-8 Oktober 2003 di Kuala Lumpur. Bahagian Tekno-Ekonomi telah mengendalikan persidangan ini dengan tema "Forestry for Society" dengan dua subtema iaitu "Second Growth Forests" dan "Improved processing and Utilisation of Wood and Non-Wood Products." Persidangan ini dirasmikan oleh Y.B. Datuk Anifah Aman, Timbalan Menteri Perusahaan Utama yang mewakili Menteri Perusahaan Utama.

Dalam ucapan perasmian, Timbalan Menteri menekankan tentang sumbangan industri perhutanan dan industri yang berasaskan kayu terhadap ekonomi Malaysia di samping kepentingan menguruskan hutan secara berkekalan. Malaysia telahpun menyebarkan polisi serta meluluskan undang-undang dan enakmen untuk memastikan pemuliharaan sumber asli kita dengan lebih baik, di samping menandatangani perjanjian antarabangsa, contohnya dengan "Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES)" dan "Convention on Biological Diversity (CBD)." Sempena persidangan ini, laman web FRIM yang baru turut dilancarkan dengan rasminya oleh Y.B. Timbalan Menteri Perusahaan Utama.

Persidangan ini menerima banyak kertas kerja dan poster yang bermutu dari luar negeri. Seramai 300 orang peserta telah menghadiri seminar dengan pembentangan 43 kertas kerja dan pameran 46 poster. Persidangan ini juga turut membincangkan tentang perkara yang berkaitan dengan peladangan hutan, hutan pusingan kedua, pemrosesan



Y. B. Dato' Dr. Abdul Razak Mohd. Ali menyampaikan kata alu-aluan beliau  
Y. B. Dato' Dr. Abdul Razak Mohd. Ali delivering his welcoming speech

### CONFERENCE ON FORESTRY AND FOREST PRODUCTS RESEARCH (CFFPR 2003)

*FRIM's Conference on Forestry and Forest Products Research (CFFPR-2003) was organised from 6-8 October 2003 in Kuala Lumpur. Helmed by the Techno-Economics Division, the theme of the Conference was "Forestry For Society" with two sub-themes, "Second Growth Forests" and "Improved Processing and Utilisation of Wood and Non-wood Products". The occasion was officiated by Y. B. Datuk Anifah Aman, Deputy Minister of Primary Industries on behalf of the Minister of Primary Industries.*

*In his opening address, the Deputy Minister emphasised the economic contribution of forestry and wood-based industries towards the Malaysian economy as well as the importance of managing the forest in a sustainable manner. To this end, Malaysia has promulgated policies and passed laws and enactments to ensure better conservation of our natural resources and by signing international agreements, such as the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) and the "Convention on Biological Diversity (CBD). FRIM'S new look web site was also launched by the honourable Deputy Minister during the Conference.*

*The conference received a number of excellent papers and posters from abroad. A total of 300 participants attended the conference in which 43 oral papers were presented and 46 posters exhibited. Matters related to forest plantations, second growth forests, and improved processing and utilisation of wood and non-wood products were discussed. Issues on conservation of biodiversity, non-wood products, forest ecology, socio-economics and the potential of new*



Timbalan Menteri melancarkan laman web baru FRIM  
sempena Persidangan  
The Honourable Deputy Minister launching FRIM's  
new web site during the Conference

dan penggunaan hasil kayu dan bukan-kayu yang telah dibuat penambahbaikan. Isu tentang pemuliharaan dan biodiversiti, hasil bukan-kayu, ekologi hutan, sosio-ekonomi dan potensi pembangunan terkini dalam industri hutan juga turut ditonjolkan.

Dua ucapatama telah disampaikan oleh Profesor Don Koo Lee dari Seoul National University dan En. Barney Chan dari Persatuan Kayu-Kayan Sarawak. Profesor Lee, yang juga Naib Presiden International Union of Forestry Research Association (Policy) membincangkan tentang penyimpanan, pemulihan dan pengurusan hutan pusingan kedua dan hutan ternyahgred. Beliau membangkitkan kebimbangan tentang penyahgredan hutan yang berterusan di seluruh dunia dan menekankan tentang perlunya usahasama dijalankan untuk memulihkan tanah ternyahgred. En. Barney Chan pula menyentuh tentang industri kayu-kayan Malaysia pada abad ke-21. Beliau menekankan keperluan untuk menjalankan aktiviti penyelidikan dan pembangunan secara intensif untuk memastikan bekalan kayu mencukupi untuk memenuhi keperluan industri tanpa berkompromi dengan matlamat alam sekitar dan sosial.

Penganjur telah mengadakan dua lawatan selepas-persidangan. Lawatan pertama ialah ke hutan pusingan kedua dan hutan rekreasi di Negeri Sembilan. Lawatan kedua ialah ke sebuah projek perumahan kayu berkualiti yang mengadunkan unsur buatan manusia dan unsur semula jadi untuk pembangunan masyarakat yang peka terhadap ekologi berdasarkan gabungan antara binaan manusia dan landskap hutan asli.

*developments in forest industry were also highlighted.*

*Two keynote addresses were delivered by Professor Don Koo Lee of the Seoul National University and Mr. Barney Chan of the Sarawak Timber Association. Professor Lee, also International Union of Forest Research Organisation's Vice President (Policy), spoke on "Restoration, rehabilitation and management of second growth and degraded forests". He raised concern about the situation of continual forest degradation worldwide and emphasised the need for concerted efforts to rehabilitate degraded land. Mr. Barney Chan spoke on "Malaysian timber industries in the 21st century". He emphasised the need to intensify R&D activities to ensure adequate wood supply to meet the needs of the industry without compromising environmental and social goals.*

*The conference organised two post-conference tours. The first tour involved a visit to second growth and recreational forests in Negeri Sembilan. The second was a visit to a quality timber housing project that blended man-made and natural elements for ecologically-sensitive community development based on integration between human construction and natural forest landscape.*



Timbalan Menteri menyaksikan poster pada Pameran Poster  
The Honourable Deputy Minister viewing displays in the Posters Exhibition



Para peserta dalam salah satu sesi persidangan  
Participants in one of the sessions of the conference

## BENGKEL PAYA LAUT KEBANGSAAN

Bengkel Paya Laut Kebangsaan anjuran Jabatan Perhutanan Negeri Perak dan FRIM ini diadakan di Hotel Legend Inn di Taiping, Perak dari 15-17 Julai 2003. Seramai 66 peserta yang mewakili agensi kerajaan, badan bukan-kerajaan, industri dan universiti menghadiri Bengkel ini. Salah seorang peserta ialah saintis Jepun dari Forestry and Forest Product Research Institute di Hokkaido.

Bengkel ini telah menghasilkan cadangan yang berikut:

### Silvikultur dan Pengurusan

- Hutan paya laut Malaysia yang mempunyai potensi pelbagai-guna memerlukan perancangan jangka pendek dan jangka panjang yang bersepadu untuk dimajukan melalui pendekatan pelbagai-sektor dan sebaik-baiknya melalui perundingan dengan pelbagai-stakeholder. Di samping itu, garis panduan pengurusan yang khusus dan dizonkan perlu dibangunkan untuk kegunaan dan fungsi paya laut yang berbeza contohnya ekopelancongan, perikanan dan akuakultur.
- Penjarangan dan pusingan kitaran yang optimum perlu ditentukan bergantung pada ciri-ciri tapak, keperluan pasaran dan kegunaan-akhir produk. Kajian yang berkaitan perlulah dijalankan.
- Terdapat keperluan untuk menjalankan kerjasama penyelidikan dan pembangunan di kalangan agensi yang berkaitan terutamanya dari aspek sosial, alam sekitar dan biodiversiti.

## NATIONAL WORKSHOP ON MANGROVES

Organised jointly by the Perak State Forestry Department and FRIM, the National Workshop on Mangroves was held at the Legend Inn in Taiping, Perak from 15-17 July 2003. A total of 66 participants representing government agencies, NGOs, industries and universities attended the workshop. A Japanese scientist from the Forestry and Forest Product Research Institute in Hokkaido was amongst the participants.

The workshop made the following recommendations:

### Silviculture and Management

- Given the multiple-use potential of mangrove forests in Malaysia, integrated short- and long-term plans will have to be developed through a multi-sectoral approach and preferably through multi-stakeholders consultation. In addition, specific management guidelines and zoning will have to be developed for different uses and function of mangroves e.g. ecotourism, fishery, and aquaculture.
- Optimum thinning and rotation cycle should be decided depending on the site characteristics, market demand and intended end-use of the product. Relevant studies should be carried out.
- There is a need for collaborative R&D among relevant agencies particularly from the social, environment and biological diversity aspects.

### Harvesting and Utilisation

- Utilisation of mangroves should be expanded beyond local demand to more value-added products for global export. New business opportunities from mangrove-based products should also be explored.

### Penebangan dan Penggunaan

- Penggunaan paya laut perlu diperluas daripada pasaran tempatan kepada produk bernilai-tambah untuk eksport dunia. Peluang perniagaan yang baru dari produk yang berasaskan hutan paya laut juga perlu diteroka.
- Dari segi ekonomi, penggunaan boleh didapati daripada bahan sampingan arang.
- Strategi perlu dibentuk untuk mengatasi kekurangan tenaga buruh dan peningkatan kos pengeluaran. Peluang untuk menerima pakai teknologi yang bersih perlu diteroka contohnya pembangunan teknologi dengan rakan penyelidikan dari negara maju.
- Teknik penebangan balak perlu dipertingkatkan untuk meningkatkan produktiviti dan mengurangkan kerosakan kepada dirian baki dan alam sekitar.

### Pemuliharaan dan Biodiversiti

- Strategi pemuliharaan paya laut yang khusus diperlukan untuk menangani kesan yang dihasilkan daripada aktiviti penggunaan tanah di luar kawasan paya laut.
- Kawasan perlu digazetkan khusus untuk pemuliharaan dan pengeluaran biodiversiti, dan menambah Hutan Simpan Hutan Dara melalui perundingan dengan pihak yang berkepentingan yang berkenaan.
- Hutan paya laut di tanah kerajaan termasuk kukup lumpur (khususnya di Selangor) perlu digazetkan sebagai hutan simpan untuk melindungi daripada pencerobohan dan penukaran.
- Kesedaran awam dan program pendidikan perlu dilaksanakan dengan lebih banyak melalui media massa. Ia perlu dijalankan secara usahasama kesemua agensi yang berkaitan serta institusi pendidikan/penyelidikan. Satu unit tambahan dicadangkan untuk memainkan peranan ini.

- Economic uses should be derived from the by-products of charcoal.
- Strategies need to be designed to overcome labour shortage and rising costs of production. Opportunities for adopting clean technologies should be explored e.g. technology development with developed countries research partners.
- Timber harvesting techniques have to be improved to enhance productivity and reduce damage to residual stand and the environment.

### Conservation and Biodiversity

- Specific mangrove conservation strategy is needed to address the impacts that result from land-use activities outside the mangroves areas.
- Areas should be set aside (gazetted) specifically for biodiversity conservation and production, and expand existing Virgin Jungle Reserves (VJRs) through consultation with relevant stakeholders.
- All stateland mangroves including mudflats (specifically in Selangor) should be gazetted as forest reserve to protect from encroachment and conversion.
- More public awareness and education program should be implemented through the mass media. These should be conducted through joint effort by all relevant agencies and education/research institutions. An extension unit is suggested to take on this role.

# LAWATAN RASMI OFFICIAL VISITS

# PEGAWAI OFFICERS

Tarikh <i>Date</i>	Pelawat <i>Visitor</i>
18 Februari <i>18 February</i>	Pegawai dari Kerala Forestry Department, India <i>Officials from the Kerala Forestry Department, India</i>
26 Februari <i>26 February</i>	Penuntut dari Forestry and Timber Technology University, Hamburg, Jerman <i>Students from the Forestry and Timber Technology University, Hamburg, Germany</i>
3 Mac <i>3 March</i>	Pegawai-Pegawai Kanan dari Union of Myanmar <i>Senior Officials from the Union of Myanmar</i>
10 Mac <i>10 March</i>	Pegawai-Pegawai Kanan dari Republik Sosialis Vietnam <i>Senior Officials from Socialist Republic of Vietnam</i>
2 April <i>2 April</i>	Menteri Sains, Penyelidikan & Seni, Federal State of Baden, Jerman <i>Minister for Science, Research &amp; Arts, Federal State of Baden, Germany</i>
19 Mac <i>19 March</i>	Prof. Habil Christoph, Technology College Hildesheim Holzminden Goettingen, Jerman <i>Prof. Habil Christoph, Technology College Hildesheim Holzminden Goettingen, Germany</i>
27 Mac <i>27 March</i>	Pegawai-Pegawai dari National Administration for Tourism, Vietnam <i>Officials from the National Administration for Tourism, Vietnam</i>
1 Mei <i>1 May</i>	Delegasi dari Kerajaan Denmark <i>Delegation from the Kingdom of Denmark</i>
16 Julai <i>16 July</i>	Program Pembiasaan bagi Wakil-Wakil Perdagangan Balak <i>Familiarisation Programme for Timber Trade Representatives</i>
30 Julai <i>30 July</i>	Delegasi dari Colombia <i>Delegation from the Republic of Colombia</i>
25 Ogos <i>25 August</i>	Pegawai Penyelidik dari IRRI, Indonesia <i>Research Officers from IRRI, Indonesia</i>
25 September <i>25 September</i>	Pustakawan dari Amerika, United Kingdom dan Singapura <i>Librarians from America, United Kingdom and Singapore</i>
19 September <i>19 September</i>	Delegasi dari Kerajaan Belanda <i>Delegation from the Kingdom of the Netherlands</i>
22 September <i>22 September</i>	Delegasi dari Republik Demokratik Rakyat Laos <i>Delegation from the Lao People's Democratic Republic</i>
16 Oktober <i>16 October</i>	Pegawai dari Kerajaan Bhutan <i>Officials from the Kingdom of Bhutan</i>

## PEJABAT KETUA PENGARAH DIRECTOR GENERAL'S OFFICE

### Ketua Pengarah *Director General*

DATO' DR. ABDUL RAZAK MOHD. ALI  
DIMP, JMN, FMIC  
B. Sc. (Hons.) (Tasmania)  
Ph. D. (UM)

### Timbalan Ketua Pengarah *Deputy Director General*

DATO' DR. WAN RAZALI WAN MOHD.  
DPMT, JSM, KMN, FIFM  
Dip. Agric. (UPM)  
B. Sc. For., M. Sc. (Louisiana State)  
Ph. D. (Washington)

### Pegawai Audit Dalam *Internal Auditor*

Abdul Halim Jawi AMN  
B. Econ., Dip. Pub. Adm. (UM),  
M. Sc. Hum. Res. (UPM), MIPM

## PUSAT PENGURUSAN PERNIAGAAN FRIM FRIM BUSINESS CENTRE

### Pengarah Urusan FBC *FBC Managing Director*

DR. ABD. LATIF MOHMOD KMN, AMN  
B. Sc. (Hons.) (UKM)  
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## Bahagian Pengurusan Perniagaan *Business Affairs Division*

### Pengarah *Director*

DR. HOI WHY KONG AMN, FMSA  
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### Pegawai Penyelidik *Research Officers*

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### Pegawai Penyelidik Kontrak *Contract Research Officers*

Ho Kam Seng  
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## Bahagian Pengurusan Penyelidikan *Research Management Division*

### Pengarah *Director*

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### Pegawai Penyelidik *Research Officers*

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Boon Kok San  
B.Sc. (Hons.) (UM)  
M. Sc. (NUS)

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Post-Grad. Dip. For. Survey (ITC)  
M. Sc. (Edinburgh)

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M. Sc. Corp. Comm. (UPM)

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**Pengarah**  
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Post-Grad. Dip. Lib. Sc. (UiTM)  
M. Sc. (UIA)

Ho Yuen Foon  
B. Sc. (Hons.), M. Sc. (UM)

Mohd. Rasol Abd. Manaf  
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B. Sc. For. (UPM)  
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Mastura Buang  
B. Sc. Agric. (UPM)  
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Zahari Othman  
B. Sc. (Hons.) (UiTM)

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*Assistant Research Officers*

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Maizura Ishak  
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**Pegawai Penyelidik Kontrak**  
*Contract Research Officers*

Mohd. Aziri Che Wil  
B. Comp. Sc. (UiTM)

#### Bahagian Pembangunan Korporat *Corporate Development Division*

**Pengarah**  
*Director*

WAN RAHMAH WAN A. RAOF  
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**Pegawai Penyelidik**  
*Research Officers*

Norhayati Nordin  
Dip. Civil Eng. (UTM)  
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**Pustakawan**  
*Librarian*

Norain Mohd Arif  
B. Sc. Info Studies (Hons.) (UiTM)

**Penolong Pegawai Penyelidik**  
*Assistant Research Officers*

Jaaffar Ahmad

Ruziah Ripin  
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Sulaiman Mohd. Zain PPN

Thomas Ng Tian Peng

#### Bahagian Pentadbiran dan Kewangan *Administration and Finance Division*

**Pengarah**  
*Director*

MOHD. ZAMSHARI ABDUL RAHMAN R.A.(M), ASCPA  
B. Comm. (W. Aust.)

**Akauntan**  
*Accountant*

Khairulnisam Harun  
B. Acc. (Hons.) (UKM)

**Pegawai Tadbir**  
*Administrative Officer*

Abdul Jabbar Sabli  
Dip. Bus. Stud. (UiTM)  
B. Bus. Adm. (Hons.) (UKM)

**Pegawai Penyelenggaraan**  
*Maintenance Officers*

Jamal Abdul Razak  
Dip. Qty. Survey (UiTM)

**Penolong Akauntan**  
*Assistant Accountants*

Norli Raja Mohamad  
Dip. Bus. Stud. (UiTM)

Norbaite Saharudin  
Dip. Bus. Stud. (UiTM)

Abd. Manab Osman (KPSL)

**Penolong Pegawai Penyelidik**  
*Assistant Research Officers*

Mohd. Azhar Ishak @ Asahak  
Dip. Mech. Eng. (Politeknik)

**Penolong Pegawai Tadbir (Kontrak)**  
*Contract Assistant Administrative Officers*

Noorsuhanis Abdul Latif  
Dip. Pub. Adm., B. Corp. Adm. (Hons.) (UiTM)

#### Bahagian Hutan Asli *Natural Forest Division*

**Pengarah**  
*Director*

DR. SHAMSUDIN IBRAHIM  
B. Sc. For. (UPM)  
M. Sc. (James Cook),  
Ph. D. (Wales)

**Pegawai Penyelidik**  
*Research Officers*

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Dip. Agric. (UPM)  
B. Sc. Agric. (Iowa State)  
M. Sc. Agric. (Central Missouri State)  
Ph. D. (Wales)

Dr. Raja Barizan Raja Sulaiman  
B. Sc., M. Sc. (UKM)  
Ph. D. (Stirling)

Dr. Khali Aziz Hamzah  
B. Sc. For. (UPM)  
M. Sc. (AIT)  
Ph. D. (Reading)

Ismail Harun  
Dip. For., B. Sc. For., M. Sc. For. (UPM)

Dr. Abd. Rahman Kassim  
Dip. For., B. Sc. For. (UPM)  
M. Sc. For. (UPLB)  
Ph. D. (Oregon State)

Abd. Razak Othman  
B. Sc. Agric. (UPM)  
M. Sc. (UKM)

Samsuddin Musa  
B. Sc. For. (UPM)

Dr. Jenny Wong Lai Ping  
B. Sc. (Env.) (UPM)  
MURP (Virginia Tech)  
Ph. D. (Oregon State)

Mohd. Nasir Husin  
Dip. For. (UiTM)  
B. Sc. For. (UPM)  
M. Sc. (UKM)

Ismail Parlan  
Dip. Sc. (UiTM)  
B. Sc. For., M. Sc. For. (UPM)

Safiah @ Yusmah Muhd. Yusoff  
Dip. Sc. (UiTM)  
B. Sc. Geog., M. Sc. (UM)

Wan Mohd. Shukri Wan Ahmad  
B. Sc. For., M. Sc. For. (UPM)

Nur Hajar Zamah Shari  
Dip. For., B. Sc. For., M. Sc. For. (UPM)

Serafina Christine Fletcher  
B. Sc. (Hons.), M. Sc. (UKM)  
(From September)

Tan Sek Aun  
B. Sc. Env. (UPM)  
(From September)

**Pegawai Penyelidik Kontrak**  
*Contract Research Officers*

Salleh Mat  
B. Sc. Res. Econ. (UPM)

Khairul Najwan Ahmad Jahari  
B. Sc. For. (UPM)

Mohamad Nazrin Yahaya  
B. Sc. Mech. Eng. (UPM)  
(Until August)

Shajoeril Tajudin  
B. Sc. Remote Sensing (Hons.) (UTM)

Norazian Mohd Zain  
Dip. For., B. Sc. For. (UPM)

Mohd. Hazley Halim  
B. Sc. Geoinformation (Hons.) (UTM)  
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**Penolong Pegawai Penyelidik**  
*Assistant Research Officers*

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Dip. Agric. (UPM)

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**Penolong Pegawai Penyelidik Kontrak**  
*Contract Assistant Research Officers*

Chong Phang Fee PPN

Harfendy Osman  
Dip. Comp. Sc. (UPM)

Syurhani Abdul Wahab  
Dip. For., B. Sc. For. (UPM)  
(From October)

**Bahagian Hutan Ladang**  
*Forest Plantation Division*

**Pengarah**  
*Director*

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**Pegawai Penyelidik**  
*Research Officers*

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B. Sc., M. Sc. (Texas)  
Ph. D. (UKM)

Dr. Adzmi Yaacob  
B. Sc. (UM)  
M. Sc. (Kent)  
Ph. D. (Aberystwyth, Wales)

Dr. Aminah Hamzah  
B. Sc. Agric. (UPM)  
M. Sc. For. (Goettingen)  
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Hashim Mohd. Nor  
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B. Sc. (Hons.) (UKM)  
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Mohd. Rosli Harun  
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**Pegawai Penyelidik Kontrak**  
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B. Sc. Biol. (UM)

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B. Sc., M. Sc. (Southern Illinois),  
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B. Sc. (UMS)  
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Jayanthi Nadarajan  
B. Sc. (Hons.) (UM)  
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Kevin Ng Kit Siong  
B. Sc. (UMS)

Dr. Kodi Isparan Kandasamy  
B. Sc. (UKM)  
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B. Sc. Agric. (Hons.), M. Sc. Agric. (UM),  
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B. Sc. For., M. Sc. (UPM)

Dr. Najib Lotfy Arshad  
B. Sc. (Hons.) (UM)  
M. Sc. (Ghent)  
Ph. D. (Wales)

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B. Sc. Plant Tech. (UMS)

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B. Sc., M. Sc (UKM)

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Dip. For., B. Sc. For. (UPM)

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B. Sc. Bio-Industry (UPM)

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B. Sc. (Hons.) (UPM)

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Mohd Jaffar Sharri

Mohd. Ghazali Hassan  
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Ong Tai Hock

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**Bahagian Alam Sekitar**  
*Forest Environment Division*

**Pengarah**  
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B. Sc. For. (Louisiana State),  
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Ph. D. (Wales)

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B. Town & Country Plan. (UTM)  
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B. Eng. (UPM)  
Post-Grad. Dip. (Italy)

Dr. Noor Azlin Yahya  
B. Sc. Biol. (Doane)  
M. Sc. Resource Mgt. (New York)  
Ph. D. Recreation Mgt. (UPM)

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Ph. D. (UM)

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Ph. D. Agric. Bot. (Reading)

Siti Aisah Samsuddin  
B. Sc. Geog., M. Phil. (UM)

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B. Landscape Design (Washington)  
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Lim Lip Hon  
B. Inf. Tech. (MMU)  
(Until April)

Hui Ting Fui  
B. Sc. Agron. (Utah State)

Normaya Nordin  
B. Sc. Biomed. Tech. (UM)

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B. Arch. (UM)  
(Until July)

Jamalludin Budin  
B. Landscape Arch. (UTM)

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B. Sc. For. (UPM)

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Mohd. Mat Sahat

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**Penolong Penyelidik**  
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Chong Mew Im  
B. Sc. For. (UPM)

**Pusat Konservasi Botani Kebangsaan**  
*National Botanic Conservation Centre*

**Pengarah**  
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B. Sc. For. (UPM)  
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B. Sc. For. (UPM)  
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Noorsiha Ayop  
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Nor Ezzawanis Abdullah Thani  
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**Penolong Pegawai Penyelidik**  
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Muhammad Asri Ismail

**Bahagian Teknologi Keluaran Hutan**  
*Forest Products Technology Division*

**Pengarah**  
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B. Sc. (Hons.) Mech. Eng. (Strathclyde)

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Hj. Mohamad Omar Mohamad Khaidzir  
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Dr. Ani Sulaiman  
B. Sc. (Hons.), M. Sc. (Wales)  
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B. Sc. (Hons.) (UKM)  
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Dip. Mech. Eng. (UTM)  
B. Eng. (Sunderland)

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M. Sc. (North Wales)

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B. Sc. For. (UPM)

Hamdan Husain  
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B. Sc. Housing, Building & Planning, B. Arch. (USM)

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B. Sc. For., M. Sc. (UPM)

Zaihan Jalaludin  
B. Sc. (Hons.) (UKM)  
M. Sc. (UPM)

Abdul Hamid Salleh  
Dip. Int. Design, B. Sc. Int. Design (UiTM)

Norul Hisham Hamid  
B. Sc. For. (UPM)  
M. Sc. (USM)

**Pegawai Penyelidik Kontrak**  
*Contract Research Officers*

Maria Zura Mohd. Zain  
B. E. Civil Eng. (Hons.) (USM)

Sik Huei Shing  
B. Sc. For. (UPM)

**Penolong Pegawai Penyelidik**  
*Assistant Research Officers*

Zawawi Kassim  
Dip. Sc. (UiTM)

Nor Azian Mohd. Kasby  
Dip. Civil Eng. (UTM)

Siti Rafidah Mahmud  
Dip. Wood Tech. (UiTM)

Baharuddin Kamaruddin  
Dip. Wood Tech. (UiTM)

Yaakob Zahari  
Dip. Marine Eng. (Ungku Omar)

Roszalli Mohd

Ahmad Ismail

**Bahagian Kimia Kayu**  
*Wood Chemistry Division*

**Pengarah**  
*Director*

DR. MOHD. NOR MOHD. YUSOFF  
B. Sc. For. (Louisiana)  
M. Sc. For. Prod. (Virginia)  
Ph. D. (Manchester)

**Timbalan Pengarah**  
*Deputy Director*

Dr. Rahim Sudin AMIC, AMSA  
B. Sc. (Hons.) (UKM)  
M. Sc. (USM)  
Ph. D. (Sheffield)

**Pegawai Penyelidik**  
*Research Officers*

Salamah Selamat AMIC, MIQ  
B. Sc. (Hons.) (UKM)

Dr. Wan Rasidah W.A. Kadir  
B. Sc. (Hons.), M. Sc. (UKM)  
Ph. D. (Ghent)

Dr. Koh Mok Poh  
B. Sc. (Hons.) (London)  
Ph. D. (Du Maine)

Wan Asma Ibrahim  
B. Sc. Chem. (Kansas State),  
M. Sc. Chem. (Missouri-Rolla)

Mahmudin Saleh  
B. Eng. (Hons.) (UM)

Suffian Misran  
B. Sc. (Hons.) (UPM)

Shaharuddin Hashim  
B. Sc. (Hons.) (USM)

Sharmiza Adnan  
B. Eng. (Chem.) (Vanderbilt)

Puad Elham  
Dip. Wood Tech. (UiTM)  
B. Sc. (For.), M. Sc. (UPM)

Rafeadah Rusli  
B. Sc. (Hons.) (USM)  
M. Sc. (UPM)

Mohamad Jani Saad  
B. Tech. (USM)  
(From October)

**Pegawai Penyelidik Kontrak**  
*Contract Research Officers*

Latifah Jasmani  
B. Sc. (Hons.) (Manchester)

Suhana Rafidah Md. Yusof  
B. Sc. (Hons.) (UPM)  
(From May)

**Penolong Pegawai Penyelidik**  
*Assistant Research Officers*

Habibah Mohamad  
Dip. Ind. Chem. (UiTM)

Zaitun Said  
Dip. Wood Tech. (UiTM)

Rozaida Latip  
Dip. Wood Tech. (UiTM)

Azizi Abdul Jalil  
Dip. Wood Tech. (UiTM)

Rozita Ahmad  
Dip. Ind. Chem. (UiTM)  
B. Sc. (Hons.) (USM)  
(On leave without pay)

**Bahagian Tumbuhan Ubatan**  
*Medicinal Plants Division*

**Pengarah**  
*Director*

DR. RASADAH MAT ALI  
B. Sc. (Hons.), M. Sc. (UM)  
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**Pegawai Penyelidik**  
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Dr. Chang Yu Shyun  
B. Sc. (Hons.), Ph. D. (Tasmania)

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Mastura Mohtar  
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B. Sc. (Hons.), M. Phil. (UM)  
Ph. D. (Okayama)

Asiah Osman  
B. Sc. (UPM)  
M. Sc. (UKM)

Nik Musa'adah Mustapha  
B. Sc. (Hons.) (UKM)

Nor Hasnida Hassan  
B. Sc. (Hons.), M. Sc. (UKM)

Nor Azah Mohd. Ali  
B. Sc. (Waterloo)  
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Noorsemira Noor  
B. Sc. Biotech. (UPM)

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B. Sc. Ind. Biol. (UTM)

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B. Sc. Biomed. (UPM)

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# PENERBITAN PUBLICATIONS

## Penolong Pegawai Penyelidik Assistant Research Officers

Mohd. Radzi Ahmad  
Dip. MLT (UKM)

Abdull Rashih Ahmad

Abu Said Ahmad

Khairuddin Kamaruddin

Nuziah Hashim  
Dip. Ind. Chem. (UiTM)

## Penolong Pegawai Penyelidik Kontrak Contract Assistant Research Officer

Salbiah Man  
Dip. Ind. Chem. (UiTM)

Rohana Sahdan  
Dip. Microbiol. (UiTM)

Mazurah Mohamed Isa  
Dip. Microbiol. (UiTM)

Halimatus Saadiah Mohamed Emran  
Dip. Comp. Sc. (UPM)

Abdul Majid Jalil  
Dip. Chem. Eng. (UTM)

## Bahagian Tekno-Ekonomi Techno-Economics Division

## Pengarah Director

DR. WOON WENG CHUEN LIMIS  
B. Sc. For. (UPM)  
M. Sc. (Berkeley)  
Ph. D. (Wales)

## Pegawai Penyelidik Research Officers

Dr. Norini Haron  
Dip. For. (UiTM)  
B. Sc. Res. Econ. (UPM)  
M. Sc. (Michigan)  
Ph. D. (Aberystwyth, Wales)

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B. Sc. Res. Econ. (UPM)  
M. Sc. (Michigan)  
Ph. D. (Washington)

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Dip. Agric., B. Sc. Agribus. (UPM)  
M. Sc. (New England)

Mohd. Azmi Muhammed Idris  
B. Sc. Res. Econ. (UPM)

Mohd. Parid Mamat  
B. Sc. For. (UPM)

## Pegawai Penyelidik Kontrak Contract Research Officers

Dr. Lim Hin Fui  
Dip. Ed., B. Soc. Sc., M. Soc. Sc. (UKM)  
Ph. D. (UM)

Tong Pei Sin  
B. Sc. For. (UPM)

Ahmad Fadli Shaharum  
B. Sc. For. (UMS)

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Shahira Ishak  
Dip. Bus. Stud. (UiTM)

Pada tahun 2003, sebanyak 23 penerbitan dihasilkan. Bilangan ini termasuk Malaysian Forest Record nombor 46; FRIM Technical Information Handbook nombor 33; Siri Alam dan Rimba bernombor 1 (dicetak semula), 6 dan 7; FRIM Reports dari nombor 77 ke 79; Timber Technology Bulletin bernombor dari 26 ke 28 dan prosiding CFFPR tahun 2001 dan 2003. Tiga keluaran FRIM in Focus telah diterbitkan dalam tahun ini.

*In 2003 a total of 23 publications was produced. This included the Malaysian Forest Record number 46; FRIM Technical Information Handbook number 33; Siri Alam dan Rimba number 1 (Reprint), 6 and 7; FRIM Reports from number 77 to 79; Timber Technology Bulletin numbers 26 to 28 and the CFFPR Proceedings for the years 2001 and 2003. Three issues of FRIM in Focus were also published this year.*

Penerbitan <i>Publication</i>	2002	2003
Journal of Tropical Forest Science	4	4
Journal of Tropical Forest Products	2	1
Malaysian Forest Records	2	1
FRIM Technical Information Handbook	1	1
Siri Alam dan Rimba	0	3
FRIM Reports	3	3
Timber Technology Bulletin	1	3
Proceedings	2	2
Annual Report	1	1
Research Report	1	1
FRIM in Focus	4	3
Research Pamphlets	0	0
FRIM Technical Information	1	0
FRIM Special Publication	1	0
<b>Total Jumlah</b>	<b>23</b>	<b>23</b>

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4. MOHD. NOR, M.Y. SHAHARUDDIN, H., RAFEADAH, R. & SHARMIZA, A. (Eds.). Peraturan Keselamatan Makmal dan Bengkel FRIM, FRIM, Kepong, 61 pp
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6. ABD. RAZAK, O. Socio-economic contribution of bamboo to the Orang Asli community in Buntu, Pahang - A case study. Pp 555-556 in Azmy, M. *et al.* (Eds.). Proceedings of the International Conference on Forestry and Forest Products Research (ICFFPR 2001). Tropical Forestry Research in the New Millennium: Meeting Demands and Challenges, Kuala Lumpur, 1 to 3 October, FRIM
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#### KERTAS KERJA WORKING PAPERS

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2. ABD. RAHMAN, K. & DOUGLAS, M.A. Evaluation of the long-term maximum size-density relationship in primary mixed dipterocarp forests of Peninsular Malaysia. Paper presented at the Seminar on Ecological Research in Tropical Rain Forests: A seminar to commemorate over 30 years of research at Pasoh Forest Reserve, FRIM, Kepong, 19 to 21 August, FRIM
3. ABD. RAHMAN, K. & SAMSUDIN, M. Silviculture options for second growth mixed dipterocarp forest. Paper presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
4. ABD. RAHMAN, K., MOHD. NASIR, H. & SHAHRULZAMAN, I. Density management issues in mangrove forest: A case of even-aged stand of *Rhizophora* sp. Paper presented at the National Mangrove Workshop: New Insight on the Management & Silviculture of Mangrove, Perak, 15 to 17 July
5. ABD. RAZAK, M.A. & NORINI, H. The role of forestry research and development (R&D) institution in policy formulation and implementation: A Malaysian perspective. Keynote paper presented at the IUFRO Workshop on the Forest Science/Policy Inference in Europe, Africa and Middle East, Copenhagen, Denmark, 23 to 27 June, IUFRO
6. ABD. RAZAK, M.A. PROSEA programme: The South East Asian perspective. Paper presented at PROSEA Mini Symposium, Netherlands, 24 April. 10 pp
7. ABD. RAZAK, M.A., TAN, Y.E. & RAJAN, S. Promoting the use of timber in construction. Paper presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
8. ABDUL HAMID, S., SITI RAFIDAH, M. & ZAIHAN, J. Panduan standard ujian perabot. Paper presented at the Seminar of the Malaysian International Furniture Fair (MIFF 2003), PWTC, Kuala Lumpur, 6 March
9. ABDUL HAMID, S., ZAIHAN, J., HASHIM, W.S., PUAD, E., NOOR AZMIZA, A.Z. & SITI ZALIFAH, M. Strength properties of common jointing system and physical performance of chair made from solid Oil Palm trunk. Paper presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong

10. ADNAN, M. & LIZA, I. Arboricultural practices in Malaysia. Paper presented at the Urban Forestry Workshop: Assessing the Need for Sustainable Landscape in a Changing Society, Kuala Lumpur, 14 to 15 October
11. ADNAN, M., AHMAD AZARUDDIN, M.N., & MOHD. ZAILANI, J. Professionalism in landscape and tree care practices in Malaysia. Paper presented at the Urban Forestry Workshop: Assessing the Need for Sustainable Landscape in a Changing Society, Kuala Lumpur, 14 to 15 October
12. ADZMI, Y. Soils and the forest environment. Paper presented at the 'Perkemah Sains Nasional, 22 to 27 September, FRIM, Kepong
13. ADZMI, Y. & WAN RASIDAH, W.A.K. Potential fertilizer usage: In particular urea, by forest plantation and medicinal species. Paper presented at the Urea Research Project Steering Committee Meeting, Kuala Lumpur, 22 May
14. AHMAD FAUZI, P., ISMARIAH, A. & NAJIB LOTFY, A. Agroforestry systems and land-use options applicable in Malaysia. Paper presented at the Seminar on Ecological Research in Tropical Rain Forests: A seminar to commemorate over 30 years of research at Pasoh Forest Reserve, FRIM, Kepong, 19 to 21 August, FRIM
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20. ALLARD, G., FORTUNA, S., LEE, S.S., NOVOTNY, J. & COURTINHO, T. Global information on outbreaks and impact of major forest insect pests and diseases. Paper presented at the XII World Forestry Congress: Forests, Source of Life, Congress: Forests for the Planet, Quebec City, Canada, 21 to 28 September, IUFRO
21. AMAT RAMSA, Y., NORINI, H., SREETHERAN, M. & ADNAN, M. Roles of urban green spaces: the social dimensions. Paper presented at the Urban Forestry Workshop: Assessing the Need for Sustainable Landscape in a Changing Society, Kuala Lumpur, 14 to 15 October
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25. AZMY, M., HALL, J.B. & WAN RASIDAH, W.A.K. Management of bamboo resources: Nami experience. Paper presented at the BAMTECH 2003 Seminar, Gauhati, Assam, India, 11 to 13 March
26. BARUDIN, M. & AHMAD FAUZI, P. Does Kuznetsian relationship exists for Malaysian forest environment. Paper presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
27. CHANG, Y.S. & RASADAH, M.A. Country report: Status of medicinal plant research in Peninsular Malaysia and on-going inventory and documentation of medicinal plants. Paper presented at the Asia Pacific Medicinal Plant Research Meeting, Kuala Lumpur, 7 to 9 April
28. CHANG, Y.S. Global network of information on MAPs - Malaysia's perspective. Paper presented at the Workshop on Strengthening Cooperation of MAPs National Focal Points, Trieste, Italy, 26 to 27 May
29. CHANG, Y.S., LIM, H.F. & MOHD. PARID, M. Legislation and Gaharu or Agarwood harvesting in Peninsular Malaysia. Paper presented at the First International Agarwood Conference: Wood of the Gods, Ho Chi Minh City/Chau Doc, Viet Nam, 10 to 15 November
30. DAVIES, S. & NUR SUPARDI, M.N. Habitat heterogeneity and niche structure in two tropical rain forests. Paper presented at the Seminar on Ecological Research in Tropical Rain Forests: A seminar to commemorate over 30 years of research at Pasoh Forest Reserve, FRIM, Kepong, 19 to 21 August, FRIM
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32. GAN, K.S., CHOO, K.T. & LIM, S.C. Basic density and moisture content distributions in Oil Palm (*Elaeis guineensis*) stems. Paper presented at the IUFRO - All Division 5 Conference, Rotorua, New Zealand, 11 to 15 March
33. HASHIM, W.S., ZAIHAN, J. & ABDUL HAMID, S. Pengenalan dan prinsip lenturan kayu. Paper presented at Kursus Teknologi Binaan Kayu WISDEC, Olak Lempit, Banting, Selangor, 16 to 27 June
34. HASHIM, W.S., ZAIHAN, J. & ABDUL HAMID, S. Pengenalan dan prinsip lenturan kayu. Paper presented at the Wood Bending Technology-Chair Component Course, Selangor, 25 to 28 August, FITEC
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37. HUI, T.F. & PHILIP, E. The growth and development of selected spices. Paper presented at the Fourteenth Conference of the Malaysian Society of Plant Physiology Conference: Challenges in Plant Productivity & Food Security in a Changing Environment, Pahang, 23 to 25 September
38. ISMAIL, H., NUR HAJAR, Z.S., & WAN MOHD. SHUKRI, W.A. Species composition changes in second growth forests in Peninsular Malaysia. Paper presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
39. ISMAIL, P., SHAMSUDIN, I., NIK MUHAMAD, N.M. & FARIDAH HANUM, I. Rehabilitation of degraded peat swamp forests in Raja Musa Forest Reserve, Selangor, Peninsular Malaysia. Paper presented at the XII World Forestry Congress: Forests, Source of Life, Quebec City, Canada, 21 to 28 September, IUFRO
40. ISMARIAH, A. & AHMAD FAUZI, P. Agro-forestry practices: A land use option for carbon sequestration. Paper presented at the National Conference on Society, Space and Environment in a Globalised World: Challenges and Prospects, Penang, 29 to 30 April, USM
41. ISMARIAH, A. Forest land-use policy: its impact on primary timber processing. Paper presented at the Second Annual Seminar on Sustainability, Science and Management (KUSTEM 2003), Terengganu, 6 to 7 May, KUSTEM
42. ISMARIAH, A. Timber certification in Malaysia: A rationale for a National Certification System. Paper presented at CINTRAFOR, Washington, U.S.A., 15 October
43. ISMARIAH, A., MOHD. PARID, M. & RAHIM, S. Forest plantation investment for wood biomass. Paper presented at the Biennial Conference on Natural Resources, Environment and Development (NARED 2003), Kuching, Sarawak, 25 to 27 September, UM-UNIMAS

44. ISMARIAH, A., RAHIM, S., MOHD. PARID, M. & AHMAD FAUZI, P. Wood composite: Opportunities in forest plantation investment. Paper presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
45. ISMARIAH, A., ZIVOT, E. & PEREZ-GARCIA, J. Forest conservation policy and the economics of CO<sub>2</sub> emissions. Paper presented at the Symposium for System Analysis in Forest Resources, Washington, U.S.A, 7 to 9 October
46. JUNJIRO, N., SIDLE, R., AHMAD, C.A.S., ABDUL RAHIM, N. The 3-year old road networks as a major source of sediment dissolved organic carbon and potassium during storm events in a small headwater catchment of Peninsular Malaysia. Paper presented at the Seminar on Ecological Research in Tropical Rain Forests: A seminar to commemorate over 30 years of research at Pasoh Forest Reserve, FRIM, Kepong, 19 to 21 August, FRIM
47. KADOMOTO, R., HIRANO, A., LING, S. K., ZHANG, Y.J., TANIMURA, S., TANAKA, T. & KOUNO, I. & KOHNO, M. The inhibitory activity of plant polyphenols on matrix metallo-proteinase. Paper presented at the One Hundred and Twenty Third Annual Meeting of the Pharmaceutical Society of Japan, Nagasaki, 27 to 29 March
48. KANDASAMY, K.I. Career opportunities in biotechnology - the scientist perspective. A paper presented at the Monash Open Day Talk on career Opportunities in Biotechnology, Monash University Malaysia Campus, 4 January
49. KOH, M.P. & HOI, W.K. Sustainable biomass production in Malaysia for energy in 2010. Paper presented at the IUFRO - All Division 5 Conference, Rotorua, New Zealand, 11 to 15 March
50. KOH, M.P. & MOHD. NOR, M.Y. Testing and inspection services for conformance to JIS and JAS standards. Paper presented at the Workshop on Meeting the New Formaldehyde Emission Requirements of Japan, Kuala Lumpur, 24 June
51. KOH, M.P., MOHD. NOR, M.Y., KHOO, K.C. & TOMIMURA, Y. Medium Density Fibreboard from Bamboo. Paper presented at the Advanced Technology Congress, Putrajaya, 20 to 21 May
52. KOH, M.P., RAHIM, S. & MOHD. NOR, M.Y. Current status of formaldehyde emission requirements for wood-based panel products. Paper presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
53. KOH, M.P., SUFFIAN, M. & RAHIM, S. Komposit kayu. Paper presented at the E-Oil Palm Residue (E-OPR) Seminar: Potential from Locally Developed Technologies, Pahang, 22 May, FELDA-FRIM
54. KRISHNAPILLAY, B. & ABD. RAZAK, M.A. Agroforestry in relation to forest plantations. Paper presented at the Seminar on Integrated Farming and Agricultural Potential: Opportunities for plantations. Putrajaya, 26 March, ISP
55. KRISHNAPILLAY, B. & ABD. RAZAK, M.A. Bioresources initiatives in Malaysia. Paper presented at the Asia Pacific Natural Products Conference, Bangkok, Thailand, 29 to 30 September, IBCA
56. KRISHNAPILLAY, B. & ABD. RAZAK, M.A. Poverty reduction - Changing roles for research and development institutions. A Malaysian perspective. Paper presented at the Conference on Forestry for Poverty Reduction: Changing roles for Research, Development and Training Institutions, Dehra Dun, India, 17 to 18 June, FORSPA-APAFRI-ICFRE
57. KRISHNAPILLAY, B., SIM, H.C. & ABD. RAZAK, M.A. Acacias - Are they a threat as invasive species in the wet tropics? Paper presented at Asia Pacific Forest Invasive Species Conference, Yunnan, China, 17 to 23 August
58. LATIFAH J., MAHMUDIN, S., SHARMIZA, A., MOHD. NOR, M.Y., ZAITUN, S., AZIZI, A.J. & ROSDI, K. Chemical properties of selected *Acacia* hybrid clones. Paper presented at the Malaysian Science & Technology Congress (MSTC 2003), Agricultural Science, Kuala Lumpur, 23 to 25 September
59. LEE, S.L. Genetic and autecology on priority and endangered species in South East Asia: A concept note prepared for Asia Pacific Forest Genetic Resources Programme (APFORGEN) to Asia Pacific Association of Forestry Research Institutions (APAFRI) and International Plant Genetic Resources Institute (IPGRI), 7 pp
60. LEE, S.L., NG, K.K.S., LEE, C.T., NORWATI, M., & SAW, L.G. *Shorea lumutensis*, an endangered dipterocarp with high levels of genetic diversity but low population differentiation. Paper presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
61. LEE, S.L., NG, K.K.S., LEE, C.T., NORWATI, M., TANI, N. & TSUMURA, Y. Genetics and autecology of *Shorea lumutensis*, an endangered endemic dipterocarp in Peninsular Malaysia. Paper presented at the Workshop on "How do we proceed: Genic study on tropical rain forest in memory of retiring Professor Tsuneyuki Yamazaki", Matsuyama, Japan, 2 March
62. LEE, S.S. & ALEXANDER, I.J. Mycorrhizas and ecosystem processes in tropical rain forest - implications for diversity. Plenary paper presented at Biotic Interactions in the Tropics: A Special Symposium of the British Ecological Society & The Annual Meeting of the Association for Tropical Biology and Conservation, Aberdeen, Scotland, 7 to 10 July, BEC-ATBC
63. LIM, H.F. Economic advancement and poverty eradication among the aborigines in Malaysia. Paper presented at the XII World Forestry Congress: Forests, Source of Life, Quebec City, Canada, 21 to 28 September, IUFRO
64. LIM, H.F., NORINI, H., WOON, W.C. & KRISHNAPILLAY, B. Forest plantation establishment in Peninsular Malaysia. Paper presented at the APARU Conference, Penang, 24 to 27 July
65. LIM, S.C. & GAN, K.S. Characteristics and structures of Rubberwood and their effect on utilisation. Paper presented at the IUFRO - All Division 5 Conference, Rotorua, New Zealand, 11 to 15 March
66. LIM, S.C., GAN, K.S., CHOO, K.T. & TAN, Y.E. Malaysian timbers - their characteristic, properties and applications. Paper presented at the Seminar on Use of Timber in Construction - What professionals need to know, Kuala Lumpur, 13 December, MTIB-FRIM-PAM
67. MAHMUD, A.W. & ADZMI, Y. Agroforestry and soil management. Paper presented at the Soils Science Conference of Malaysia, Kelantan, 23 to 24 April
68. MAHMUD, A.W., NAJIB LOTFY, A., AHMAD FAUZI, P. & AB. RASIP, A.G. Plantation of forest species: Monoculture or agroforestry. Paper presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
69. MAHMUDIN, S. & ABDUL RAHMAN, O. Primary specifications establishment of processing machinery through innovative adoption of quality function deployment. Paper presented at the Conference on Engineering and Technology (EnTech 2003), Sarawak, 30 July to 1 August
70. MAHMUDIN, S., MOHD. NOR, M.Y., ABDUL RAHMAN, O., WAN ASMA, I. & PUAD, E. Oil palm fibres extraction: current industrial practice and the way forward. Paper presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
71. MAHMUDIN, S., PUAD, E., WAN ASMA, I., WAN RASIDAH, W.A.K., MOHD. NOR, M.Y. & RAHIM, S. Teknologi penghasilan gentian Kelapa Sawit. Paper presented at the E-Oil Palm Residue (E-OPR) Seminar: Potential from Locally Developed Technologies, Pahang, 22 May, FELDA-FRIM
72. MASTURA, M., MAZURAH, M.I. & SAIFUL, A.J. Medicinal chest from the Malaysian rainforest: Quest for anti-Methicillin Resistant *Staphylococcus aureus* (MRSA) agents. Paper presented at the Third Conference of the Federation of Asia Pacific Microbiology Societies, Kuala Lumpur, 15 to 18 October
73. MASTURA, M., MAZURAH, M.I., HANI KARTIKA, H.K.P. & KHOZIRAH, S. Inhibitory potential of Henna (*Lawsonia inermis* L.) towards Methicillin Resistant *Staphylococcus aureus* (MRSA). Paper presented at the Nineteenth Annual International Seminar and Workshop of the Malaysian Natural Product Society, Kuala Lumpur, 13 to 16 October, UM
74. MAZURA, P., RASADAH, M.A. & IBRAHIM, J. Platelet Activating Factor (PAF) receptor binding antagonist activity of selected Malaysian medicinal plants. Paper presented at the Malaysian Science & Technology Congress (MSTC 2003-Agricultural Science): Research and Development Findings Towards Excellence in Science and Technology, Kuala Lumpur, 23 to 25 September
75. MOHD. AZMI, M.I., MOHD. SHAHWAHID, H.O. & AHMAD FAUZI, P. The prospect of medicinal plants trade in Malaysia. Paper presented at the Conference on Scientific and Social Research, Selangor, 26 to 27 August, UiTM
76. MOHD. DAHLAN, J., MOHD. SHUKARI, M. & MARIA ZURA, M.Z. Opportunities for recycling of wood waste from the construction industry. Paper presented at the Seminar on Construction Waste Management, Putrajaya, 26 March

77. MOHD. DAHLAN, J., MOHD. SHUKARI, M. & MARIA ZURA, M.Z. Potential products from wood waste in construction sites. Paper presented at the Workshop on Wood Waste Minimization and Recycling Potential in Construction Sites, Kuala Lumpur, 18 December
78. MOHD. DAHLAN, J., SALAMAH, S., SALMIAH, U., ROSZAINI, K., SHAHRUDDIN, H. & ANI, S. Status of boron treated timber - Malaysian context. Paper presented at the Workshop on Treatment of Timber with Boron Preservatives, Kuala Lumpur, 8 April, FRIM
79. MOHD. FARID, A. Serangan penyakit anak pokok dan langkah pengawalan. Paper presented at the Jabatan Perhutanan Negeri Pahang Seminar, Pahang, 28 March, JPNP
80. MOHD. FARID, A., LEE, S.S., MOHD. ROSLI, H., NORWATI, M., AHMAD ZUHAI, Y. & MAZIAH, Z. Preliminary report on the incidence of basal root rot disease of teak in Peninsular Malaysia. Paper presented at the Sixth International Conference on Plant Protection in the Tropics: Globalization and Plant Protection in Developing Economies, Kuala Lumpur, 11 to 14 August, MAPPS-CABI
81. MOHD. FAUZI, S., NOR AZAH, M.A., SALWA, M. & ZAIDAH, Z.A. Identification of essential oil composition of selected species from Family *Zingiberaceae* using gas chromatography. Paper presented at the International Conference on Biotourism, Sarawak, 18 to 19 August
82. MOHD. ILHAM, A. Commercialization of herbal products. Laboratory to market. Paper presented at Course on Herbal and Phytochemical Processing: Freeze and Spray Drying, Johore, 7 to 9 July, UTM
83. MOHD. ILHAM, A. Khazanah hutan Malaysia; peranan generasi muda dalam mengawal dan memanfaatkannya. Paper presented at the Pameran Herba Malaysia, Kuala Lumpur, 30 May, Pusat Sains Negara
84. MOHD. ILHAM, A. Malaysia herbs and herbal product. Paper presented at the Workshop for Herbal and Phytochemical Processing, Chemical Engineering Pilot Plant (CEPP), University Technology Malaysia (UTM), Skudai, Johore, 7 to 9 January, UTM
85. MOHD. ILHAM, A. Pengurusan hutan hujan tropika Malaysia: Isu dan cabaran sumber biologi herba. Paper presented at Ceramah Hari Terbuka Sekolah Sains Integratif, and Kolej Universiti Teknologi Pengurusan Malaysia (KUTPM), Selangor, 4 September
86. MOHD. ILHAM, A. Penyediaan bahan mentah tumbuhan ubatan berkualiti. Paper presented at Bengkel Piawaian Tumbuhan Ubatan 2003, FRIM, Kepong, 10 to 12 June
87. MOHD. ILHAM, A. Penyelidikan tentang tumbuhan ubatan. Paper presented at the Tree Camp Workshop, Kuala Lumpur, 12 to 14 September, FRIM, Kepong
88. MOHD. ILHAM, A. Potensi herba untuk kecantikan. Paper presented at Kursus Tumbuhan Ubatan, Selangor, 28 to 30 July, JPS
89. MOHD. ILHAM, A. Quality assessment activities in the herbal industry. Presented at the Aspek Kawalan Kualiti di dalam Industri Herba Seminar, Kuala Lumpur, 24 December
90. MOHD. ILHAM, A., ABDUL RAZAK, M.A., BASKARAN, K. & RASADAH, M.A. Conservation of biodiversity. Whose responsibility is it? Presented at the Fifth International Traditional/ Complementary Medicine Conference and Exhibition (INTRACOM 2003), Selangor, 20 to 22 October
91. MOHD. ILHAM, A., CHAN, K.L., ZHARI, I., AZIMATHOL, H.L.P., AZIAH, Y., NOR RAIN, A., MARZIAH, M., NURHANAN, M.Y., MOHD. SHAHIDAN, M.A., ASIAH, O., NOR HASNIDA, H., ONG, B.K., ZAMREE, M.S., MOHD. RADZI, A., NORIFIZA, M.R. & SALBIAH, M. Current status on the development of phytomedicine from Tongkat Ali. Paper presented at the Seminar on Natural Products Malaysia 2002, Sabah, 22 to 25 October, UMS
92. MOHD. ILHAM, A., MOHD. NAJIB, L.A., MAHMUD, A.W. & MOHD. RADZI, A. Planting of medicinal and aromatic plants with Oil Palm. Presented at the Second National Seminar on Livestock and Crop Integration (LCI) with Oil Palm, Selangor, 25 March
93. MOHD. ILHAM, A., NORWATI, A., NURHANAN, M.Y., ASIAH, O., NOR HASNIDA, H., NORLIA, B., MOHD. ROSLI, H., VIMALA, S., ABDULL RASHIH, A., MOHD. RADZI, A. & ROHANA, S. Temuan-temuan penyelidikan bioteknologi FRIM yang boleh dikomersilkan. Paper presented at the Sumbangan Bioteknologi Selangor Seminar, Malacca, 17 to 19 August
94. MOHD. ILHAM, A., NURHANAN, M.Y., ASIAH, O., VIMALA, S., ROHANA, S., ABDULL RASHIH, A. & MOHD. RADZI, A. Mengindustri khazanah hutan Malaysia. Paper presented at the Seventh Symposium of Applied Biology, Selangor, 3 to 4 June
95. MOHD. ILHAM, A., NURHANAN, M.Y., ONG, B.K., MOHD. SHAHIDAN, M.A., ASIAH, O., NORHASNIDA, H., ZAMREE, M.S., MOHD. RADZI, A. & SALBIAH, M. Commercialisations of Malaysian herbs: Factors to consider. Paper presented at Herbal Symposium 2003: Spices & Herbs Paradise, Johore, 25 January
96. MOHD. PARID, M. Institutional arrangement of marine-based ecotourism in Malaysia. Paper presented at the Graduate Seminar UPM, Selangor, 20 March, UPM
97. MOHD. PARID, M., AWANG NOOR, A.G. & LIM, H.F. Malaysian marine parks: An ecotourism potential. Paper presented at the International Ecotourism Conference: Sustainability of Ecotourism Development in a Competitive Global Environment, Selangor, 15 to 17 April
98. MOHD. SALIM, J., PINARD, M.A., WOODWARD, S. & LEE, S.S. Resource availability and responses to wounding and inoculation with a stem fungal pathogen in dipterocarp saplings. Paper presented at Biotic Interactions in the Tropics: A Special Symposium of the British Ecological Society & The Annual Meeting of the Association for Tropical Biology and Conservation, Aberdeen, Scotland, 7 to 10 July, BEC-ATBC
99. MOHD. SHAHIDAN, A., ZAMREE, M.S. & FAIZAL, K. Development of the high quality herbal products. Paper presented at the National Biology Conference 2003: Biologi Merentasi Globalisasi, Perak, 14 to 16 December, UPSI
100. MOHD. SHAHIDAN, A., ZAMREE, M.S. & FAIZAL, K. Pembangunan produk herba. Paper presented at Maktab Rendah Sains Mara Serting, Negeri Sembilan, 29 to 30 July, MARA
101. MOHD. SHAHIDAN, A., ZAMREE, M.S. & FAIZAL, K. Piawaian produk herba. Paper presented at SMIDEC, Petaling Jaya, 14 September
102. MOHD. SHAHIDAN, A., ZAMREE, M.S. & FAIZAL, K. Saintis herba. Paper presented at the Scientific Research Camp, Kuala Lumpur, 22 September, KPM-FRIM
103. MOHD. SHAHIDAN, A., ZAMREE, M.S., FAIZAL, K. & RASADAH, M.A. Pembangunan produk herba - penggunaan teknik pengeringan sejuk beku dan semburan kering di dalam pemprosesan produk herba. Paper presented at Bengkel Piawaian Tumbuhan Ubatan 2003, FRIM, Kepong, 10 to 12 June
104. MOHD. SHUKARI, M, MOHD. DAHLAN, J. & MARIA ZURA, M.Z. Timber properties and utilization. Paper presented at the Workshop on Wood Waste Minimization and Recycling Potential in Construction Sites, Kuala Lumpur, 18 December
105. MOHD. SHUKARI, M. Derivation of the basic and grade stresses and the strength grouping of Malaysian timbers. Paper presented at the Course on Design of Timber Structures in accordance with MS544:2001, Selangor, 11 December, IEM
106. MOHD. TAMIZI, M. Processing and market potential of Mahogany. Paper presented at Bengkel Penanaman Balak Secara Ladang, Perak, 2 to 3 July
107. MOHD. TAMIZI, M., ABDUL LATIF, M. & MUHD. ALIYAH, D. Kaedah pengaturan mesin dan penyusunan didalam kilang pembuatan barangan buluh. Paper presented at Kursus Asas Pemesinan Buluh, Felda Mempaga 3, Pahang, 13 to 18 October
108. MOHD. TAMIZI, M., MOHD. ZAKI, M.I. & KHAIRUL, A. Implementation of non-wood material (Bamboo, Rattan etc.) in furniture design. Paper presented at the National Seminar on Toward Malaysian Furniture Design 2003, Kuala Lumpur, 11 to 12 December
109. NADARAJAN, J. Extending storage life of *Koompassia malaccensis*, a tropical rain forest tree species through cryopreservation. Paper presented at the Tenth Annual Postgraduate Research Students Seminar, Albertay University, Scotland, U.K., 26 May
110. NG, K.K.S., LEE, S.L. & KOH, C.L. Spatial patterns and genetic diversity of two tropical tree species with contrasting breeding systems. Paper presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong

111. NG, Y.F., IDRIS, A.B., ABDULLAH, M. & NUR SUPARDI, M.N. Diversity and abundance of the *Xanthopimpla* (Ichneumonidae: Pimplinae) at different habitats of Pasoh Forest Reserve, Negeri Sembilan. Paper presented at the Seminar on Ecological Research in Tropical Rain Forests: A seminar to commemorate over 30 years of research at Pasoh Forest Reserve, FRIM, Kepong, 19 to 21 August, FRIM
112. NG, Y.F., IDRIS, A.B., ABDULLAH, M. & NUR SUPARDI, M.N. Perbezaan kepelbagaian dan kelimpahan Genus *Xanthopimpla* (Ichneumonidae: Pimplinae) secara vertical di habitat hutan sekunder dan primer di Hutan Simpan Pasoh, Negeri Sembilan. Paper presented at the Kolokium FST, Selangor, 30 to 31 July, UKM
113. NIYAMA, K., ABD. RAHMAN K., IIDA, S., KIMURA, K. & AZIZI, R. Current species composition of clear-cut plots logged for IBP project in Pasoh Forest Reserve. Paper presented at the Seminar on Ecological Research in Tropical Rain Forests: A seminar to commemorate over 30 years of research at Pasoh Forest Reserve, FRIM, Kepong, 19 to 21 August, FRIM
114. NOOR AZLIN, Y. & SYAMSUL HERMAN, M.A. Utilizing and creating landscapes for environmental education: Efforts of a Malaysian research institution. Paper presented at the First World Environmental Education Congress, Espinho, Portugal, 20 to 24 May, 15 pp
115. NOOR AZLIN, Y. Memupuk kesedaran alam sekitar melalui aktiviti rekreasi FRIM. Paper presented at Seminar Pendidikan Alam Sekitar Merentas Kurikulum, Jabatan Pendidikan Selangor, 12 to 14 March, Selangor, 7 pp
116. NOOR AZLIN, Y. Research and management to lessen impacts in Malaysian Recreation Areas. Paper presented at Workshop on Nature Education as an Approach in Resource Management of Recreation Areas, Kuala Lumpur, 30 September to 1 October
117. NOR AZAH, M.A., MASTURA, M., VIMALA, S., MAWARDI, R., ALI, A.M. & KHOZIRAH, S. Chemical constituent and biological activities of some Malaysian *Cinnamomum* species. Paper presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
118. NOR AZAH, M.A., ZARIDAH, M.Z., MASTURA, M., MAILINA, J., ABU SAID, A., ABD. MAJID, A.J., ROPIEN, J., ROZITA, B. & RAJA SHIREN, R.A. Evaluation of the chemical and biological properties of locally produced citronella oils (*Cymbopogon nardus*) in personal care products. Paper presented at COSTAM 2003, Kuala Lumpur, 23 to 25 September
119. NORINI, H. Sustainable management of forest resources in Peninsular Malaysia: A review. Paper presented at the Second Annual Seminar on Sustainability, Science and Management (KUSTEM 2003), Terengganu, 6 to 7 May, KUSTEM
120. NORINI, H. & KHAMURUDIN, M.N. Economic valuation of non-timber forest produce and its dissemination in Malaysia: A review. Paper presented at the IUFRO Workshop on the Forest Science/Policy Interface in Europe, Africa and Middle East, Copenhagen, Denmark, 23 to 27 June
121. NORINI, H. & MOHD. AZMI, M.I. Timber versus steel roof trusses in Malaysian construction industry. Paper presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
122. NORINI, H. Management of forest resources in Peninsular Malaysia: Is it sustainable? Paper presented at the National Conference on Society, Space and Environment in a Globalised World: Challenges and Prospects, Penang, 29 to 30 April, USM
123. NORINI, H. Sustainability of the Forest Research Institute Malaysia (FRIM) as an ecotourism centre. Paper presented at the International Ecotourism Conference: Sustainability of Ecotourism Development in a Competitive Global Environment, Selangor, 15 to 17 April
124. NORUL HISHAM, H. Properties of Rattan polymer composite from polymethyl methacrylate by the solvent exchange process. Paper presented at the Malaysian Science & Technology Congress (MSTC 2003-Agricultural Science): Research and Development Findings Towards Excellence in Science and Technology, Kuala Lumpur, 23 to 25 September
125. NORWATI, M., AB. RASIP, A.G., MOHD. ZAKI, A., NOR AZURAWATI, S. & NG, C.H. Genetic mapping of quantitative trait loci controlling wood pulp quality in *Acacia* hybrid using CAPS and RFLP markers. Paper presented at the IRPA seminar, Langkawi, Kedah, 19 to 21 September, UKM & MOSTE
126. NUMATA, S., YASUDA, M., OKUDA, T., MATSUMOTO, J., MIYAZAKI, C., NISHIMURA, S., YOSHIDA, K., KACHI, N. & NUR SUPARDI, M.N. Temporal and spatial patterns of mass flowerings: Data from the Pasoh Forest Reserve, Malaysia. Paper presented at the Seminar on Ecological Research in Tropical Rain Forests: A seminar to commemorate over 30 years of research at Pasoh Forest Reserve, FRIM, Kepong, 19 to 21 August, FRIM
127. NUR HAJAR, Z.S., ISMAIL, H., WAN MOHD SHUKRI, W.A. & SAMSUDIN, M. Management of tropical forest in Peninsular Malaysia; Issues and way forward. Paper presented at the National Conference on Society, Space and Environment in a Globalised World: Challenges and Prospects, Penang, 29 to 30 April, USM
128. NUZIAH, H., MAJIDAH, A., MASTURA, M. & MAZURAH, M.I. Anacardiaceae: Presence of tannins and its inhibitory potential against Methicillin resistant *Staphylococcus aureus* (MRSA). Paper presented at the Nineteenth Annual International Seminar and Workshop of the Malaysian Natural Product Society, Kuala Lumpur, 13 to 16 October, UM
129. OKUDA, T., SUZUKI, M., ADACHI, N., YOSHIDA, K., NUMATA, S., NISHIMURA, S., NIYAMA, K., NUR SUPARDI, M.N., MANOKARAN, N. & MAZLAN, H. Landscape change, logging history and its impact on forest structure in the Pasoh Forest Reserve - implications for the ecosystem management for sustainable natural resources. Keynote paper presented at the Seminar on Ecological Research in Tropical Rain Forests: A seminar to commemorate over 30 years of research at Pasoh Forest Reserve, FRIM, Kepong, 19 to 21 August, FRIM
130. PATAHAYAH, M. & LEE S.S. Ability of indigenous ectomycorrhizal fungi, *Tomentella* sp. in forming ectomycorrhizae with selected dipterocarps seedlings. Paper presented at the National Biology Conference 2003: Biologi Merentasi Globalisasi, Perak, 14 to 16 December, UPSI
131. PHILIP, E. & MOHD. RIZAL, M.K. Fluorescence measurement - a diagnostic tool for environmental stress in plants. Paper presented at the Fourteenth Conference of the Malaysian Society of Plant Physiology Conference: Challenges in Plant Productivity & Food Security in a Changing Environment, Pahang, 23 to 25 September
132. POLA, S., WONG, H.K., KOH, M.P., HOI, W.K. & FRANCIS, X. Potential of Oil Palm residues as fuel for electricity generation in Malaysia. Paper presented at the IUFRO - All Division 5 Conference, Rotorua, New Zealand, 11 to 15 March
133. RAFEADAH, R., RAHIM, S. & SUFFIAN, M. Chemical properties of *Acacia* hybrid. Paper presented at the Symposium Kimia Analisis, Malaysia KeEnam Belas, Sarawak, 9 to 11 September
134. RAFEADAH, R., RAHIM, S., KOH, M.P., SUFFIAN, M., RAZALI, A.K. & SITI NORALAKMAM, Y. *Acacia* hybrid: an alternative raw material for wood composite industries. Paper presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
135. RAHIM, S. & SWAMY, R.N. Bamboo and wood fibre cement composites for sustainable infrastructure regeneration. Paper presented at the Inter American Conference on Non-conventional Materials and Technologies in the Eco-construction (IAC-NOCMAT), Brazil, 13 to 16 November
136. RAHIM, S., PUAD, E., GAN, L.T. & LIM, S.H. Development of lightweight Oil Palm fibre reinforced cement composite for industrial building system. Paper presented at the Sixth National Seminar on Oil Palm Tree Utilisation, Kuala Lumpur, 15 to 17 December
137. RAHIM, S., SUFFIAN, M. & MOHD. NOR, M.Y. Development of specialty particleboard using Oil Palm empty fruit bunches fibre. Paper presented at the Advanced Technology Congress, Putrajaya, 20 to 21 May
138. RAJA BARIZAN, R.S. Forest resource management of tropical forests in Peninsular Malaysia: Biodiversity consideration. Paper presented at the National Biology Conference 2003: Biologi Merentasi Globalisasi, Perak, 14 to 16 December, UPSI
139. RAJA BARIZAN, R.S., SHAMSUDIN, I. & ABD. RAHMAN, K. Rehabilitation of logged over forests. Chapter presentation at the Expert Group Meeting for the Manual on Assisted Natural Regeneration For Tropical Forests In South East Asia, Kuala Lumpur, 14 to 15 April
140. RAJA BARIZAN, R.S., SHAMSUDIN, I., ISMAIL, P. & KHAIRUL NAJWAN, A.J. Rehabilitation of degraded sites within the second growth forests using improved planting techniques. Paper presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong

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44. WAN RAZALI, W.M. Sustainable forestry: Philosophy, science, economics and environment, or myth and mystery. Paper presented at the INTAN-MCTP Course on Integrated Environmental Planning and Management, Kuala Lumpur, 7 July to 1 August, 15 pp
45. WONG, J.L.P. National options paper on modalities for including afforestation and reforestation activities under Article 12 of the Kyoto Protocol in the first commitment period. A confidential report for the Ministry of Primary Industries Malaysia, Kuala Lumpur, 20 pp
46. ZAIHAN, J. & NOR AZIAN, M.K. Corrective action for ISO/IEC 17025, compliance audit for Fire Protection Laboratory. Report submitted to the Department of Standard Malaysia (DSM), 13 November
47. ZAIHAN, J. & NOR AZIAN, M.K. Guidelines for fire door manufacturing. Report submitted to Kilang Papan Yusof & Anak-Anak Sdn. Bhd.
48. ZAIHAN, J. & NOR AZIAN, M.K. Guidelines for fire door manufacturing. Report submitted to Priceworth Sdn. Bhd.
49. ZAINON, A.S. Laporan Kemajuan Projek Kerjasama FRIM-KETENGAH
50. ZAINON, A.S. Laporan Teknikal Projek Kerjasama FRIM-KETENGAH

#### POSTER POSTERS

1. AB. RASIP, A.G., MOHD. NOOR, M., MOHD. LOKMAL, N. & MOHD. ZAKI, A. Early performance of rooted cuttings of *Endospermum malaccense*. Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
2. AHMAD NAZARUDIN, M.R., TSAN, F.Y. & ADNAN, M. Maintaining landscape plants of *Acalypha siamensis*, *Ficus microcarpa* and *Syzygium oleina* by the application of Paclobutrazol: A non-mechanical approach. Poster presented at the Fourteenth Conference of the Malaysian Society of Plant Physiology Conference: Challenges in Plant Productivity & Food Security in a Changing Environment, Pahang, 23 to 25 September
3. AHMAD NAZARUDIN, M.R., TSAN, F.Y. & ADNAN, M. Controlling the growth of hedge plants by the application of Paclobutrazol: Some preliminary studies. Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
4. AHMAD, C.A.S., ABDUL RAHIM, N. & SITI AISAH, S. Integration of GPS and GIS in plantation forest. Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
5. AMINAH, H., HASYUZAINI, C.H. & HAMZAH, M. Effects of commercial hormones on leafy stem cuttings of *Pouteria malaccensis*. Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
6. AMINAH, H., PATAHAYAH, M. & LEE, S.S. Effect of potting media and indigenous ectomycorrhizal inoculum on *Hopea odorata* rooted cuttings in nursery. Poster presented at the National Biology Conference 2003: Biologi Merentasi Globalisasi, Perak, 14 to 16 December, UPSI
7. ANI, S., SALAMAH, S., SHAHARUDDIN, H., & MOHD. DAHLAN, J. The treatability of three selected timber species used for roof trusses. Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
8. AZMARIAH, M. & NOOR AZLIN, Y. Nature education centers in Peninsular Malaysia: a survey on distribution and facilities. Poster presented at Workshop on Nature Education as an Approach in Resource Management of Recreation Areas, Kuala Lumpur, 30 September to 1 October
9. BOON, K.S., KIRTON, L.G. & LEE, S.S. Stingless bee species found in Sungai Lalang Forest Reserve, Hulu Langat district, Selangor and flight activity patterns of *Trigona apicalis* (Hymenoptera: Meliponidae). Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
10. CHANG, Y.S., LEE, S.S., CHAN, H.T. & KAM, K.W. Preliminary survey of edible mushrooms and related products in the Klang Valley. Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
11. CHANG, Y.S., NOR AZAH, M.A., ABU SAID, A., LOK, E.H., NOR HASNIDA, H., NORWATI, M., SALBIAH, M., LIM, H.F., MOHD. PARID, M., READER, S., SPIERS, A. & AZIAH, M.Y. Gaharu or Agarwood research in Malaysia. Poster presented at the First International Agarwood Conference: Wood of the Gods, Ho Chi Minh City/Chau Doc, Viet Nam, 10 to 15 November
12. CHONG, M.I., NOOR AZLIN, Y. & MANOHAR, M. Willingness to pay for user fee at FRIM. Poster presented at Workshop on Nature Education as an Approach in Resource Management of Recreation Areas, Kuala Lumpur, 30 September to 1 October
13. CHUNG, R.C.K. Are pollen of the genera *Grewia* and *Microcos* (Tiliaceae) morphologically distinct in Peninsular Malaysia and Borneo? Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
14. FAZRUREENA, J., KHOZIRAH, S., RASADAH, M.A., ISHRAF, D.A., NORDIN, L., SHAHIDAH, A. & NAZRUL, D.M. *In-vitro* evaluation of anti-inflammatory activities of *Vitex negundo* extracts. Poster presented at the Pameran Rekacipta dan Penyelidikan 2003, Selangor, 8 to 10 July, UPM
15. FLETCHER, C.D., NORMAH, M.N., ZUBAID, A. & APPANAH, S. Seed coat morphology - Possible key for seed identification. Poster presented at the Seventh Symposium of Applied Biology, Selangor, 3 to 4 June
16. HASHIM, W.S., PUAD, E., ZAIHAN, J. & ABD. HAMID, S. Strength properties of Oil Palm laminated veneer lumber. Poster presented at the Sixth National Seminar on Oil Palm Tree Utilisation, Kuala Lumpur, 15 to 17 December
17. ISMAIL, P. SHAMSUDIN, I. & CHONG, P.F. Forest weeds to wealth. Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
18. ISMAIL, P. SHAMSUDIN, I. & MOHD. NASIR, H. Challenges on rehabilitating degraded peat swamp forests in Peninsular Malaysia. Poster presented at the XII World Forestry Congress: Forests, Source of Life, Quebec City, Canada, 21 to 28 September, IUFRO
19. LATIFAH, J., MAHMUDIN, S., SHARMIZA, A., MOHD. NOR, M.Y., ZAITON, S. & ROSDI, K. Properties of kraft pulp and paper from *Acacia* hybrid. Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
20. LING, S.K., FUKUMORI, S., TOMII, K., TANAKA, T. & KOUNO, I. Chemical constituents of Perah (*Elateriospermum tapos*). Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
21. LING, S.K., TANAKA, T. & KOUNO, I. Lipoxygenase and hyaluronidase inhibitory activities of constituents from *Phyllagathis rotundifolia* and *Carallia brachiata*. Poster presented at the Nineteenth Annual International Seminar and Workshop of the Malaysian Natural Product Society, Kuala Lumpur, 13 to 16 October, UM
22. MAHMUDIN, S., PUAD, E., MOHD. NOR, M.Y., SUHANA RAFIDAH, M.Y., RAFEADAH, R., WAN ASMA, I., WAN RASIDAH, W.A.K., RAHIM, S., KOH, M.P., SUFFIAN, M., SHAHARUDDIN, H., SHARMIZA, A., & LATIFAH, J. E-Oil Palm Residues: Potential from locally developed technologies. Poster presented at the Penilaian Anugerah Kualiti Perdana Menteri Exhibition 2003, FRIM, Kepong, 26 August, FRIM
23. MAHMUDIN, S., PUAD, E., MOHD. NOR, M.Y., SUHANA RAFIDAH, M.Y., RAFEADAH, R., WAN ASMA, I., WAN RASIDAH, W.A.K., RAHIM, S., KOH, M.P., SUFFIAN, M., SHAHARUDDIN, H., SHARMIZA, A. & LATIFAH, J. ICT: The catalyst for technology transfer towards community development through Oil Palm residues utilisation. Poster presented at the Sixth National Seminar on Oil Palm Tree Utilisation, Kuala Lumpur, 15 to 17 December

24. MAHMUDIN, S., PUAD, E., MOHD. NOR, M.Y., SUHANA RAFIDAH, M.Y., RAFEADAH, R., WAN ASMA, I., WAN RASIDAH, W.A.K., RAHIM, S., KOH, M.P., SUFFIAN, M., SHAHARUDDIN, H., SHARMIZA, A. & LATIFAH, J. E-Oil Palm residues: Potential from locally developed technologies (E-OPR). Poster presented at the E-Oil Palm Residue (E-OPR) Seminar: Potential from Locally Developed Technologies, Pahang, 22 May, FELDA-FRIM
25. MAHMUDIN, S., WAN ASMA, I., PUAD, E., RAHIM, S., KOH, M.P., WAN RASIDAH, W.A.K., MOHD. SHUKARI, M. & MOHD. NOR, M.Y. Exploitation of oil palm biomass into products. Poster presented at OIC Expo, Putrajaya, 14 to 19 October
26. MAILINA, J. & NOR AZAH, M.A. Formulation study of *Cinnamomum sintoc* essential oils in personal care products. Poster presented at the Nineteenth Annual International Seminar and Workshop of the Malaysian Natural Product Society, Kuala Lumpur, 13 to 16 October, UM
27. MARZALINA, M., NASHATUL, Z.N.A. & NOR ASMAH, H. FRIM ensuring seed quality for its customers. Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
28. MOHD. FARID, A., LEE, S.S., MOHD. ROSLI, H., NORWATI, M. & AHMAD ZUHAI, Y. Development of a PCR-based technique for rapid detection of root disease in forest plantations. Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
29. MOHD. FAUZI, S., NOR AZAH, M.A., NORJANAH, Y. & ZAIDA, Z.A. Identification of essential oil composition of peel and fruits of *Citrus hystrix* Dc. Poster presented at the Nineteenth Annual International Seminar and Workshop of the Malaysian Natural Product Society, Kuala Lumpur, 13 to 16 October, UM
30. MOHD. NASIR, H. & ISMAIL, P. *Rhizophora stylosa*: a lesser-known *Rhizophora* species. Poster presented at the National Mangrove Workshop: New Insight on the Management & Silviculture of Mangrove, Perak, 15 to 17 July
31. MOHD. NOOR, M., AB. RASIP, A.G., MOHD. ZAKI, A. & MOHD. JAFFAR, S. Assessment of *Azadirachta excelsa* progeny at nursery stage. Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
32. MOHD. NOOR, M., AB. RASIP, A.G., MOHD. ZAKI, A. & MOHD. JAFFAR, S. Assessment of six-month-old *Shorea leprosula* progeny at nursery stage. Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
33. MOHD. ROSLI, H., MOHD. FARID, A., LEE, S.S., & NORWATI, M. Comparison of DNA sequences of ITS region cloned from eight isolates of *Phellinus* obtained from diseased root of teak (*Tectona grandis*). Poster presented at the Sixth International Conference on Plant Protection in the Tropics: Globalization and Plant Protection in Developing Economies, Kuala Lumpur, 11 to 14 August, MAPPS-CABI
34. MOHD. ZAKI, A., AB. RASIP, A.G., MOHD. NOOR, M. & AMIR SAAIFUDDIN, K. Performance of *Chukrasia* provenances at 34 months after planting in Peninsular Malaysia. Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
35. NADARAJAN, J., STAINES, H.S., BENSON, E. KRISHNAPILLAY, B. & MARZALINA, M. A novel application of Taguchi experimental design for the conservation of *Koompassia malaccensis* seeds aiding the conservation of a Malaysian rain forest tree species. Poster presented at the Scottish Plant Biology Meeting, Glasgow, U.K., 10 January, Glasgow University
36. NG, Y.F., GONZAGA, A.D., IDRIS, A.B., ABDULLAH, M. & NUR SUPARDI, M.N. Influence of habitat location, structure and floristic variation on *Xanthopimpla* (Ichneumonidae: Pimplinae) diversity at Pasoh Forest Reserve, Negeri Sembilan. Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
37. NIK MUSA'ADAH, M., MANN, G.E. & CHIBBER, R. Protective effects of a medicinal plant extract against D-glucose-induced cytotoxicity in cultured bovine retina pericytes. Poster presented at the Joint Scientific Meeting of the British Pharmacology Society and the Physiological Society, Manchester, 9 to 12 September
38. NISHIMURA, S., NUR SUPARDI, M.N. & OKUDA, T. Timber and biomass values of lowland dipterocarp forests in Negeri Sembilan. Poster presented at the Seminar on Ecological Research in Tropical Rain Forests: A seminar to commemorate over 30 years of research at Pasoh Forest Reserve, FRIM, Kepong, 19 to 21 August, FRIM
39. NOOR AZLIN, Y., PHILIP, E. & CHONG, M.I. Impacts of recreational trampling on forest trail seedlings: results on five species. Poster presented at the Seminar on Ecological Research in Tropical Rain Forests: A seminar to commemorate over 30 years of research at Pasoh Forest Reserve, FRIM, Kepong, 19 to 21 August, FRIM
40. NOR AZAH, M.A., NORSEHA, A., ZARIDAH, M.Z., ABD. MAJID, J., ABU SAID, A. & MOHD. FARIDZ, Z.P. Essential oil constituents of four varieties of *Citrus medica*. Poster presented at the Nineteenth Annual International Seminar and Workshop of the Malaysian Natural Product Society, Kuala Lumpur, 13 to 16 October, UM
41. NOR HASNIDA, H., AZIAH, M.Y., SALBIAH, M. & ROHANI, A. Shoot multiplication and *in vitro* rooting of *Aquilaria malaccensis*. Poster presented at the Fourteenth National Biotechnology Seminar: DNA Fifty years and Beyond, Penang, 11 to 13 December, USM-MOSTE
42. NORASWATI, M.N.R., NORAZLINA, J., LEE, S.S. & CHANG, Y.S. Preliminary observations of mycelial growth of five strains of *Lignosus* sp. on different media. Poster presented at the National Biology Conference 2003: Biologi Merentasi Globalisasi, Perak, 14 to 16 December, UPSI
43. NORINI, H. & MIDMORE, P. The development of the forest-based industries in Malaysia: Lesson to be learned. Poster presented at the XII World Forestry Congress: Forests, Source of Life, Quebec City, Canada, 21 to 28 September, IUFRO
44. NORMAYA, N., SANG, J. & SOH, W.K. Botanical expedition to Usun Apau, Sarawak- a contribution towards the conservation and sustainable management of tree resources in Sarawak. Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
45. NORSHAM, Y. Frogs and toads of Pasoh Forest Reserve, Negeri Sembilan. Poster presented at the Seminar on Ecological Research in Tropical Rain Forests: A seminar to commemorate over 30 years of research at Pasoh Forest Reserve, FRIM, Kepong, 19 to 21 August, FRIM
46. NUR HAJAR, Z.S., ISMAIL, H., WAN MOHD. SHUKRI, W.A., CHE DIN, D. & MOHD. SHAHID, M. Effect of log formula on the accuracy of volume estimate for secondary forest timber species. Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
47. NURHANAN, M.Y., MOHD. ILHAM, A., RAFEDAH, A. & MOHD. RADZI, A. Surface enhanced laser desorption ionisation-mass spectrometer: A quick new tool to assess the quality of phytopharmaceutical. Poster presented at the Twenty Eighth Annual Conference of the Malaysian Society for Biochemistry and Molecular Biology, Putrajaya, 12 August
48. NURHANAN, M.Y., RASADAH, M.A., ONG, B.K. & RAFEDAH, A. Cytotoxicity evaluation on *Vitex negundo* anti-inflammatory extract. Poster presented at the Nineteenth Annual International Seminar and Workshop of the Malaysian Natural Product Society, Kuala Lumpur, 13 to 16 October, UM
49. ONG, B.K., FRY, R.C. & CHO, K.R. Transcriptional response of mouse fibroblast tissues to cytotoxic extracts of *Eurycoma longifolia* (Tongkat Ali) by microarray hybridization. Poster presented at the Thirteenth Scientific Meeting of the Malaysian Society for Molecular Biology and Biotechnology, Putrajaya, 19 to 21 May
50. ONG, B.K., NASEEM, M., SHAARI, M., ZAKIAH, I. & MOHD. ILHAM, A. Evaluation of hypoglycemic and antihyperglycemic effect of *Eurycoma longifolia* in normal and induced-diabetic rat. Poster presented at the National Biology Conference 2003: Biologi Merentasi Globalisasi, Perak, 14 to 16 December, UPSI
51. ONG, B.K., RASADAH, M.A., AZIZUL, H. & NIK YASMIN, N.Y. Development of Legundi (*Vitex negundo*) as anti-inflammatory technical product. Poster presented at the National Biology Conference 2003: Biologi Merentasi Globalisasi, Perak, 14 to 16 December, UPSI
52. ONG, B.K., RASADAH, M.A., CHEONG, W.Y., AZIZUL, H. & NIK YASMIN, N.Y. Development of ginger (*Zingiber officinale*) as anti-inflammatory technical product. Poster presented at the Nineteenth Annual International Seminar and Workshop of the Malaysian Natural Product Society, Kuala Lumpur, 13 to 16 October, UM

53. ONG, L.L., PARIDAH, T., WONG, E.D. & RAHIM, S. Origin of the thickness swelling of three- and five-layered oriented strand board. Poster presented at Bio-engineering Conference 2003, Putrajaya, 20 May
54. PATAHAYAH, M., BREARLEY, F & LEE, S.S. Responses of three ectomycorrhizal fungi to different temperatures and media *in vitro*. Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
55. PHILIP, E. & NOOR AZLIN, Y. The growth of seedling along Keruing trail. Poster presented at the Workshop on Nature Education as an Approach in Resource Management of Recreation Areas, Kuala Lumpur, 30 September to 1 October
56. PUAD, E. & ABD. RAZAK, O. Preliminary assessment of charcoal produced from bamboo. Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
57. PUAD, E. & MOHD. NASIR, H. Production of charcoal from *Rhizophora stylosa*. Poster presented at the National Mangrove Workshop: New Insight on the Management & Silviculture of Mangrove, Perak, 15 to 17 July
58. RAFEDAH, A., MOHD. ILHAM, A., NURHANAN, M.Y. & MOHD. RADZI, A. Protein profiling of *Centella asiatica* accessions using surface enhanced laser desorption ionization-mass spectrometer. Poster presented at the National Biology Conference 2003: Biologi Merentasi Globalisasi, Perak, 14 to 16 December, UPSI
59. RAHIM, S., PUAD, E., HABIBAH, M., JALALI, S., NORDIN, P., GAN, L.T. PHOON, W.W. & LIM, S.H. Development of lightweight Oil Palm fibre reinforced cement composite for industrial building system. Poster presented at Anugerah Inovasi Perkhidmatan Awam 2003, Sabah, 18 to 21 August
60. RAHIM, S., PUAD, E., HABIBAH, M., JALALI, S., NORDIN, P., GAN, L.T., PHOON, W.W. & LIM, S.H. Development of lightweight Oil Palm fibre reinforced cement composite for industrial building system. Poster presented at Expo Science & Technology, Kuala Lumpur, 7 to 9 August
61. RAHIM, S., PUAD, E., HABIBAH, M., JALALI, S., NORDIN, P., GAN, L.T., PHOON, W.W. & WANG, J.S. First lightweight Oil Palm fibre reinforced cement composite panel. Poster presented at I.TEX 2003, Kuala Lumpur, 16 to 18 May
62. RAHIM, S., SUFFIAN, M., RAFEDAH, R., SAIMIN, B., JALALI, S. & NORDIN, P. Feasibility of using particleboard from oil palm EFB for flooring, Poster presented at the Sixth National Seminar on Oil Palm Tree Utilisation, Kuala Lumpur, 15 to 17 December
63. RAJA BARIZAN, R.S., SHAJOERIL, T. & MOHAMAD NAZRIN, Y. A GIS map used for monitoring growth of planted plants using improved planting techniques in logged-over hill dipterocarp forests. Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
64. RAZAK, W., HASHIM, W.S., OTHMAN, S. & ROKIAH, H. Effect of heating process on the durability of *Gigantochloa scortechinii* bamboo. Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
65. ROSZAINI, K., SALMIAH, U., SALAMAH, S. & SHAHARUDDIN, H. Assessment of treated timber fender in marine environment. Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
66. SAUFI, M., HAMID, M., MAMAT, A.A., KHOZIRAH, S. & NIK MUSA'ADAH, M. Insulinothropic study of methanol extract Malaysian medicinal plants of BRIM-BDII cell lines. Poster presented at the Nineteenth Annual International Seminar and Workshop of the Malaysian Natural Product Society, Kuala Lumpur, 13 to 16 October, UM
67. SHARMIZA, A. Brosur Kenaf Sumber alternatif untuk produk pulpa dan kertas. Poster presented at the Pameran Hari Peladang, Penternak dan Nelayan Kebangsaan, Perlis, 6 to 14 September
68. SHARMIZA, A., LATIFAH, J., MAHMUDIN, S. & ROSDI, K. Preliminary investigation on chemi-mechanical pulp and paper properties of Acacia hybrid. Poster presented at the Conference on Forestry and Forest Products Research (CFFPR 2003): Forestry for Society, Kuala Lumpur, 6 to 8 October, FRIM, Kepong
69. SRI NURESTRI, A.M., HONG, S.L., NORHAAYTI, M. & NOR AZAH, M.A. Investigation on the stem bark of *Trema orientalis*. Poster presented at the Nineteenth Annual International Seminar and Workshop of the Malaysian Natural Product Society, Kuala Lumpur, 13 to 16 October, UM
70. SUFFIAN, M., RAHIM, S. & RAFEDAH, R. Phenol formaldehyde binders for rubberwood oriented strand board. Poster presented at the Symposium Kimia Analisis, Malaysia KeEnam Belas, Sarawak, 9 to 11 September
71. SUFFIAN, M., RAHIM, S., MOHD. NOR, M.Y. & PARIDAH, M.T. Properties of rubberwood oriented strand board (OSB) using two types phenol formaldehyde binders. Poster presented at the Advanced Technology Congress, Putrajaya, 20 to 21 May
72. SYAMSUL HERMAN, M.A, NOOR AZLIN, Y. & NIK AZYYATI, A.K. Visitors perceptions on utilization of recreational facilities at Sungai Kroh waterfall in FRIM. Poster presented at IMT-GT International Conference on Eco-tourism: Issues and Challenges, Kedah, 12 to 14 October, UUM
73. SYAMSUL HERMAN, M.A, NOOR AZLIN, Y. & NIK AZYYATI, A.K. Electronic Nature Education Programme: Promoting nature education through networking. Poster presented at Workshop on Nature Education as an Approach in Resource Management of Recreation Areas, Kuala Lumpur, 30 September to 1 October
74. SYAMSUL HERMAN, M.A., NOOR AZLIN, Y. & JAAFAR, A. Forest Research Institute Malaysia; providing for nature recreation experience. Poster presented at the Asia Pacific Ecotourism Conference, Kedah, 22 to 25 October
75. WAN RASIDAH, W.A.K., WAN ASMA, I., TSAN, F.Y. & ROZITA, A. Composts from Oil Palm fibres. Poster presented at the Sixth National Seminar on Oil Palm Tree Utilisation, Kuala Lumpur, 15 to 17 December
76. ZAMREE, M.S., MOHD. SHAHIDAN, M.A., FAIZAL, K., ONG, B.K. & RASADAH, M.A. Preliminary study on the development of herbal-based product - *Garcinia atroviridis*. Poster presented at the National Biology Conference 2003: Biologi Merentasi Globalisasi, Perak, 14 to 16 December, UPSI
77. ZARIDAH, M.Z., NOR AZAH, M.A., ABU SAID, A., MOHD. FARIDZ, Z.P., HAFIZAN, H., IMA KHUSAILA, M.J. & SITI ASHA, A.B. Four monoterpene compounds: Repellency evaluations against *Aedes aegypti*. Poster presented at the Nineteenth Annual International Seminar and Workshop of the Malaysian Natural Product Society, Kuala Lumpur, 13 to 16 October, UM

#### ARTIKEL ARTICLES

1. FLETCHER, C.D. Going batty: A walk in Krau Wildlife Reserve (Peninsular Malaysia). WILDAsia.net. October 2003
2. GAN, K.S. & LIM, S.C. Maintaining correct moisture content for successful manufacturing. MWIA NEWS Volume 38. August/September
3. KAMARULZAMAN, N., HASHIM, W.S., MANSUR, A. & MOHD. ARIF, J. Improved properties of oil palm through the inclusion of rubberwood veneers. Science Letters 1(1):51-56.
4. MOHD. SHAHIDAN, A., ZAMREE, M.S. & FAIZAL, K. & RASADAH, M.A. Development of Herbal Technology Centre (HTC) at FRIM. FRIM in Focus. December, p 9
5. ONG, T. Asian Pied Starling *Sturnus contra* at Kepong Metropolitan Park, Suara Enggang No. 4, July to August, 6 pp
6. RAJA BARIZAN, R.S. Rattan industries - bring out the Rotan. FRIM in Focus. January to March, p 12
7. RASADAH, M.A. Anti-inflammatory drug soothing swell. FRIM in Focus. March, p 7
8. SALMIAH, U. Kulapuk - Pencemar dalaman. Dewan Kosmik, Oktober 2003.
9. SAMSUDIN, M. & FLETCHER, C.D. The second time around. FRIM in Focus. January to March, p 4
10. SAW, L.G. & CHUA, L.S.L. Discovering dipterocarps in an era of diminishing forests. FRIM in Focus. October to December pp 6-7.

## PROJEK IRPA PADA 2003 IRPA PROJECTS IN 2003

11. SOH, W.K., NORMAYA, N. & SANG, J. Botanical Expedition: To boldly go where no botanist has gone before. FRIM in Focus. July to September, pp 8-9
12. VIMALA, S. In all fairness: Antioxidants & skin whitening agents. FRIM in Focus. March, p 11
13. ZAINON, A.S. Industri pertanian dalam kemajuan ekonomi negara. Peraduan Esei Badan Berkanun. Dewan Bahasa dan Pustaka.
14. ZAMREE, M.S., MOHD. SHAHIDAN, A. & MOHD. FAIZAL, K. & RASADAH, M. A. Anti-obesity drugs: Fighting fat. FRIM in Focus. March, p 7
15. ZARIDAH, M.Z. Anti-parasitic drug. Cannon balling-parasites. FRIM in Focus. March, p 6

### TESIS THESES

1. LING, S.K. Chemical and biological studies of four selected medicinal plants of Malaysia. Ph. D. thesis submitted to the Nagasaki University, Japan
2. MOHD. TAMIZI, M. Basic properties and quality of Sentang (*Azadirachta excelsa*) wood at different ages. M. Sc. thesis submitted to the Universiti Sains Malaysia, Penang

Bil. No.	Nama Projek dan Ketua Projek <i>Project Title and Project Leader</i>
1	An evaluation of Selective Management System (SMS) in achieving forest sustainability: A case study in the state of Terengganu ( <i>Wan Mohd. Shukri Wan Ahmad</i> )
2	Determination of seed storage behaviour of selected timber tree species and their potential for long-term storage ( <i>Nashatul Zaimah Noor Azman</i> )
3	Development of indicators for assessing susceptibility of degraded peat land areas to forest fires in Peninsular Malaysia ( <i>Shamsudin Ibrahim</i> )
4	Weaning of tissue-cultured plantlets of selected forest species (Jelutong, Sesenduk and Karas) with commercial potential ( <i>Kodi Isparan Kandasamy</i> )
5	Systematic evaluation of essential oil plants towards the development of insect repellants for mosquito control ( <i>Nor Azah Mohamad Ali</i> )
6	The production of wood fibre and agro-based cellulosic materials ( <i>Rahim Sudin</i> )
7	Properties enhancement of composite products manufactured from new rubberwood species and clones and oil palm fibre blend ( <i>Mohd. Nor Mohd. Yusoff</i> )

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