



Laporan Tahunan MFRDB FRIM *MFRDB FRIM Annual Report* 2012

Institut Penyelidikan Perhutanan Malaysia
Forest Research Institute Malaysia



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



Kementerian Sumber Asli dan Alam Sekitar
Ministry of Natural Resources and Environment





Rasional kulit hadapan
Kekuatan modal insan tonggak kecemerlangan organisasi.

Cover page rational
Human capital – the pillar of organisational excellence.

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A low-angle photograph of a dense forest. The camera is positioned on the ground, looking up at the tall, slender tree trunks that reach towards the sky. The canopy is thick with green leaves, and sunlight filters through, creating a bright starburst effect in the upper right quadrant. The overall atmosphere is serene and natural.

Lembaga Penyelidikan dan
Pembangunan Perhutanan Malaysia
Malaysian Forestry Research and
Development Board (MFRDB)

Laporan Pengerusi Chairperson's Report



HAJAH NANCY HJ SHUKRI (KMN, AMN) • Pengerusi/Chairperson

Dengan penuh rasa gembira dan bangga, saya selaku Pengerusi Lembaga Penyelidikan dan Pembangunan Perhutanan Malaysia (MFRDB) ingin berkongsi prestasi yang cemerlang serta pelbagai kejayaan yang telah dicapai oleh FRIM pada 2012.

Sorotan prestasi

FRIM terus berusaha bersungguh-sungguh bagi mencapai sasarannya dalam bidang-bidang yang tertentu pada 2012. Pelbagai prakarsa dan kejayaan luar biasa dalam R&D bidang perhutanan dan hasil hutan telah dicapai. Sejumlah 18 projek R&D baharu dengan dana berjumlah RM3.2 juta telah diluluskan oleh pelbagai agensi pemberi dana dari dalam dan luar Negara. Lapan projek R&D bernilai RM1.6 juta dibiayai di bawah dana Sciencefund Kementerian Sains, Teknologi dan Inovasi (MOSTI), lima geran Penyelidikan, Prakomersialisasi dan Penerbitan (RPP) di bawah MFRDB berjumlah RM95 375 dan sebanyak lima projek berjumlah RM1.5 juta dibiayai di bawah Skim Geran Penyelidikan NKEA (NRGS).

It is with great joy and pride, as Chairperson of the Malaysian Forestry Research and Development Board (MFRDB), to share with all the excellent performance and many achievements of FRIM in 2012.

Performance review

FRIM has been striving conscientiously to achieve her targets in several areas and it was no different in 2012. Many remarkable forestry and forest products R&D initiatives and achievements were made. A total of 18 new R&D projects amounting to RM3.2 million funds were approved by various national and international funding agencies. Eight R&D projects worth RM 1.6 million were funded under Science Fund by the Ministry of Science, Technology and Innovation (MOSTI), five Research, Pre-commercialisation and Publications (RPP) grants under the MFRDB totalling RM95 375, and five projects amounting to RM1.5 million were funded under MKEA Research Grant Scheme (NRGS).

Pihak industri banyak mengguna pakai kepakaran yang terdapat di FRIM. Para penyelidik FRIM terlibat dengan 59 projek perundingan ikhtisas berjumlah RM2.2 juta. Saya berharap agar FRIM terus meningkatkan khidmat perundingan mereka sejajar dengan pelbagai cabaran yang dihadapi oleh pihak industri yang perlu ditangani oleh pakar-pakar khusus dalam bidang masing-masing di FRIM. Pihak Lembaga akan terus menggalakkan penglibatan para penyelidik dalam projek-projek perundingan yang berkaitan dengan cabaran-cabaran dari aspek teknikal yang sebenarnya. Usaha ini akan menyediakan para penyelidik yang berpandangan jauh dalam menjalankan penyelidikan mereka pada masa-masa yang akan datang.

Pada tahun ini, FRIM turut mencatatkan sebanyak 30 pendedahan reka cipta, 11 pemfailan paten dan berjaya memperoleh paten bagi Artificial Lumber Block (MY-144683-A). Saya mengucapkan setinggi-tinggi tahniah kepada para penyelidik yang telah melindungi harta intelek ke arah komersialisasi produk-produk yang berpotensi.

Bagi menamatkan dengan jayanya sesuatu projek R&D, sangatlah penting bagi seseorang penyelidik untuk menyebarkan secara berkesan mengenai hasil penemuan mereka. Penyebaran boleh dilakukan menerusi penerbitan ataupun penyertaan dalam seminar dan persidangan. Pada 2012, sebanyak 55 seminar/bengkel/ceramah teknologi/persidangan/kursus telah dilaksanakan bagi menyebarkan hasil-hasil penyelidikan kepada pihak-pihak yang berkepentingan. Lebih daripada 125 kertas kerja teknikal diterbitkan dalam jurnal, buku teknikal dan separa-teknikal; serta 220 kertas kerja teknikal dibentangkan di seminar dan persidangan. Jilid ketiga *Seed Plant Series* dalam buku *Flora of Peninsular Malaysia* menyediakan maklumat tentang 10 famili, 48 genera dan 127 spesies. Jilid ketiga ini mengabadikan kerjasama antara ahli taksonomi FRIM (lima famili) dan institusi antarabangsa (lima famili). Satu spesies baharu *Cycas* (Cycadaceae), tiga spesies baharu *Barringtonia* (Lecythidaceae), satu spesies baharu *Kedrostis* (Cucurbitaceae) dan satu varieti baharu *Strombosia* (Olacaceae) telah ditemui dan diterangkan secara saintifik semasa kajian ke atas famili-famili ini. Di samping itu, terdapat rekod baharu sembilan spesies bagi famili Cucurbitaceae yang tidak ditemui di Semenanjung Malaysia sebelum ini. *Flora of Peninsular Malaysia* turut mengambil kira penemuan-penemuan terkini dalam bidang biologi molekul yang membolehkan pemahaman yang lebih baik tentang konsep spesies dan generik. Secara keseluruhannya, buku ini menunjukkan sebanyak 22% (28 spesies) adalah endemik di Semenanjung Malaysia dan 24% (31 taksa) berada dalam kategori terancam. Satu kategori pemuliharaan bagi *Rare* (RA) telah diperkenalkan dalam buku ini.

Saya dengan penuh rasa bangga mengucapkan tahniah kepada FRIM di atas penerimaan pelbagai anugerah khususnya The BrandLaureate Awards 2012–2013 bagi penjenamaan terbaik dalam Perhutanan—Pemuliharaan Alam Sekitar, Anugerah Sains dan Teknologi oleh Bank Pembangunan Islam (IDB), Anugerah Kecemerlangan dalam Penyelidikan dari Persatuan Badan Berkanun

The industries have beginning to tap into the many expertises available in FRIM. It was creditable that FRIM research officers were involved in 59 consultancy projects amounting to RM2.2 million. I hope this will continue to increase as the many challenges face by the industries require specialised skills available here in FRIM. The Board will continue to encourage the involvements of research officers in consultancy projects dealing with the actual technical challenges in the industries. This will provide them with the foresight in their future research undertaking.

During the year, FRIM also recorded 30 invention disclosures, 11 patent filings (Malaysia: 5; International: 6) and one patent granted for “Artificial Lumber Block” (MY-144683-A). I would like to congratulate the researchers for protecting the IPs for potential successful commercialisation that may follow.

To successfully complete an R&D project, effective dissemination of the findings is an important element. These may be in the form of publications or/and public discourses such as seminars and conferences. During 2012, 55 events such as seminars/workshops/technology talks/conferences/courses were conducted to disseminate research findings to various stakeholders. More than 125 technical papers were published in the form of journal articles, technical and semi-technical books, and 220 technical presentations in seminars and conferences. The third volume of the Seed Plant Series for the Flora of Peninsular Malaysia includes 10 families, 48 genera and 127 species. This third volume perpetuates collaboration between FRIM taxonomists (5 families) and international institutions (5 families). One new species of *Cycas* (Cycadaceae), three new species of *Barringtonia* (Lecythidaceae), one new species of *Kedrostis* (Cucurbitaceae) and one new variety of *Strombosia* (Olacaceae) were discovered and scientifically described during the study of these families. In addition, there are new records of nine species for family Cucurbitaceae previously unknown in Peninsular Malaysia. The Flora of Peninsular Malaysia also takes into account recent findings from the field of molecular biology and these have led to a better understanding of species and generic concepts. Overall this volume shows that 22% (28 species) are endemic to Peninsular Malaysia and that 24% (31 taxa) fall within threatened categories. A new conservation category of Rare (RA) is introduced in this volume.

I take great pride to congratulate FRIM for the various awards received particularly: The BrandLaureate Awards 2012–2013 for the Best Brand in Forestry—Environment Conservation, the Islamic Development Bank (IDB) Science and Technology Prize, Excellence Award for Research by Malaysian Statutory Bodies Association, National Book Award for the Best Technical Book Category. The Board applauds Prof Dr Engkik Soepadmo, a research fellow based at FRIM Biodiversity Division fondly known as “Bapak”, for being awarded Merdeka Award 2012 for outstanding contributions to the people of Malaysia by Prime Minister YAB Dato’ Sri Najib Tun Razak. We hope that Bapak’s many achievements will be inspirational to scientists in FRIM. The Board would also like to congratulate the Director General

Malaysia dan Anugerah Buku Negara bagi Kategori Buku Teknikal Terbaik. Pihak Lembaga juga mengucapkan syabas kepada Prof Dr Engkik Soepadmo, seorang felo penyelidik di Bahagian Biodiversiti FRIM di atas penerimaan Anugerah Merdeka 2012 bagi sumbangan unggul kepada rakyat Malaysia daripada Perdana Menteri YAB Dato' Sri Najib Tun Razak. Kami berharap agar pencapaian beliau dapat dijadikan inspirasi kepada para saintis di FRIM. Seterusnya saya bagi pihak Lembaga juga ingin menyampaikan ucapan tahniah kepada Ketua Pengarah FRIM yang telah menerima pelbagai anugerah seperti yang berikut: Anugerah Emas Penyelidikan Rotary, Anugerah "The Name in Science" daripada European Business Assembly Socrates Nomination Committee, Club of Rectors of Europe and the International Club of Leaders, dan Anugerah daripada Persatuan Saintifik Malaysia bagi pencapaian terunggul dalam Sains, Teknologi dan Inovasi di Malaysia.

Pembangunan

Ke arah memberikan perkhidmatan secara berkesan kepada industri berasaskan perhutanan, Lembaga menggalakkan makmal-makmal penyelidikan untuk terus mempertingkatkan kemudahan ujian serta melebarkan skop ujian bagi menepati keperluan piawai antarabangsa masing-masing. Lembaga memperakui 10 makmal yang berjaya memperoleh akreditasi ISO 17025 dan enam makmal yang berjaya memperoleh akreditasi BioNexus Partners (BNP).

Stesen Penyelidikan Pasoh ternyata amat dikenali dan dengan rekod yang baik, dan penyelidikan masih lagi dilaksanakan. Di samping itu, terdapat sembilan stesen penyelidikan FRIM di seluruh Negara yang perlu dipertingkatkan lagi dari segi aktiviti penyelidikannya. Para penyelidik digalakkan untuk menggunakan kemudahan-kemudahan ini sebelum membuat replikasi di tempat lain.

Hala tuju masa depan

Sememangnya hutan memainkan peranan yang sangat penting dalam pelbagai aspek kesejahteraan rakyat di seluruh dunia. Terdapat keperluan untuk menggalakkan pendekatan secara dimensi berganda kepada R&D berkaitan hutan jika dilihat dari segi cabaran dalam sosial dan alam sekitar sekarang. Penyelidikan baharu, penilaian tempatan ke atas sumber-sumber hutan, penggunaan dan kajian terhadap hasil-hasil hutan, dan garis panduan amalan terbaik diperlukan untuk menangani perubahan iklim, memulihara biodiversiti, memerangi degradasi tanah serta menyediakan kehendak dan pembangunan ekonomi tempatan yang sesuai. Pihak Lembaga, bersama-sama dengan pihak Pengurusan sentiasa menyokong kerjasama dalam kalangan penyelidik sebagai satu pasukan bagi menangani isu ini yang akan menghasilkan impak yang penting.

Dua Panel Penasihat Teknikal (TAP) telah dilantik untuk menilai aktiviti penyelidikan dan memberikan syor-syor mengenai hala tuju Bahagian Biodiversiti Hutan dan

of FRIM for receiving the following awards: the Rotary Research Gold Award, "The Name in Science" Award by the European Business Assembly Socrates Nomination Committee, Club of Rectors of Europe and the International Club of Leaders, and Award from the Malaysian Scientific Association for outstanding achievement in Science, Technology and Innovation in Malaysia.

Development

In order to serve the forestry based industries effectively, the Board encourages the research laboratories to continuously upgrade the testing facilities and increase the testing scope to meet the respective international standard testing requirements. The Board acknowledges the ten ISO 17025 accredited laboratories and six laboratories accredited with the BioNexus Partners (BNP) status. We hope to see more laboratories pursuing and getting these accreditations in the near future.

It is notable that Pasoh Research Station is well-known and with good records, and research is still going on. Besides this, there are nine research stations around the country that should be further enhanced in terms of research activities. The Board recognises the different levels of development and status of these stations and encourages the development of facilities and specific plan to enhance R&D activities in these stations. Researchers are encouraged to use these facilities as the testing bed before replicating in other sites.

Future direction

It is greatly acknowledged that forest plays an important role in many aspects of the well beings of people globally. There is a need to promote multiple dimensions approaches to local forest related R&D in view of the current social and environmental challenges. New research, local assessment of forest resources, utilisation and outlook studies of forest produces, and best practice guidelines are needed to mitigate climate changes, conserving biodiversity, combating land degradation and provide the necessary local economic needs and development. The Board, together with the management, has always supported the collaboration of researchers as a team to address these issues that will produce significant impact.

Two Technical Advisory Panels (TAPs) were appointed to assess the research activities and provide suggestions on the way forward for the Forest Biodiversity and Forest Biotechnology Divisions in June. The reports of the TAPs were reviewed and accepted by the Board. The main recommendations for the Forest Biodiversity Division: to establish Key Performance Index (KPI) for researchers aimed at addressing the imbalance performance between individuals in the programme; to enhance inter-divisional collaboration and cooperation to support institutional mission; and, to work, cooperate and collaborate not only with related agencies under Ministry of Natural Resources and Environment but also with other research institutes (such as SIRIM, IMR and MARDI) and local universities in

Bioteknologi Perhutanan pada bulan Jun. Laporan TAP telah diulas dan diterima oleh pihak Lembaga. Antara syor utama bagi Bahagian Biodiversiti Hutan: untuk menyediakan Petunjuk Prestasi Utama (KPI) kepada penyelidik bertujuan untuk menangani ketidakseimbangan prestasi dalam kalangan pegawai di Program tersebut; untuk meningkatkan kerjasama antara Bahagian dalam menyokong misi FRIM; dan untuk menjalin kerjasama bukan hanya dengan agensi-agensi di bawah NRE malah juga dengan institusi penyelidikan yang lain (seperti SIRIM, Institut Penyelidikan Perubatan (IMR) dan MARDI) dan universiti tempatan sebagai tambahan kepada program-program *outreach* dan jalinan kerjasama yang lalu. Antara syor yang dikemukakan kepada Bahagian Bioteknologi Perhutanan: untuk menumpukan kepada spesies utama dan elakkan daripada mengubah bidang keutamaan dalam jangka masa pendek; untuk menangani kekurangan sumber manusia berdasarkan keperluan segera, khususnya pakar dalam pembiak baik pokok (tree breeders); untuk mendokumenkan kesemua klon/bahan pembiakbakaan untuk memastikan kesinambungan dan kemampuan program pembiakbakaan dalam jangka panjang; serta untuk terus menjalankan aktiviti bagi memenuhi obligasi/konvensyen antarabangsa (seperti CITES, CBD).

Pada bulan Disember, Lembaga telah melantik Jawatankuasa Penasihat Penyelidikan untuk membuat semakan semula ke atas aktiviti-aktiviti penyelidikan dan komersialisasi, di samping memberikan syor-syor ke atas hala tuju FRIM sebagai sebuah institusi R, D & C yang utama. Jawatankuasa ini terdiri daripada pakar-pakar dalam bidang masing-masing dari dalam dan luar negara telah memberikan pandangan mereka dari sudut tempatan dan global bagi menentukan hala tuju FRIM yang lebih bermakna bagi lima tahun yang akan datang.

Penghargaan

Saya ingin menyampaikan ucapan setinggi-tinggi terima kasih kepada YB Dato Douglas Uggah Embas, Menteri NRE yang terus memberi kepercayaan kepada saya untuk menerajui Lembaga. Dengan sokongan dan iltizam yang padu daripada kesemua Ahli Lembaga, saya yakin untuk terus menggerakkan FRIM ke arah yang lebih cemerlang.

Selaku Pengerusi Lembaga, saya juga ingin mengucapkan terima kasih di atas sumbangan semua Ahli Lembaga. Diharap FRIM akan terus menghasilkan pelbagai out put yang signifikan dalam bidang perhutanan di Malaysia dan seterusnya menjadi sebuah institusi penyelidikan hutan tropika terunggul di persada dunia.



**HAJAH NANCY HJ SHUKRI
(KMN, AMN)**

PENGERUSI/CHAIRPERSON

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

addition to its past and current outreach and networking programmes with the region and international bodies. Among the recommendations for Forest Biotechnology Division: to focus on core species and avoid the shifting of priority over short-term period; to address critical short-handedness of human resources on an urgent basis, in particular its plant/tree breeders; to document all clones/breeding materials to ensure the continuity as well as the sustainability of long-term breeding programmes; to work with MOSTI so that forest species can be considered and selected as model species for national (NGS) genome project; and to continue undertaking activities to fulfil international obligations/conventions (e.g. CITES, CBD).

In December, a Research Advisory Committee was also appointed to review FRIM's research and commercialisation activities, and to provide recommendations on the way forward for FRIM as a premier R, D & C institution. The committee consisted of both local and foreign experts in their respective fields had provided a good local and global outlook to set more meaningful direction for FRIM in the next five years.

Acknowledgement

First and foremost, I wish to express my sincere gratitude to YB Dato Douglas Uggah Embas, Minister of NRE, for trust in me as a Chairperson of the Board. With the full support and commitment from all the Board members, we hope to be able to propel FRIM towards greater heights.

As a chairman of the Board, I also wish to thank all the members for their contributions. It is our earnest hope that FRIM will continue to post more and significant outputs for the betterment of forestry in Malaysia and become the apex tropical forest research institution in the world. On behalf of the Board, I would like to congratulate the management and staff of FRIM for this year's accomplishments and extend my thanks for their cooperation and exceptional efforts shown in their outstanding performance.

Ahli Lembaga Board Members

Pengerusi/Chairman

YB PUAN/MADAM HAJAH NANCY HJ SHUKRI
(KMN, AMN)

Ahli dan Ahli Silih Ganti Members and Alternate Members

Kementerian Sumber Asli dan Alam Sekitar Malaysia Ministry of Natural Resources and Environment Malaysia (NRE)

DATUK DR ABDUL RAHIM NIK (KMN, AMN)
(Dari 6 Januari 2012/From 6 Januari 2012)

PUAN/MADAM ZURINAH PAWANTEH
(Sehingga 31 Ogos 2012/Until 31 August 2012)
(Ahli silih ganti/Alternate member)

PUAN/MADAM WAN HASMAH WAN MOHD
(Dari 3 September 2012/From 3 September 2012)

Kementerian Kewangan Ministry of Finance (MOF)

EN/MR ZURAIIDI HUSAIN

EN/MR WAN FARISAN WAN SULAIMAN
(Ahli silih ganti/Alternate member)

Jabatan Perhutanan Semenanjung Malaysia (JPSM) Forestry Department of Peninsular Malaysia

DATO' DR HJ ABDUL RAHMAN HJ ABDUL RAHIM
(DIMP, ANS)

DATO' MASRAN MD SALLEH
(BSK, BCM, ANS, SPMP, AMN)
(Ahli silih ganti/Alternate member)

Lembaga Perindustrian Kayu Malaysia Malaysian Timber Industry Board (MTIB)

PROF MADYA/ASSOCIATE PROF DR JALALUDDIN
HARUN

PUAN/MADAM HJH NORCAHAYA HASHIM
(Ahli silih ganti/Alternate member)

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EN/MR TEOH TIAN MEN
(Ahli silih ganti/Alternate member)

Persatuan Industri Kayu-Kayan Malaysia Malaysian Wood Industries Association (MWIA)

EN/MR NG KAY YIP

EN/MR PON CHIA HWEE
(Ahli silih ganti/Alternate member)

Persatuan Pengusaha Kayu-Kayan dan Perabot Bumiputera Malaysia (PEKA) Association of Malaysian Bumiputera Timber and Furniture Entrepreneurs

TUAN HJ IR WAHID JAAFAR

TUAN HJ HANAFEE YUSOFF
(SMK)
(Ahli silih ganti/Alternate member)

Kementerian Sains, Teknologi dan Inovasi Ministry of Science, Technology and Innovation (MOSTI)

PROF DATO' DR MOHAMED ISA ABD MAJID
(DSPN)

Pejabat Pembangunan Negeri Selangor Selangor State Development Office

DATUK HJ ABDUL GHANI SALLEH
(DMSM, KMN, SMS, AMS, PPT)

Yayasan Sabah/Sabah Foundation

EN/MR GREGORY MOSIGIL

**Jabatan Perhutanan Sarawak
Sarawak Forestry Department**

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(PPC, PBK, PPB, PPS)

EN/MR ABANG MOHD MOHTAR ABANG PAWOZAN
(Ahli silih ganti/Alternate member)

**Pejabat Setiausaha Kerajaan Negeri Selangor
Selangor State Secretary Office**

DATO' NOORDIN SULAIMAN
(DPMS, SIS)
(Sehingga 31 Oktober 2012/31 October 2012)

DATO HJ MOHAMAD ROSLAN SAKIMAN
(DPMS, AMS, PJM)
(Dari/From 1 November 2012)

**Pusat Kepelbagaian Biologi Sarawak
Sarawak Biodiversity Centre (SBC)**

DR RITA MANURUNG
(PPB, PBK)

**Perbadanan Teknologi Malaysia Sdn Bhd
Malaysian Teknologi Corporation Sdn Bhd (MTC)**

DATO' DR MOHD NAZLEE KAMAL (DIMP)

**Institut Penyelidikan Perhutanan Malaysia
Forest Research Institute Malaysia (FRIM)**

DATO' DR ABD LATIF MOHMOD
(DIMP, JSM, KMN, AMN)

Mesuarat Lembaga/Board Meetings 2012:

1/2012—8 Mac/March
2/2012—24 Mei/May
3/2012—15 Ogos/August
4/2012—26 November

Ahli Lembaga Board Members



YB Puan/Madam Hajah Nancy Hj Shukri
(KMN, AMN)



Datuk Dr Abdul Rahim Nik
(KMN, AMN, PMW, DPMT)



En/Mr Zuraidi Husain



Dato' Dr Hj Abdul Rahman
Hj Abdul Rahim
(DIMP, ANS)



Prof Madya/Associate Prof
Dr Jalaluddin Harun



Datuk Hj Abdul Ghani Salleh
(DMSM, KMN, SMS, AMS, PPT)



En/Mr Ng Kay Yip



Tuan Hj Ir Wahid Jaafar



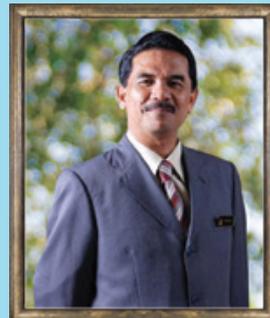
Dato' Dr Mohamed Isa Abd Majid
(DSPN)



En/Mr Gregory Mosigil



Datu Hj Ali Yusop
(PPC, PBK, PPB, PPS)



Dato' Noordin Sulaiman
(DPMS, SIS)



Dato Hj Mohamad Roslan Sakiman
(DPMS, AMS, PJM)



Dato' Sheikh Othman Sheikh Abdul Rahman
(DIMP, JP)



Dato' Dr Mohd Nazlee Kamal
(DIMP)



Dato' Dr Abd Latif Mohmod
(DIMP, JSM, KMN, AMN)

*Tiada dalam gambar/
Not in picture:*
Dr Rita Manurung

Jawatankuasa Kewangan dan Perjawatan (JKKP) Finance and Establishment Committee

Pengerusi **Chairman**

YB PUAN/MADAM HAJAH NANCY HJ SHUKRI
(KMN, AMN)

Ahli dan Ahli Silih Ganti **Members and Alternate Members**

Kementerian Sumber Asli dan Alam Sekitar Malaysia **Ministry of Natural Resources and Environment (NRE)** **Malaysia**

DATUK DR ABDUL RAHIM NIK (KMN, AMN)
(Dari/From 6 Januari/January 2012)

PUAN/MDM ZURINAH PAWANTEH
(Sehingga 31 Ogos /Until 31 August 2012)
(Ahli silih ganti/Alternate member)

PUAN/MDM WAN HASMAH WAN MOHD
(Dari/From 3 September 2012)
(Ahli silih ganti/Alternate member)

Kementerian Kewangan/ **Ministry of Finance (MOF)**

EN/MR ZURAIID HUSAIN

EN/MR WAN FARISAN WAN SULAIMAN
(Ahli silih ganti/Alternate member)

Jabatan Perhutanan Semenanjung Malaysia (JPSM) **Forestry Department of Peninsular Malaysia**

DATO' DR HJ ABDUL RAHMAN HJ ABDUL RAHIM
(DIMP, ANS)

DATO' MASRAN MD SALLEH
(BSK, BCM, ANS, DPMP, AMN)
(Ahli silih ganti/Alternate member)

Persatuan Industri Kayu-Kayan Malaysia **Malaysian Wood Industries Association (MWIA)**

EN/MR NG KAY YIP

EN/MR PON CHIA HWEE
(Ahli silih ganti/Alternate member)

Pejabat Pembangunan Negeri Selangor **Selangor State Development Office**

DATUK HJ ABDUL GHANI SALLEH
DMSM, KMN, SMS, AMS, PPT

Perbadanan Bioteknologi Malaysia Sdn Bhd **Malaysian Biotechnology Corporation Sdn Bhd**

DATO' DR MOHD NAZLEE KAMAL, DIMP

Jabatan Perkhidmatan Awam Malaysia **Public Service Department of Malaysia**

DATO' MOHTAR MOHD. ABDUL RAHMAN
(Dari 21 Mac /From 21 March 2012)

Unit Perancang Ekonomi **Economic Planning Unit**

CIK/MISS ZARINA ALI MERICAN
(Dari 13 Disember /From 13 December 2012)

Institut Penyelidikan Perhutanan Malaysia **Forest Research Institute Malaysia (FRIM)**

DATO' DR ABD LATIF MOHMOD
(DIMP, JSM, KMN, AMN)

Mesyuarat JKPP /JKPP Meetings:

1/2012—23 Februari/February

2/2012—14 Mei/May

3/2012—14 Ogos/August

4/2012—30 Oktober/October

Jawatankuasa Audit Audit Committee

Pengerusi Chairman

Kementerian Sumber Asli dan Alam Sekitar Malaysia Ministry of Natural Resources and Environment (NRE) Malaysia

DATUK DR ABDUL RAHIM NIK (KMN, AMN)
(Dari/From 6 Januari/January 2012)

PUAN/MDM ZURINAH PAWANTEH
(Sehingga 31 Ogos /Until 31 August 2012)
(Ahli silih ganti/Alternate member)

PUAN/MDM WAN HASMAH WAN MOHD
(Dari/From 3 September 2012)
(Ahli silih ganti/Alternate member)

Ahli dan Ahli Silih Ganti Members and Alternate Members

Kementerian Kewangan/Ministry of Finance (MOF)

EN/MR ZURAIID HUSAIN

EN/MR WAN FARISAN WAN SULAIMAN
(Ahli silih ganti/Alternate member)

Lembaga Perindustrian Kayu Malaysia Malaysian Timber Industry Board (MTIB)

PROF MADYA/ASSOCIATE PROF DR JALALUDDIN
HARUN

PUAN/MADAM HJH NORCAHAYA HASHIM
(Ahli silih ganti/Alternate member)

Persatuan Pekilang Panel Malaysia Malaysian Panel-Products Manufacturer's Association (MPMA)

DATO' SHEIKH OTHMAN SHEIKH ABDUL RAHMAN
(DIMP, JP)

EN/MR TEOH TIAN MEN
(Ahli silih ganti/Alternate member)

Pejabat Setiausaha Kerajaan Negeri Selangor Selangor State Secretary Office

DATO' NOORDIN SULAIMAN (DPMS, SIS)
(Sehingga 31 Oktober/Until 31 October 2012)

Mesyuarat Audit/Audit Meetings:

1/2012—13 Februari/February

2/2012—7 Mei/May

3/2012—15 Ogos/August

4/2012—23 November

Panel Penasihat Penyelidikan Research Advisory Committee (RAC) 2012–2015

Ahli Panel/Panel Members

Jawatankuasa Kecil Perhutanan dan Alam Sekitar Forestry and Environment Sub-Committee

DATO' SHAHARUDDIN MOHAMAD ISMAIL
Felo Utama & Ketua Governans Air,
Hutan dan Sumber Asli
Universiti Kebangsaan Malaysia (UKM)

PROF DR MOHD NORDIN HAJI HASAN
International Council for Science (ICSU)
Regional Office for Asia and the Pacific

PROF DR TORU ASANO
School of Life Sciences
Tohoku University, Japan

Jawatankuasa Kecil Keluaran Hutan Forest Products Sub-Committee

DR RAZALI ABDUL KADIR
Chairman K-Special Sdn Bhd

DR DAVID JOHN COWN
Deputy Coordinator IUFRO Division 5 (Forest Products)
NEW ZEALAND

DR MOHAMAD JAMIL ABU HASAN
Chief Executive Officer
SPPT Engineering Sdn Bhd

Jawatankuasa Kecil Bioteknologi Perhutanan Forestry Biotechnology Sub-Committee

PROF DR MOHAMAD OSMAN
Coordinator, Plant Sciences Programme
Kulliyah of Sciences International Islamic University
Malaysia (IIUM)

DR CHRISTOPHER ERIC HARWOOD
CSIRO Sustainable Ecosystems
Tasmania, Australia

DR RUSLAN ABDULLAH
Yayasan Sime Darby

Jawatankuasa Kecil Biodiversiti Perhutanan/Forest Biodiversity Sub-Committee

PROF DATO' DR ABDUL LATIFF MOHAMAD
Faculty of Science and Technology
Universiti Kebangsaan Malaysia (UKM)

PROF DR EDWINO S FERNANDO
College of Forestry and Natural Resources
University of the Philippines – Los Banos

PROF DR MOHD TAJUDDIN ABDULLAH
Faculty of Resources Science and Technology
Universiti Malaysia Sarawak (UNIMAS)

Jawatankuasa Kecil Keluaran Hutan Natural Products Sub-Committee

PROF DR SUKHDEV SWAMI HANDA
University Institute of Pharmaceutical Sciences,
Panjab University, India

PUAN/MADAM SHARIFAH FAUZIYAH SYED MOHTHAR
Regulatory Affairs
Pharmaniaga Berhad

Jawatankuasa Kecil Komersialisasi dan Inovasi Commercialization and Innovation Sub-Committee

EN/MR MOHAMMAD HAZANI HJ. HASSAN
Director, Technology Ventures Division
Malaysian Technology Development Corporation

EN/MR KAMAL KORMIN
Head, Patent Examination Section (Applied Science)
Intellectual Property Corporation of Malaysia (MyIPO)

Jawatankuasa Kecil Ekonomi dan Analisis Strategik Economic and Strategic Analysis Sub-Committee

PROF DR JAMAL OTHMAN
Faculty of Economics and Management
Universiti Kebangsaan Malaysia (UKM)

DR HERMINIA A. FRANCISCO
Economy and Environment Program for Southeast Asia
(EEPSEA),
Canadian International Development Research Centre
(IDRC), Manila

Mesyuarat RAC / Meeting:

4–7 Disember/December 2012



Institut Penyelidikan Perhutanan Malaysia
Forest Research Institute Malaysia (FRIM)

Laporan Ketua Pengarah Director General's Report



DATO' DR ABD LATIFF MOHMOD
(DIMP, JSM, KMN, AMN)
Ketua Pengarah/Director General



Tahun 2012 telah menyaksikan FRIM berkembang sebagai sebuah institusi penyelidikan perhutanan yang lebih dinamik walaupun menghadapi pelbagai cabaran untuk terus berada di hadapan dalam penyelidikan perhutanan tropika. Segala aspirasi telah dibuktikan menerusi tindakan dan pencapaian yang mendapat pelbagai pengiktirafan.

Meneliti Petunjuk Prestasi Utama 2012 secara sepintas lalu menunjukkan terdapat peningkatan yang signifikan dalam jumlah dana penyelidikan serta janaan pendapatan menerusi perkhidmatan ujian dan khidmat perundingan ikhtisas yang menggambarkan keberkesanan dan kestabilan pertumbuhan aktiviti-aktiviti R&D serta kepentingan FRIM dalam industri perhutanan. Dengan 184 projek penyelidikan yang dilaksanakan pada tahun ini, jumlah dana yang terlibat ialah 33% lebih tinggi berbanding pada tahun 2011, atau bersamaan dengan jumlah sebanyak RM24 juta. Daripada jumlah ini, sebanyak RM3.2 juta disumbangkan oleh 18 projek baharu yang diluluskan oleh agensi penaja geran tempatan.

2012 has evidently witnessed FRIM evolving into a more dynamic research institution notwithstanding the immense challenges to stay ahead in tropical forestry research. Aspirations are continuously being translated into actions and achievements into recognitions.

A quick glance at the Key Performance Indicators in 2012 indicated a significant increase in the amount of research funds as well as income generation through testing services and professional consultancies indicating strong yet stable growth of R&D activities and relevance of FRIM to the forestry industry. With 184 research projects being carried out this year, the amount of research fund was 33% higher compared to 2011, or equivalent to a total of RM24 million. Of this amount, RM3.2 million came from 18 new projects approved by local funding agencies.

Dalam bidang R&D, FRIM telah dipilih oleh Institut Darul Ridzuan di Perak untuk membuat pemetaan dan seterusnya mengenal pasti status terkini serta taburan hutan tanah lembap di negeri tersebut. Hasil daripada kajian tersebut akan digunakan untuk menyokong langkah-langkah bagi memastikan pengurusan dan pemuliharaan secara mampan sumber-sumber di hutan tanah lembap. FRIM juga akan berkerjasama dengan Jabatan Perhutanan Semenanjung Malaysia (JPSM) dalam empat projek baharu mengenai REDD+, anggaran biojisim, penilaian stok karbon dan isu-isu perubahan iklim yang ditaja oleh Forestry and Forest Product Research Institute (FFPRI), Asia Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet), Japan Aerospace Exploration Agency (JAXA), dan International Tropical Timber Organisation (ITTO). Penyelidikan dalam perubatan secara semula jadi menggunakan tumbuh-tumbuhan telah membawa kepada penemuan polisakarida dalam buah noni yang dapat menurunkan paras gula di dalam darah. Teknologi tersebut telah diguna pakai oleh sektor swasta untuk menghasilkan polisakarida sebagai bahan aktif dalam produk makanan.

Dengan penyelidikan tetap sebagai tunjang utama, FRIM terus mendapat kepercayaan daripada pelanggan baik daripada syarikat swasta, agensi kerajaan, akademik mahupun organisasi antarabangsa dalam khidmat perundingan ikhtisas yang ditawarkan oleh para penyelidikannya. Sejumlah 59 projek perundingan, iaitu peningkatan sebanyak 12 projek berbanding dengan tahun 2011, berjumlah melebihi RM2 juta telah dilaksanakan pada tahun ini. Selaras dengan Pelan Strategik bagi mengkomersialkan hasil-hasil penyelidikan, FRIM perlu terus mengekalkan kedudukannya sebagai perintis dalam penyelidikan perhutanan tropika menerusi penyelidikan dan inovasi. Usaha-usaha ke arah ini membolehkan kita berjaya memperoleh 30 pendedahan reka cipta, lima pemfailan paten tempatan dan enam antarabangsa dan satu paten. Di samping itu, sebanyak enam perjanjian pelesenan mengenai produk-produk kultur tisu, kayu dan herba telah ditandatangani. Segala penat lelah daripada mereka yang terlibat sangatlah dihargai.

Di samping terus meneroka pelbagai peluang dalam komersialisasi hasil-hasil penyelidikan, jalinan hubungan dengan rakan-rakan strategik turut memainkan peranan penting. Pada 2012, sebanyak 13 memorandum persefahaman (MoU) dan empat perjanjian ditandatangani oleh MFRDB. Antara lain, di bawah perjanjian antara FRIM dan TRADA Technology Ltd, FRIM akan berkerjasama sebagai Makmal Ujian yang diluluskan untuk produk kayu dan binaan, cadangan untuk eksport ke Eropah, untuk menyemak pematuhan kepada keperluan keselamatan, prestasi dan mutu produk. Di samping itu, perjanjian antara FRIM dan Agensi Inovasi Malaysia akan membolehkan FRIM memperkasa usaha-usaha ke arah komersialisasi, contohnya menerusi kajian asas pasaran, carian harta intelek dan mengenal pasti pelesen-pelesen berpotensi.

In the R&D arena, FRIM was selected by the Institut Darul Ridzuan (IDR) in Perak to map and identify the current status and distribution of wetland forests in the state. Findings from the study will be used to support measures for ensuring the sustainable management and conservation of the wetland forest resources. FRIM will also be working closely with the Forestry Department of Peninsular Malaysia (FDPM) in four new projects focusing on REDD+, biomass estimation, carbon stock assessment and climate change issues. Venturing into the research on natural healing powers of plants has led to the discovery of polysaccharides in noni fruit as a remedy to reduce blood sugar level after meal. The technology has subsequently been taken up by the private sector to produce polysaccharide fractions as an active ingredient in food products. Research is thus not merely science, but innovation with a purpose.

While research is still a mainstay, FRIM is gaining a momentum of trust from clients ranging from private companies, government agencies, academics as well as international organisations through the demand for professional consultancies. A total of 59 consultancy projects—an increase of 12 projects from 2011—worth more than RM2 million were registered this year. Concomitant with our strategic plan to commercialise our R&D outputs, it is vital for FRIM to stay ahead as a pioneer in tropical forestry research via research and innovation. Endeavors in this mission have led FRIM to achieve 30 invention disclosures, 5 local and 6 international patent filings, and 1 patent granted. Additionally 6 licensing agreements were signed on tissue culture, wood and herbal products. These inspiring efforts by all involved are highly commendable.

As FRIM continues to explore opportunities in commercialization of research findings, building alliances with strategic partners is an essential foundation. In 2012, 13 memoranda of understanding (MoU) and four agreements were signed by the MFRDB. Among others, under the agreement between FRIM and TRADA Technology Ltd., FRIM will work with the latter as an Approved Testing Laboratory for timber and construction products, intended for export to Europe, to check compliance to requirements for product safety, performance and quality. In addition, the agreement between FRIM and the Malaysian Innovation Agency will allow FRIM to strengthen fundamental efforts in commercialisation for instance through basic market research, IP search and identification of potential licensees.

Selain altiviti utama iaitu R&D, FRIM turut menjalankan aktiviti tanggungjawab sosial korporat (CSR) melibatkan lebih daripada 200 peserta yang terdiri daripada warga FRIM, ahli akademik dan pelajar, warga negara serta wakil-wakil media; contohnya sambutan Hari Perhutanan Sedunia, program sekolah, bengkel, dan pertandingan fotografi yang menonjolkan keunikan FRIM. FRIM turut bekerjasama dengan Pos Malaysia menerusi pelancaran himpunan setem baharu serta barangan filatelik mengenai tumbuhan beraroma iaitu limau kasturi, kesum dan pudina. Dalam usaha untuk meningkatkan kesedaran awam mengenai kepentingan melindungi, mengurus dan memulih hutan kita, FRIM berterima kasih kepada kedua-dua media cetak dan media penyiaran yang telah membuat 363 laporan media dengan anggaran nilai perhubungan awam sebanyak RM9.5 juta pada 2012 dengan peningkatan signifikan laporan dalam akhbar-akhbar di Sabah dan Sarawak.

Daripada aspek pemindahan teknologi, di sepanjang tahun 2012, FRIM telah menganjurkan sebanyak 55 persidangan, seminar, bengkel, dialog dan kursus. Pada 23-24 Oktober, FRIM dengan kerjasama Universiti Malaysia Pahang (UMP) dan Higher Education Leadership Academy (AKEPT) telah menganjurkan International Conference on Biomass for Biofuel and Value Added Products. Persidangan ini bertujuan untuk menyebarkan maklumat mengenai teknologi terkini, aktiviti-aktiviti dan hasil-hasil R&D dalam penggunaan biojisim bagi biobahan api dan produk-produk bernilai tambah. FRIM turut menganjurkan Seminar bertajuk "Long-Term Ecological Research in East Asia Pacific Region" pada 4-5 Julai. Dengan sokongan APAFRI, FRIM turut menganjurkan "International Symposium on Reclamation, Rehabilitation and Restoration Towards a Greener Asia" pada 3-5 Julai.

FRIM telah menyertai sebanyak 27 pameran tempatan pada tahun ini. Pameran merupakan kaedah penting dalam memindahkan teknologi FRIM dan juga untuk merebut peluang perniagaan sejajar dengan aspirasi FRIM ke arah komersialisasi. FRIM memenangi dua pingat emas, tiga perak dan empat gangsa dalam "International Invention, Innovation and Technology Exhibition (ITEX)". FRIM juga muncul sebagai pemenang pertama dalam Pertandingan Hiasan Kreatif dan Gerai Pameran Terbaik serta Pertandingan Poster Propaganda (kategori motivasi) bersempena dengan Hari Inovasi NRE 2012.

Kecemerlangan FRIM dalam penyelidikan perhutanan sekali lagi mendapat pengiktirafan di peringkat kebangsaan dan antarabangsa baik dari segi penglibatan aktif dalam R&D perhutanan dan kolaborasi dengan pelbagai pihak yang berkepentingan, malah juga atas usahanya menyebarkan hasil-hasil R&D dan menggalakkan kesedaran awam dalam pemuliharaan hutan. FRIM bertuah kerana dianugerahi "International Diamond Prize for Excellence in Quality", oleh European Society for Quality Research (ESQR) di Belgium pada 2 Disember sebagai pengiktirafan ke atas usaha, pencapaian dan kecemerlangan dalam pengurusan kualiti. FRIM turut menerima "Science and Technology Prize 2012" dari Bank Pembangunan Islam di atas sumbangannya

Apart from core business in R&D, FRIM has also conducted Corporate Social Responsibility (CSR) activities involving more than 200 participants ranging from FRIM staff, academic staff and students, citizens and media representatives for example in World Forestry Day celebration, school programmes, workshops and photography competition featuring the uniqueness of FRIM. FRIM is also pleased to collaborate with Pos Malaysia in launching a new collection of stamps and philatelic items on aromatic plants namely the kaffir lime, *kesum* and peppermint. In raising the public awareness on the importance of protecting, managing and restoring our forests, FRIM is grateful to both the print and broadcast media for reports amounting to 363 with public relations value estimated at RM9.5 million in 2012 with significant increase of reports by newspapers in Sabah and Sarawak.

Throughout 2012, FRIM has conducted a total of 55 conferences, seminars, workshops, dialogues and courses as part of technology transfer commitment. On 23-24 October, the International Conference on Biomass for Biofuel and Value Added Products, designed to disseminate the latest technology, activities and R&D findings in the utilisation of biomass for biofuel and other value-added products, was co-organised by the Universiti Malaysia Pahang (UMP), FRIM and the Higher Education Leadership Academy (AKEPT) Asia Pacific Association of Forestry Research Institutions (APAFRI) also organised the Seminar on Long-Term Ecological Research in East Asia Pacific Region on 4-5 July. With the support from APAFRI, FRIM also organised the International Symposium on Reclamation, Rehabilitation and Restoration towards a Greener Asia on 3-5 July.

FRIM has participated in 27 exhibitions held locally this year. Exhibitions are crucial as a means to transfer FRIM technologies and as business opportunities parallel to our aspiration in commercialisation. FRIM won two gold medals, three silver and four bronze in the International Invention, Innovation & Technology Exhibition (ITEX). FRIM also emerged as the first prize winner in Creative Decoration and Best Booth Competition and the Propaganda Poster Competition (motivation category) in conjunction with NRE Innovation Day 2012.

FRIM's excellence in forestry research has again been recognised at the national and international levels not only for contributing actively in forestry R&D and collaborations with multi-stakeholders but also for effectively disseminating R&D findings and promoting awareness on forest conservation. FRIM is honoured by being awarded the International Diamond Prize for Excellence in Quality, presented by the European Society for Quality Research (ESQR) in Belgium on 2 December in recognition of its efforts, achievements and excellence in quality management. FRIM also received the Islamic Development Bank (IDB) Science and Technology Prize 2012 for contributing to the

kepada kemajuan sains dan teknologi dalam sektor perhutanan di Malaysia. Selain itu, satu lagi anugerah berprestij yang diterima ialah “BrandLaureate Award 2011–2012 for the Best Brand in Forestry-Environment Conservation” sebanyak dua kali berturut-turut sejak 2010. Antara kriteria yang menyumbang kepada pemilihan ini termasuklah kedudukan di tangga teratas FRIM sebagai institut penyelidikan hutan tropika serta peningkatan faktor impak *Journal of Tropical Forest Science*.

Pada 10 Mei 2012, FRIM diisytiharkan sebagai Warisan Kebangsaan, status yang diberi di atas usaha-usaha pemuliharaan, mempunyai kepentingan dan legasi dari segi sejarah, merupakan hutan tropika buatan manusia yang terbesar dan tertua di dunia di samping merupakan satu-satunya institut penyelidikan hutan tropika di Malaysia. Di samping itu, FRIM diiktiraf dalam 10 sijil kebangsaan yang diterima dari Malaysia Book of Records; termasuklah koleksi terbesar sampel kayu dan pokok hidup, yang pertama menggunakan pengecapjarian DNA bagi menjejaki kayu balak dan denai alam mesra orang kurang upaya yang pertama. Buku terbitan FRIM yang bertajuk *Wild Orchids of Peninsular Malaysia* telah memenangi Anugerah Buku Negara 2012 bagi kategori Buku Teknikal Terbaik. Pada 2012, FRIM turut menerima Anugerah Kecemerlangan dalam Penyelidikan dari Persatuan Badan Berkanun Malaysia bagi sumbangannya kepada industri ekopelancongan kerajaan negeri Selangor serta Anugerah Penghargaan bagi Pengguna Malaysian Standards (MS) dari Jabatan Standards Malaysia kerana sumbangan dan inisiatif pempiawaian bagi menambah baik kualiti penyampaian perkhidmatan dan aktiviti R&D. Selain pencapaian di peringkat institusi, saya ingin menyampaikan ucapan setinggi-tinggi tahniah kepada Profesor Dr Engkik Soepadmo, seorang felo penyelidikan di FRIM yang dianugerahi Anugerah Merdeka di atas dedikasi beliau dalam bidang botani termasuklah sumbangan ke arah penubuhan Kawasan Hutan Perlindungan.

Kepada semua warga FRIM termasuk di kampus Kepong dan stesen-stesen penyelidikan, saya ingin menyampaikan ucapan terima kasih di atas usaha-usaha dan iltizam yang berterusan pada 2012. Apabila menyambut tahun 2013, marilah kita menyedari kekuatan dan peluang yang sedia ada serta menghadapi ancaman dan kelemahan bagi memperlihatkan perspektif baharu dalam aktiviti penyelidikan, pembangunan dan komersialisasi yang termaktub dalam visi dan misi kita.

scientific and technological development in the Malaysian forestry sector. Another prestigious award received was the BrandLaureate Award 2011-2012 for the Best Brand in Forestry-Environment Conservation consecutive since 2010. Among the criteria that contributed to this selection include the rating of FRIM as the top tropical forest research institute and an increase in the impact factor of the *Journal of Tropical Forest Science*.

On 10 May 2012, FRIM was declared as a National Heritage, a status accorded to FRIM for conservation efforts, the historical significance and legacy, being the largest and oldest man-made tropical forest in the world as well as the one and only tropical forest research institute in Malaysia. Also in the string of achievements are the 10 National Records certificates received from the Malaysia Book of Records which include the largest collections of wood samples and living trees, the first to use DNA fingerprinting for timber tracking and the first physically-challenged-friendly nature trail. The book entitled “Wild Orchids of Peninsular Malaysia” published by FRIM has won the National Book Award 2012 in the Best Technical Book category. In 2012, FRIM also received the Excellence Award for Research by the Malaysian Statutory Bodies Association for contributing to the ecotourism industry of the Selangor State and the Appreciation Award for Users of the Malaysian Standards (MS) from the Department of Standards Malaysia for its contributions and standardisation initiatives to improve the quality of FRIM’s service delivery and R&D activities. Aside from institutional achievements, I would like to extend my heartiest congratulations to Professor Dr Engkik Soepadmo—a research fellow in FRIM—for being conferred the prominent Merdeka Award for his assiduous dedication in botany including his contributions towards the establishment of Protected Forest Areas.

To all FRIM staff, both in the Kepong campus and in research stations, thank you for your collective efforts and sustained commitments in 2012. As we greet 2013, let us be cognizant of our strengths and opportunities while confronting threats and weaknesses to reveal new perspectives of research, development and commercialisation activities that are imperative to our vision and mission.



DATU' DR ABD LATIFF MOHMOD
(DIMP, JSM, KMN, AMN)
KETUA PENGARAH/DIRECTOR GENERAL
Institut Penyelidikan Perhutanan Malaysia
Forest Research Institute Malaysia





Pengurusan Tertinggi Top Management



1 Ketua Pengarah/Director General
DATO' DR ABD. LATIF MOHMOD
DIMP, JSM, KMN, AMN

2 Timbalan Ketua Pengarah
(Penyelidikan dan Pembangunan)
Deputy Director General
(Research and Development)
DR MOHAMED NOR MOHD. YUSOFF, KMN

3 Timbalan Ketua Pengarah (Operasi)
Deputy Director General (Operational)
PUAN WAN RAHMAH WAN A. RAO, KMN

4 Pengarah Bahagian Perhutanan dan Alam Sekitar
Director Forestry and Environment Division
DR ISMAIL HARUN

5 Pengarah Bahagian Keluaran Hutan
Director Forest Products Division
DR RAHIM SUDIN

6 Pengarah Bahagian Bioteknologi Perhutanan
Director Forestry Biotechnology Division
DR NORWATI MUHAMMAD

7 Pengarah Bahagian Biodiversiti Hutan
Director Forest Biodiversity Division
DR SAW LENG GUAN

8 Pengarah Bahagian Hasil Semula Jadi
Director Natural Products Division
DR RASADAH MAT ALI, AMP

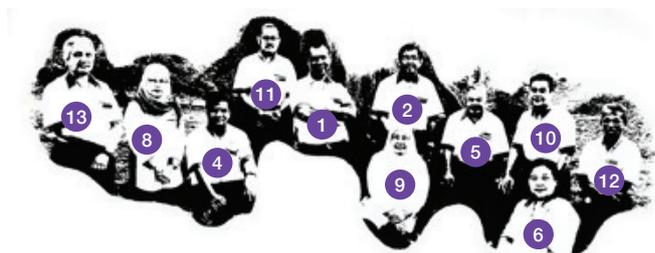
9 Pengarah Bahagian Perancangan Penyelidikan
dan Korporat
Director Research Planning and Corporate Division
DR NORINI HARON, AMN

10 Pengarah Bahagian Pentadbiran dan Penyelenggaraan
Director Administration and Maintenance Division
EN. ABDUL JABBAR HJ SABL

11 Pengarah Bahagian Kewangan
Director Finance Division
&
Pengarah Bahagian Inovasi dan Komersialisasi
Director Innovation and Commercialization Division
TUAN HJ MOHD. ZAMSHARI ABD. RAHMAN

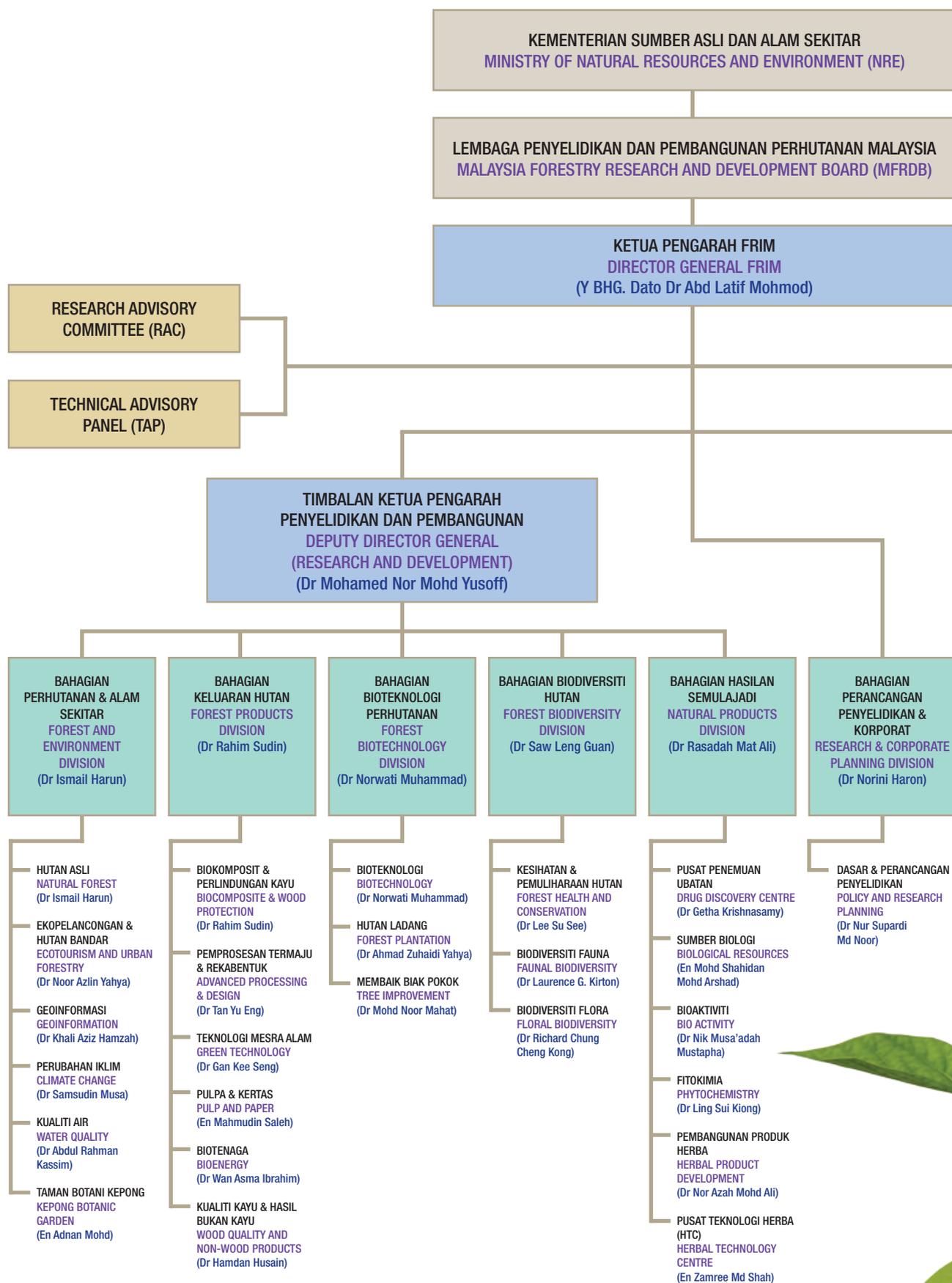
12 Pengarah Bahagian Sumber Manusia
Director Human Resource Division
EN IMALUDEEN MOHAMAD

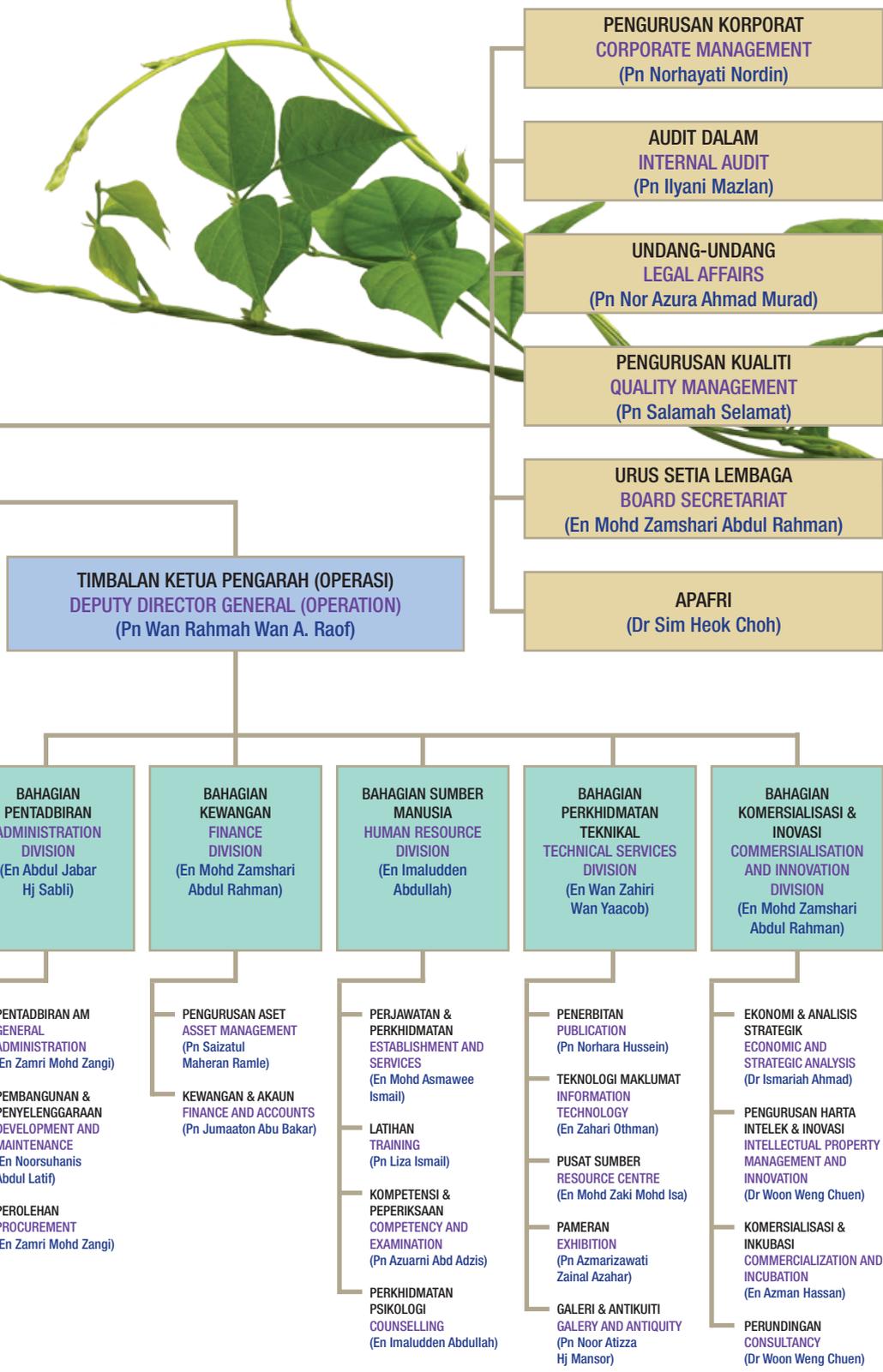
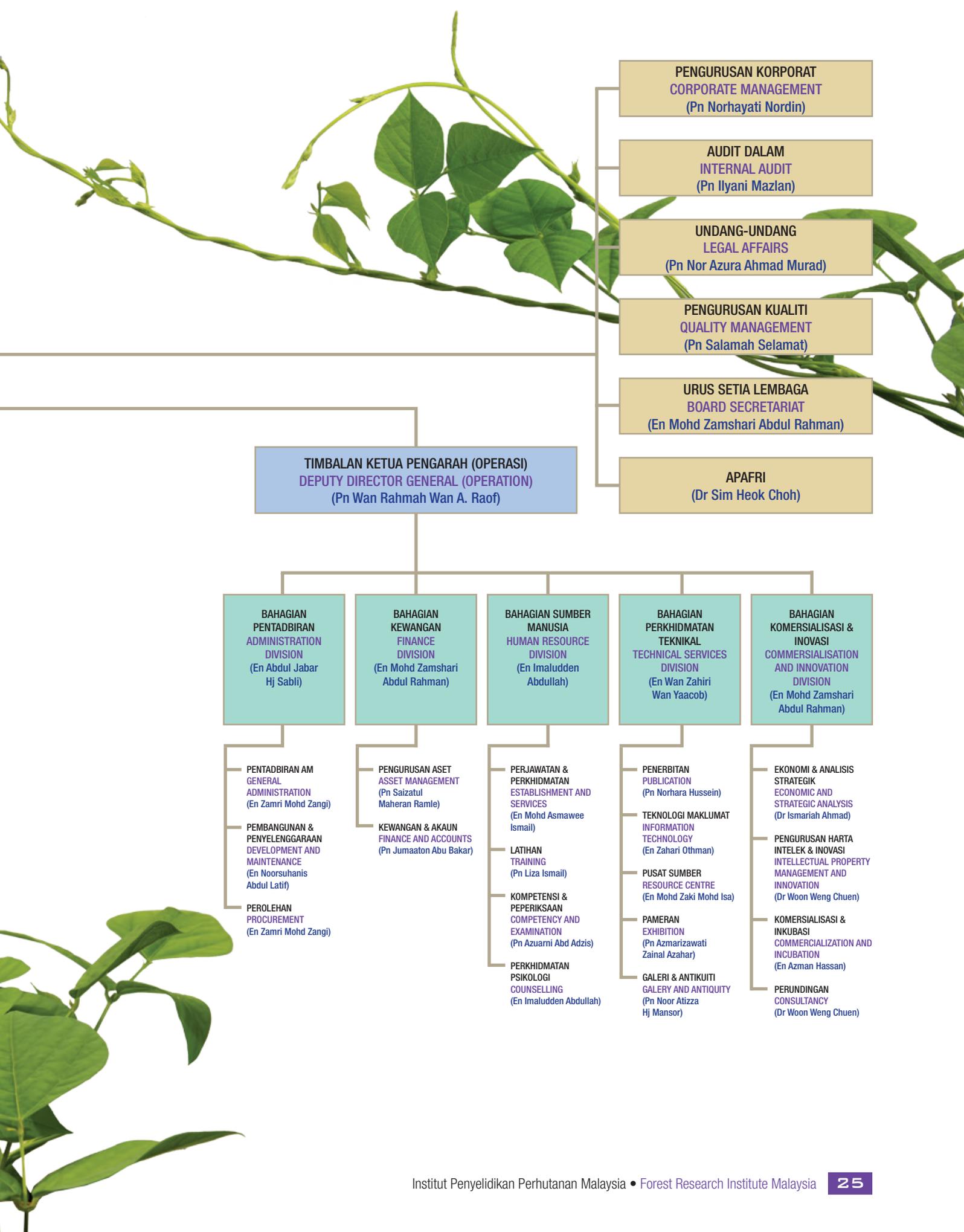
13 Pengarah Bahagian Perkhidmatan Teknikal
Director Technical Services Division
EN WAN ZAHIRI WAN YAACOB



Carta Organisasi FRIM 2012

FRIM 2012 Organisational Chart





LATAR BELAKANG

Institut Penyelidikan Perhutanan Malaysia (FRIM) ditubuhkan pada tahun 1929, dahulunya dikenali sebagai Institut Penyelidikan Perhutanan (IPP) di bawah Ibu Pejabat Jabatan Perhutanan Semenanjung Malaysia. Pada tahun 1985 FRIM menjadi sebuah badan berkanun di bawah Akta 319 Lembaga Penyelidikan dan Pembangunan Perhutanan Malaysia dan diletakkan di bawah Kementerian Perusahaan Utama sebelum berpindah ke Kementerian Sumber Asli dan Alam Sekitar pada tahun 2004.

VISI

Menjadikan FRIM sebuah institusi penyelidikan hutan tropika yang bertaraf dunia

MISI

Mencapai kecemerlangan dalam penyelidikan saintifik, pembangunan dan perkhidmatan sektor perhutanan

OBJEKTIF

Objektif Umum FRIM adalah untuk:

- Menjana pengetahuan saintifik bagi pemahaman, pengurusan dan penggunaan sumber hutan
- Mencapai kecemerlangan dalam penyelidikan dan pembangunan dengan penggunaan alat saintifik terkini
- Mengkaji kepelbagaian biologi bagi menghasilkan produk berguna melalui penyelidikan dan pembangunan yang intensif
- Memajukan teknologi berkaitan bagi memenuhi keperluan industri perhutanan
- Mempakejkan hasil penyelidikan dan pembangunan untuk disebar kepada pelanggan
- Mengkomersialkan hasil penyelidikan dan pembangunan melalui pemindahan teknologi kepada pihak yang berminat
- Menyediakan perkhidmatan cemerlang untuk memenuhi kepuasan pelanggan
- Mewujudkan kerjasama strategik dengan agensi tempatan dan antarabangsa
- Meningkatkan kesedaran awam terhadap kepentingan alam sekitar dan pemuliharaan kepelbagaian biologi hutan

Objektif Operasi FRIM adalah untuk:

- Menyediakan program pembangunan sumber manusia bagi melahirkan golongan saintis yang berwibawa dan kompeten
- Menyediakan suasana kerja yang kondusif bagi menggalakkan cetus idea di kalangan saintis dan perhubungan lebih rapat dengan pelanggan
- Menyebarkan hasil teknologi, penyelidikan serta memberi perkhidmatan nasihat dan teknikal yang tepat dan profesional
- Menyediakan penyelesaian praktikal kepada masalah berkaitan pengurusan dan penggunaan sumber dan hasil hutan
- Menyediakan kemudahan dan memberi perkhidmatan profesional dalam meningkatkan kesedaran awam terhadap alam sekitar

BACKGROUND

The Forest Research Institute Malaysia (FRIM) founded in 1929 as the Forest Research Institute (FRI) was a department under the Forestry Headquarters Peninsular Malaysia. It was not until 1985, the Institute became a statutory body under 319 Act governed by the Malaysian Forestry Research and Development Board (MFRDB) under the then Ministry of Primary Industries. Later in 2004, FRIM was administered by the Ministry of Natural Resources and Environment.

VISION

To make FRIM a world-class tropical forest research institute

MISSION

To achieve excellence in scientific research, development and forestry services

OBJECTIVES

General Objectives:

- To generate scientific knowledge for the understanding, management, conservation and use of forest resources
- To achieve excellence in research and development through the use of the latest scientific equipment
- To study biodiversity to produce useful products through intensive research and development
- To develop related technology to fulfill the needs of the forestry industry
- To package research and development findings for dissemination to clients
- To commercialise research and development findings through technology transfer to all interested parties
- To provide excellent service to fulfill client needs
- To create strategic cooperation with local and international agencies
- To raise public awareness regarding the importance of the environment and the conservation of forest biodiversity

Operational Objectives:

- To provide human resource development programmes to produce a class of authoritative and competent scientists
- To provide a work environment that is conducive to encourage creative thinking among scientists and a close relationship with clients
- To disseminate the technological and research products as well as giving accurate and professional advice and technical services
- To provide practical solutions to problems involving management and usage of forest resources and products
- To provide facilities and professional services in order to raise environmental awareness.

FUNGSI

Fungsi utama FRIM adalah untuk:

- Merancang dan melaksanakan penyelidikan bagi pembangunan sektor perhutanan dan pemuliharaan sumber hutan
- Memperoleh dan menyebarkan maklumat hasil penyelidikan bagi meningkatkan pengurusan hutan dan penggunaan hasil hutan
- Mengadakan hubungan kerjasama penyelidikan dan pembangunan perhutanan dengan badan-badan dalam dan luar Malaysia

PIAGAM PELANGGAN

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

- Menghasilkan 15 teknologi setahun yang berpotensi untuk ditingkatkan skala, diperintis, dikomersial atau diterima pakai bagi menyelesaikan masalah pengurusan perhutanan dan mempertingkatkan nilai ekonomi penggunaan hasil hutan
- Menghasilkan sekurang-kurangnya 90 artikel di dalam jurnal dan 30 daripadanya di dalam jurnal yang mempunyai faktor impak
- Memastikan 95% penyerahan laporan perkhidmatan kepada pelanggan dan pembayaran bil/tuntutan mengikut tempoh yang ditetapkan
- Memberi maklum balas sekurang-kurangnya 90% daripada aduan kepada pelanggan dalam tempoh 5 hari bekerja dari tarikh aduan diterima
- Menjalankan 35 khidmat perundingan dan usahasama pintar dengan pihak industri dan perdagangan bagi kepakaran dan teknologi yang dimiliki
- Memastikan 15 makmal menepati standard antarabangsa dan menjadi makmal rujukan yang berwibawa (MS ISO/IEC 17025/ Bionexus/ FIRA/ ift)

DASAR KUALITI

FRIM komited dalam menyediakan perkhidmatan penyelidikan dan perkhidmatan sokongan dengan cekap dan berkesan bagi memenuhi keperluan pelanggannya. Ini dilaksanakan berasaskan Piawaian MS ISO 9001:2008. FRIM akan melaksanakan penambahbaikan berterusan bagi meningkatkan keberkesanan sistem berkaitan.

SLOGAN KUALITI

Kualiti teras kecemerlangan
Inovasi kunci keunggulan

SLOGAN PERSEKITARAN BERKUALITI

Persekitaran berkualiti pemangkin kecemerlangan produktiviti

FUNCTIONS

The main functions of FRIM are:

- To plan and implement research for the development of the forestry sector and conservation of forest resources
- To obtain and disseminate research information to enhance forest management and the use of forest products
- To establish joint research and joint forest development with other bodies within and outside Malaysia

CLIENTS' CHARTER

We pledge to develop and enhance the utilisation of forest resources and products on a sustainable basis through research, development and application. For this purpose, we ensure that:

- Produce each year 15 technologies with potential for up-scaling; to be pioneered, commercialised and accepted in resolving forestry management related problems and increasing the economic value of forest products utilization
- Produce at least 90 articles in journals including 30 articles in impact factor journals
- Ensure 95% submission of reports to clients for services rendered and payment of bills/claims according to the specified duration
- Respond to at least 90% of complaints from clients within 5 working days from the date of receipt
- Undertake 35 consultancy service assignments and smart partnerships with the trade and industrial sector in areas where it has the expertise and technologies
- Ensure 15 laboratories adhere to the international standards and serve as trusted reference laboratories (MS ISO/ IEC 17025/ Bionexus/ FIRA/ ift)

QUALITY POLICY

FRIM is committed to providing effective research and related supporting services to fulfill its clients' needs. This is carried out in accordance with MS ISO 9001:2008 Standards. FRIM will carry out continuous improvements to enhance the effectiveness of related systems.

QUALITY SLOGAN

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

QUALITY ENVIRONMENT SLOGAN

Quality environment as catalyst to excellence in productivity

Aktiviti Utama dan Hasil R&D

R&D Highlights and Outcomes

BAHAGIAN PERHUTANAN DAN ALAM SEKITAR

KESAN PENUAIAN HUTAN SECARA KOMERSIAL TERHADAP KUALITI AIR DAN ENAPAN DI DALAM HUTAN DIPTEROKARPA ATAS DI KOMPARTMENT 44, H.S.TEMENGGOR, PERAK

Kajian telah dijalankan di hutan dipterokarpa atas di Malaysia untuk menilai kesan penuaian kayu secara komersial terhadap kepekatan enapan (SS) dan kualiti air di kawasan tadahan air. Ini merupakan sebahagian daripada projek pemuliharaan kepelbagaian biologi di dalam hutan pengeluaran yang ditaja bersama oleh Global Environmental Facilities (GEF), International Tropical Timber Organization (ITTO) dan kerajaan Malaysia. Sistem tebangan memilih (SMS) ialah sistem penuaian hutan yang digunakan di Malaysia manakala sistem tebangan yang ditambah baik (IHP) ialah sistem yang diperkenalkan dalam penyelidikan ini. Dua kawasan tadahan air telah dikenal pasti; iaitu satu daripadanya telah dibalik menggunakan SMS manakala yang satu lagi menggunakan IHP. Kepekatan enapan dan kualiti air dipantau setiap bulan sebelum, semasa dan selepas penuaian hutan. Keputusan menunjukkan IHP telah mengumpul jumlah kepekatan enapan yang kurang berbanding dengan IHP dalam jangka masa penebangan pokok dijalankan. Kepekatan SS juga bertambah tinggi semasa musim hujan. Kesan aktiviti penebangan hutan telah mempengaruhi kepekatan SS yang meningkat sehingga 100 kali ganda daripada nilai asal sebelum penebangan di dalam setiap tadahan air dan menurun secara perlahan-lahan sehingga mencapai 10 kali ganda setahun selepas tamat penuaian hutan. Nilai kualiti air juga berubah di dalam kedua-dua tadahan air tersebut dalam jangka masa penebangan terutamanya kekeruhan air dan konduktiviti manakala parameter kualiti air yang lain tidak banyak berubah. SMS telah meningkatkan kepekatan kekeruhan air sehingga tiga kali ganda daripada nilai asal sebelum penebangan pokok dan mengurangkan secara perlahan kepada tiga kali ganda setahun selepas penuaian tamat. IHP juga telah meningkatkan kepekatan kekeruhan air sehingga dua kali ganda tetapi nilai tetap sama selepas penuaian. Maka, berdasarkan kajian awal ini terdapat kesan berbeza antara penggunaan teknik penuaian SMS dan IHP terhadap konduktiviti dan kekeruhan air.

PERAK BIODIVERSITY TOOL SETS

Perak Biodiversity Tool Sets dibangunkan di bawah Projek UNDP-GEF-ITTO-FRIM *Conservation of Biodiversity* untuk menyokong Jabatan Perhutanan Semenanjung Malaysia (JPSM) dalam mengurus tadbir hutan pengeluaran daripada aspek pengeluaran balak serta mementingkan pemuliharaan biodiversiti dan kawasan tadahan air. Projek ini dibiayai oleh United Nations Development Program-Global Environment Facility (UNDP-GEF) dan International Tropical Timber Organization (ITTO) pada tahun 2007. Agensi-agensi yang terlibat dalam menjayakan kajian ini termasuk Kementerian Sumber Asli dan Alam Sekitar (NRE) selaku Agensi Penyelaras dan FRIM sebagai Agensi

FORESTRY AND ENVIRONMENT DIVISION

IMPACT OF COMMERCIAL TIMBER HARVESTING ON SEDIMENTATION AND WATER QUALITY PARAMETERS IN UPPER HILL DIPTEROCARP FOREST AT COMPARTMENT 44, TEMENGGOR F.R. PERAK

A study was conducted at an upper hill dipterocarp forest in Malaysia to assess the impact of commercial timber harvesting on suspended sediment (SS) concentration and water quality in watershed area. This project is part of the conservation of biological diversity in production forest project funded by Global Environmental Facilities (GEF), International Tropical Timber Organization (ITTO) and the Malaysian Government. The current timber harvesting practice in Malaysia is Selective Management System (SMS) while the improved harvesting protocol (IHP) was introduced in this study. Two watershed areas were identified in which one was harvested with SMS while the other with IHP. Monthly sediment concentration and water quality were observed before, during and after timber harvesting. The results showed that the IHP accumulated lesser total SS than SMS during tree felling periods. The accumulation of SS increased during rainy season. The tree felling activities affected SS concentration in which it was increased to more than 100 times from its original state values before tree felling activities in each watershed and slowly decreased to 10 times in the following year after harvesting activities completed. The water quality values changed during tree felling periods in both watersheds especially for conductivity and turbidity while other parameters were maintained. The SMS increased water turbidity concentration to three times than its original state before harvesting and slowly decreased to three times higher after harvesting was completed the following year. The IHP also doubled water turbidity concentration but remained at the same level after harvesting. Hence, this preliminary study shows that there were different impacts observed from SMS and IHP harvesting techniques to water conductivity and turbidity.

PERAK BIODIVERSITY TOOL SETS

Perak Biodiversity Tool Sets was developed by UNDP-GEF-ITTO-FRIM Conservation of Biodiversity Project and aimed to support the Forestry Department Peninsular Malaysia (FDPM) in managing production forests not only for timber production but also for other important values and functions such as biodiversity conservation and water catchments. This project was financed by Global Environment Facility (UNDP-GEF) and International Tropical Timber Organization (ITTO) in 2007. This five-year project was aimed to address the issue of biological conservation in production forests. The Ministry of Natural Resources and Environment (NRE) involved in the implementation of the project as the Executing Agency and the Forest Research Institute Malaysia (FRIM) acted as the Implementing Agency. The United Nation Program Office in Kuala Lumpur provided assistance and guidance to both

Pelaksana. JPSM juga terlibat secara langsung sebagai Agensi Kerjasama. Projek ini berakhir pada Ogos 2012.

Perak Biodiversity Tool Sets ini merangkumi empat komponen utama iaitu; (i) Garis Panduan *Rapid Biodiversity Assessment*, (ii) Model Kapasiti Regeneratif (iii) Perisian Pengurusan Hutan peringkat Landskap dan (iv) Protokol Tebangan.

- i. Manual *Rapid Biodiversity Assessment* (RBA). Manual ini menyediakan panduan langkah-langkah pengukuran kumpulan-kumpulan biodiversiti tertentu seperti semut, kelawar pemakan serangga, kumbang tinja, pokok, rama-rama, makro-invertebrata akuatik, kelulut dan burung bawah kanopi di hutan tropika. Kaedah yang disyorkan dalam panduan ini direka oleh Pasukan Penyelidik Ekologi CBioD dan telah diuji sekurang-kurangnya di lapan kawasan hutan di seluruh Semenanjung Malaysia, meliputi hutan primer dan sekunder di hutan pamah dan hutan bukit. Manual ini disediakan dalam bahasa yang ringkas dan mudah difahami. Ilustrasi juga disediakan bagi memudahkan pemahaman kaedah.
- ii. Model Kapasiti Regeneratif Dirian Hutan Selepas Pembalakan. Satu perisian *open-source* telah dibangunkan untuk menilai impak pelbagai had tebangan terhadap dirian hutan dari segi isi padu, luas pangkal dan komposisi dipterokarpa dirian hutan. Pengguna boleh menetapkan kitaran tebangan dan membuat unjuran sehingga 100 tahun yang akan datang melalui perisian ini;
- iii. Perisian Pengurusan Hutan peringkat Landskap dapat memberi pilihan yang optimum kepada pembuat dasar dalam menguruskan hutan pengeluaran. Unsur pemuliharaan kepelbagaian biologi dan hidrologi diberi perhatian yang khusus di samping pengiraan Catatan Tebangan Tahunan (*Annual Allowable Coupe*— AAC) berdasarkan Keluasan Hutan Pengeluaran Sebenar (*Net Production Area*) yang ditentukan untuk sesuatu kawasan hutan pengeluaran;
- iv. Protokol Tebangan yang dibangunkan oleh projek ini memberikan pilihan kepada kaedah pemilihan pokok untuk ditebang. Ia dapat memelihara integriti hutan pengeluaran dengan meningkatkan kemampuan untuk memastikan dirian tinggal adalah baik, produktif serta dapat dipulihkan bagi tebangan seterusnya.

Perak Biodiversity Tool Sets telah dibentangkan dalam mesyuarat MAJURUS pada 5 Disember dan mesyuarat memutuskan untuk menguji dengan lebih lanjut dua komponen *Perak Biodiversity Tool Sets* di empat buah negeri (Perak, Pahang, Terengganu dan Kelantan). Unit Pengurusan JPSM akan menjalankan pengujian tersebut dan FRIM bertindak sebagai pemudah cara.

the Executing and Implementing Agencies in conducting the project. The Forestry Department Peninsular Malaysia was also involved directly with the project as Collaborating Agency. The project ended in August 2012.

Perak Biodiversity Tool Sets comprises four major components; (i) *Rapid Biodiversity Assessment Manual*, (ii) *Regenerative Capacity Model* (iii) *Forest Landscape Planning Tools* and (iv) *Improved Harvesting Protocol*.

- i. *Rapid Biodiversity Assessment* (RBA) Manual aimed to provide users with a step-by-step guide on how to measure selected groups of biodiversity; ants, aquatic macro-invertebrate, bats, birds, dung beetles, stingless bees, moths, and trees and plants in tropical forests. The methods recommended in this manual were drafted by the Ecology Research Team of the CBioD Project and tested in at least eight forest areas throughout Peninsular Malaysia, both in lowland and hill forests, as well as primary and secondary forests. The manual was written in a simple language and is easy to understand. Illustrations are provided to better visualise the methods;
- ii. *Regenerative Capacity Model* of forest structure after logging. An open source software was developed to evaluate the impact of different cutting limits to the forest structure including volume, basal area and composition of the dipterocarp forest standing. Users are able to determine the cutting cycle and estimate the forest regeneration for up to 100 years using this application;
- iii. *Forest Landscape Planning Tools* (FLPT) were developed to allow optimum selection to the stakeholder in the management of their production forests. Biodiversity conservation and hydrology elements were incorporated into the planning tools with special attention given to the calculation of *Annual Allowable Coupe* (AAC) based on the *Net Production Area* that was determined for a production forest;
- iv. *Improved Harvesting Protocol* was developed by the project to give an alternative to the tree selection process for timber harvesting. The protocol allows the integrity of the production forest to be maintained by enhancing the ability to ensure the forest stands are intact, productive and able to regenerate for the next cycle.

The *Perak Tool Sets* was presented to MAJURUS on 5 December and the meeting decided two components of the tool sets, RBA and the FLPT to be further tested in four states (Perak, Pahang, Terengganu and Kelantan) with the Management Unit at the FDPM will take the lead in conducting the test and FRIM will act as a facilitator.

MODEL TANDA ARAS UNTUK MENILAI FUNGSI HIDROLOGI OLEH KEPELBAGAIAN BIOLOGI HUTAN TROPIKA

Perkhidmatan tadahan air mempunyai ikatan ekonomi terhadap pemeliharaan kepelbagaian biodiversiti dalam sektor pengeluaran. Hutan dara mempunyai nilai pemeliharaan yang tinggi berbanding hutan yang telah dibalok. Pembalakan di Semenanjung Malaysia kebanyakannya berlaku di dalam hutan dara. Kajian FRIM membangunkan model statistik membolehkan kita menganggarkan kesan pembalakan ke atas hutan dara di dalam kawasan tadahan air tertentu yang akan memberi kesan kepada pengaliran air dan sedimen. Kesan hidrologi yang dikaji adalah berdasarkan analisis statistik dan ekonomi daripada data hidrologi, meteorologi dan litupan hutan dengan analisis Sistem Maklumat Geografi (GIS). Dengan mengetahui kos melepas daripada perlindungan hutan, iaitu kos yang hilang akibat daripada penukaran kepada guna tanah yang baharu dan faedah daripada perkhidmatan tersebut, seseorang dapat mengenal pasti paras optimum ekonomi oleh perkhidmatan tadahan air; iaitu apabila paras jumlah faedah daripada perkhidmatan melebihi jumlah kos. Faedah perkhidmatan tadahan air dalam kajian ini menganggarkan kesan daripada perubahan dalam pengelasan hutan kepada kos operasi di loji rawatan air (LRA). Maklumat ini dapat membantu Jabatan Hutan dan pihak berkuasa yang bertanggungjawab ke atas bekalan air untuk membentuk sistem pembayaran terhadap perkhidmatan tadahan air; iaitu jumlah yang perlu dibayar oleh loji-loji untuk melindungi hutan dalam kawasan tadahan tersebut.

Hutan dara menawarkan perkhidmatan kualiti air yang signifikan berbanding kawasan bukan hutan, yang mana kuantiti sedimen di dalam sungai akan meningkat jika hutan dara di dalam kawasan tadahan dibalok atau ditukarkan kepada kawasan bukan hutan. Kekurangan kualiti air akan meningkatkan kos di loji rawatan air, yang mana semakin kotor air, semakin mahal kos untuk dibersihkan. Anggaran hasil marginal daripada luas kawasan yang dibalok dikaji dan diberikan mengikut negeri dan tahun yang tertentu. Kos melepas yang dicatat adalah pelbagai antara negeri dan tahun. Dari segi kajian kos, negeri yang mencatatkan kos sut yang rendah ialah calon yang terbaik untuk program bayaran kepada perkhidmatan ekosistem (PES). Berdasarkan kriteria ini, calon ketiga tertinggi pada tahun 2009 ialah Kelantan, Perak dan Pahang. Hasil kajian menunjukkan berbanding kawasan bukan hutan, hutan dara secara signifikan mengurangkan kos rawatan air, pertanian pindah meningkatkan kos dan hutan yang dibalok tidak mempengaruhi kos. Secara purata, jika jumlah peratusan hutan dara tinggi dalam kawasan tadahan bagi loji rawatan air, maka kos operasi loji menunjukkan kira-kira 0.5% lebih rendah berbanding dengan kawasan bukan hutan. Sebaliknya, jika jumlah peratusan pertanian pindah dalam kawasan tadahan tersebut meningkat, kos operasi bagi loji tersebut juga akan meningkat sebanyak 6%. Penukaran hutan dara kepada kawasan pertanian pindah akan meningkatkan kos operasi loji kira-kira 6.5%.

BENCHMARK MODEL FOR VALUING HYDROLOGICAL FUNCTIONS OF BIOLOGICALLY RICH TROPICAL FOREST

Watershed services have an important economic connection to biodiversity conservation in a tropical production landscape. Virgin forests have higher conservation value than forests that have been logged. Log harvested in Peninsular Malaysia come primarily from the virgin forests. Our study developed a statistical model that enabled us to predict how logging could affect discharge and sediment. The hydrological impact is based on statistical and economic analysis of dataset that combined hydrological, meteorological and forest cover data with extensive Geographic Information System (GIS) analysis. Knowing the opportunity cost of such protection—in terms of forgone stumpage revenue and benefits of the services—one can determine the economically optimal level of provision of watershed services: the point where the total benefits of the services exceed the total costs by the greatest amount. The benefit of watershed services in this study predicts the effect of changes in forest classification on the operating cost of a water treatment plant (WTP). This information can help forestry departments and water authorities design watershed services payment systems—how much WTPs should pay to protect forests in their catchments.

Virgin forests provide a significant water quality service compared to non-forested area, in that the amount of sediment in a river will increase if virgin forests in the river basin are logged or converted to a non-forest land use. The reduced water quality increases the cost of water treatment, as dirty water is costlier to treat. Predicted marginal revenue from the logged areas was studied and recorded accordingly. The opportunity costs vary substantially between states and years. From a cost standpoint, states with lower marginal costs are better candidates for payment for ecosystem service (PES) programs. According to this criterion, the top three candidates in 2009 were Kelantan, Perak, and Pahang. The results indicated that, compared to non-forest land use, virgin forests significantly reduce water treatment costs, while shifting cultivation significantly raises costs, and logged forests do not significantly affect cost. On average, if one more percentage point of a water treatment plant's catchment is in a virgin forest instead of a non-forest land use, then the plant's operating cost is approximately 0.5% lower. On the other hand, if one more percentage point of the catchment is in shifting cultivation instead of a non-forest land use, then the operating cost is approximately 6% higher. Converting one percentage point of the catchment from virgin forest to shifting cultivation would thus increase the operating cost by about 6.5%.

BAHAGIAN KELUARAN HUTAN

PENCEGAHAN SERANGAN KULAT PEWARNA KE ATAS KAYU GETAH MENGGUNAKAN *MYCELIA* DARIPADA KULAT PEREPUTAN TERPILIH

Kecacatan/kerosakan yang disebabkan kulat pewarna merupakan satu masalah utama apabila kayu terdedah pada keadaan kelembapan yang tinggi dan suhu antara 28 °C dan 38 °C. Serangan kulat pewarna ke atas kayu mengakibatkan penurunan nilai estetik kayu dan produk kayu; sekaligus mengakibatkan penurunan nilai komersial kayu di pasaran, yang juga memberi kesan kepada ekonomi terutama dalam industri kayu gergaji. Kecacatan disebabkan kulat pewarna boleh mempengaruhi hampir semua jenis kayu terutama pada kayu berwarna cerah seperti kayu getah.

Serangan kulat pewarna ke atas kayu getah merupakan satu masalah dalam industri perindustrian. Permukaan kayu getah selepas tebanan yang tidak dirawat sepenuhnya akan diserang oleh kulat pewarna. Ia mula menyerang pada bahagian kayu gubal (sapwood) sehingga kayu dikeringkan mencapai kandungan kelembapan di bawah 22 °C. Pada masa kini maklumat mengenai kaedah pengawalan serangan kulat pewarna amat kurang di Malaysia. Oleh itu keutamaan projek ini adalah untuk mengenal pasti keberkesanan kaedah biofungisid menggunakan hasilan semula jadi daripada ekstrak miselium kulat pereputan terpilih. Secara keseluruhannya, projek ini merangkumi aktiviti pengawalan serangan kulat pewarna dan pengujian keberkesanannya terhadap kayu getah melalui ujian makmal.

Daripada pemerhatian awal, lazimnya kulat pewarna akan mula menyerang kayu getah selepas sahaja tebanan. Untuk memastikan ketulenan kulat pewarna yang digunakan dalam projek ini, kulat yang menyerang kayu getah diinokulasi terus daripada kayu getah ke dalam piring petri dengan 2% agar-agar ekstrak (malt-extract) bagi membantu tumbesaran kulat pewarna selama dua minggu. Pencegaman dan pengesanan kulat pewarna dibuat secara mikroskopik 100X di bawah mikroskop untuk pengenalpastian kulat. Jumlah keberhasilan kulat pewarna ini akan direkodkan dari semasa ke semasa. Kebanyakan kulat yang menyerang ialah kumpulan spesies *Ascomycotina* atau *Deutromycotina*. Kulat daripada genus *Lasiodiplodia*, *Aspergillus*, *Fusarium*, *Curvularia* dan *Penicillium* sering menyerang kayu getah. *Lasiodiplodia* merupakan kumpulan kulat pewarna terbesar dan ketara berbanding dengan kulat yang lain sebagai penyebab dalam serangan ke atas kayu dan produk-produk kayu getah di Malaysia. Daripada maklumat tersebut, kulat pewarna daripada spesies *Lasiodiplodia theobromae* digunakan dalam kajian ini. Kulat *L. theobromae* berkeupayaan menyerang sehingga kedalaman 25 mm dari permukaan kayu getah dalam tempoh 4–5 hari selepas perkembangan hifanya iaitu kurang daripada satu minggu.

Kulat pereputan kayu diperoleh dari beberapa negeri di Malaysia iaitu Pahang; Endau Rompin, Johor; Perlis

FOREST PRODUCTS DIVISION

PREVENTION OF SAPSTAIN ON RUBBERWOOD USING *MYCELIA* FROM SELECTED POLYPORES

Sapstain fungi cause major damage when the wood is exposed to humid conditions between 28 °C and 38 °C. Sapstain will reduce the aesthetic value of wood and wood products; as a result such damaged wood loses its entire commercial value, posing a major economic problem for the wood industry. Sapstain can affect nearly all wood species especially light-coloured wood such as rubberwood.

Rubberwood affected by sapstain fungi is still a problem to the wood industries. Once felled, without treatment almost 100% of the wood surface would be attacked by fungi. Fungal stain develops in the sapwood until the wood undergoes a reduction of moisture content below 22 °C. Currently, the information on controlling sapstain in Malaysia is lacking. The priority of this project is to investigate the effectiveness of the biofungicide against sapstain on rubberwood using basidiomycetes mycelial extracts. The bulk of the work covered the antisapstain activities followed by testing on rubberwood.

An initial investigation on stain fungi was done to determine which sapstain is the most common and occurred frequently in rubberwood. To ensure the purity of the fungus, the stain on the rubberwood was inoculated and grown in 2% malt-extract agar for two weeks. The fungus was then observed microscopically at X100 for fungal identification. The number of occurrence of a specific stain fungus was noted and recorded. Most stain fungi are in the *Ascomycotina* or *Deutromycotina* group. Fungal species of *Lasiodiplodia*, *Aspergillus*, *Fusarium*, *Curvularia* and *Penicillium* were found to be commonly present in rubberwood samples in this investigation. *Lasiodiplodia* was found to be abundant compared to others in attacking rubberwood and wood products in Malaysia. Based on this, the sapstain fungus, *Lasiodiplodia theobromae* was chosen and used in the study. This fungus can completely stain 25 mm thick rubberwood boards in four to five days after hyphal development i.e., in less than a week.

Wood decay fungi were collected from various sites in Malaysia i.e. from Pahang, Endau-Rompin Johor, Perlis and FRIM campus. Some wood decay fungi in Wood Mycology collection were also used in the study. A total of 40 decay fungi were screened in the interference test to determine the vigor of fungi against sapstain. Antagonistic activity was detected by a modified dual culture technique. Antioxidant assay will be conducted to determine the biofungicide. Biofungicides are to be tested on rubberwood samples and the effectiveness will be rated according to a specific scale.

dan kampus FRIM. Sebahagian daripada kulat pereput diambil daripada koleksi simpanan Makmal Mikologi yang digunakan dalam penyelidikan. Pada keseluruhannya sejumlah 40 kulat pereputan dibuat ujian saringan untuk menentukan keberkesanan pengawalan serangan kulat pewarna. Daripada aktiviti ujian antagonistik antara kulat pereputan dan kulat pewarna, maka dapat dipastikan keberkesanan kulat pereputan yang merencat serangan kulat pewarna tersebut. Langkah seterusnya ialah ujian cerakinan antioksidan untuk menentukan kandungan biofungisid dalam kulat pereputan terpilih. Bahan semula jadi biofungisid daripada kulat pereputan kemudian akan diuji ke atas sampel kayu getah untuk memastikan keberkesanan pengawalan kulat pewarna mengikut satu skala yang ditentukan.

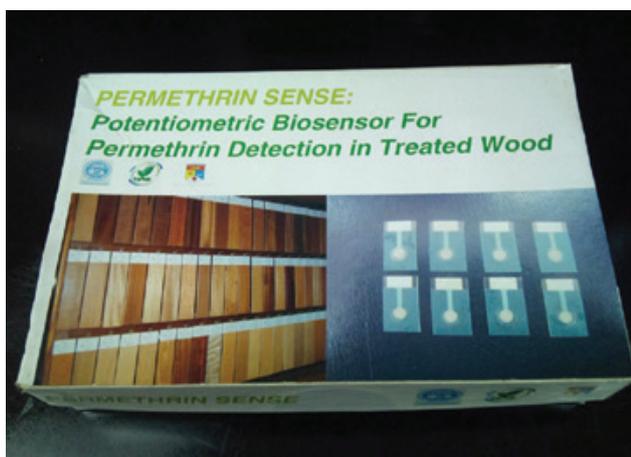
PEMBINAAN BIOSENSOR KULAT UNTUK PENENTUAN RACUN PERMETRIN DALAM KAYU BERAWET

Racun permetrin merupakan sebahagian daripada kumpulan piretroid. Dalam bidang pengawetan kayu, permetrin merupakan bahan utama dalam bahan awet berasaskan pelarut organik yang ringan (LOSP) dan membentuk formulasi bersama racun kulat perosak seperti propakonazol dan tebukonazol. Kelebihan penggunaan permetrin sebagai bahan awet ialah ia bebas daripada logam berat. Berdasarkan penggunaan bahan awet kayu menggunakan kromium, kuprum dan arsenik yang semakin terhad, dijangkakan bahan awet berasaskan permetrin akan menjadi pilihan untuk digunakan oleh industri pengawetan kayu. Proses pengawetan kayu secara teratur dengan bahan awet permetrin boleh meningkatkan ketahanan kayu yang telah dirawat daripada serangan anai-anai. Oleh yang demikian, pengilang kayu perlu merawat kayu mengikut spesifikasi yang telah ditetapkan oleh piawai berkaitan kualiti yang mana kuantiti permetrin di dalam kayu mestilah mencukupi. Untuk memantau kualiti rawatan ini, keperluan teknik pengesanan yang boleh mengesan kepekatan permetrin dalam bahan awet amat diperlukan. Kaedah piawai untuk penentuan permetrin dalam kayu berawet adalah dengan menggunakan kromatografi cecair berprestasi tinggi (HPLC) dan kromatografi gas (GC). Kelemahan penggunaan teknik ini ialah kos pembelian peralatan yang sangat tinggi dan analisis tidak boleh dijalankan pada masa yang sebenar. Kadang kala, pengukuran pada keadaan sebenar di tempat rawatan kayu dan membawa pulang sampel kayu ke makmal untuk diuji akan mengambil masa. Masalah ini boleh diatasi dengan pembangunan satu alat mudah yang berupaya mengesan permetrin di tapak rawatan. Oleh yang demikian, pembinaan biosensor dapat menyediakan satu kaedah pengesanan permetrin yang mudah dan murah. Dalam kajian ini, tiga jenis biosensor elektrokimia untuk pengesanan permetrin secara kualitatif telah berjaya dibangunkan (Rajah 1). Biosensor telah direka bentuk berasaskan tiga jenis sel daripada kulat *Lentinus sajor-caju* (Fr.) Fr. - (A), *Pycnoporus sanguineus* (Fr.) Murr. dan *Phellinus noxius* yang dipegun secara berasingan ke dalam matriks campuran polimer alginat dengan pHEMA yang terletak di atas elektrod pencetak skrin (SPE). Biosensor permetrin menggunakan

DESIGN OF FUNGI BIOSENSORS FOR DETERMINATION OF PERMETHRIN PESTICIDE IN TREATED WOOD

Permethrin pesticide is part of group pyrethroid compound. In wood preservation, permethrin is major ingredient in light organic solvent preservative (LOSP) and form formulations with other fungicide such as propaconazole and tebuconazole. The advantage of using LOSP in wood preservative is the chemical are free from heavy metal compounds. Due to the limitation use of chromated copper arsenate (CCA) to treat the wood, it is expected permethrin will be another choice to use in wood preservation industry. Proper treatments process of wood with permethrin will ensure the durability of the treated wood against insects such as termite. As a result, the timber manufacturer need to follow treatment procedure as required by the standard which relates to quality assurance of treatment process, the quantity of the LOSPs that penetrate the wood must be sufficient and follow the standard requirements. To deal with that, there must be a technique which can quantify the amount of permethrin in wood preservatives to adhere to the quality assurance of the sample. Standard methods of detecting permethrin in treated wood are using high performance liquid chromatography (HPLC) and gas chromatography (GC). The disadvantages of using this method are the instrument is very expensive and cannot bring along if test need to perform in real time measurement. Sometimes real time measurements need to be done in wood treatment site and bringing sample to lab will make the quality process consume some time. This disadvantage can be solved by developing a simple device that can perform measurement of permethrin at treatment site. Hence, the development of a biosensor can provide a simple and rapid method for permethrin routine measurements at affordable cost. In this research, an electrochemical biosensor for the quantitative determination of permethrin pesticide has been developed. For fungus cell based potentiometric biosensor, three biosensors were designed by using *Lentinus sajor-caju* (Fr.) Fr. - (A), *Pycnoporus sanguineus* (Fr.) Murr. and *Phellinus noxius* immobilized in alginate mixture with pHEMA and deposited into the surface of screen printed electrode (SPE). Potentiometric biosensors with *Lentinus sajor-caju* (Fr.) Fr. - (A), *Pycnoporus sanguineus* (Fr.) Murr. and *Phellinus noxius* were able to detect permethrin in the range of 0.56-100.00 μM concentrations ($R^2 = 0.9901$) (LOD = 0.56 μM) and 0.39-100.00 μM ($R^2 = 0.9932$) (LOD = 0.39 μM), and 0.60-100.00 μM concentrations ($R^2 = 0.9901$) (LOD = 0.60 μM) respectively. Validation study was conducted to determine the accuracy of the permethrin determination using wood samples. The results showed that the biosensor based on fungus were comparable to the HPLC method.

sel kulat *Lentinus sajor-caju* (Fr.) Fr. – (A), *Pycnoporus sanguineus* (Fr.) Murr. dan *Phellinus Noxius* telah berupaya mengesan kepekatan permetrin masing-masing dalam julat 1.00–100.00 μM ($R^2 = 0.9901$) (LOD = 1.00 μM), 0.39–100.00 μM ($R^2 = 0.9932$) (LOD = 0.39 μM), dan 0.60–100.00 μM ($R^2 = 0.9901$) (LOD = 0.60 μM). Kajian validasi menggunakan sampel kayu dan sayur-sayuran telah mengenal pasti bahawa biosensor ini jitu dalam penentuan permetrin. Keputusan keseluruhan menunjukkan bahawa biosensor yang direka bentuk berasaskan enzim, kulat dan DNA setanding dengan kaedah HPLC dalam penentuan permetrin.



Kit Permetrin Sense
Permethrin Sense Kit

EKSTRAK POKOK TUBA SEBAGAI BAHAN AWET KAYU MESRA PENGGUNA

Kebanyakan bahan awet kayu yang terdapat di pasaran berhadapan dengan masalah sukar untuk dilupuskan menyebabkan penggunaannya yang berterusan akan mengakibatkan pencemaran alam sekitar yang amat serius. Kreosot ialah salah satu daripada bahan awet kayu yang tertua dicipta untuk merawat kayu. Walau bagaimanapun, bahan awet tersebut boleh menyebabkan kebakaran dan letupan, manakala *copper chrome arsenic* (CCA) pula mengandungi bahan kimia bersifat toksik seperti arsenik dan kromium. Berdasarkan kajian, 12–13% CCA di dalam kayu yang dirawat akan mengalami larut resap. Bahan kimia tersebut kemudiannya akan menjadi sebati dengan zarah-zarah tanah terutamanya tanah liat dan tanah beralkali tinggi yang menyebabkan masalah pencemaran alam sekitar. Bagi menangani masalah alam sekitar, penyelidik perlu mencari alternatif bahan awet kayu yang lebih mesra pengguna.

Ekstrak pokok tuba dipercayai mengandungi sumber biosid semula jadi yang boleh diguna pakai sebagai bahan awet kayu mesra pengguna. Sumber biosid tersebut bersifat mudah terurai terutamanya dalam sel badan manusia, tanah, air dan udara menyebabkan ia diklasifikasi sebagai tidak berbahaya kepada manusia dan alam sekitar. Tuba merupakan pokok jenis menjalar yang berasal dari hutan

TUBA PLANT EXTRACT AS GREEN WOOD PRESERVATIVE

The majority of wood preservatives available in the market are associated with the problem of non-degradable and under constant usage would ultimately cause very serious environmental pollution. Creosote which is one of the oldest wood preservative may cause fire hazard and explosion, while CCA contains toxic chemicals such as arsenic and chromium. A study has revealed that 12–13% of CCA leached from treated wood are likely to bind to soil particles, especially in soil with clay or soils that are more alkaline than neutral. Due to the environmental concern, researchers should find out the alternative wood preservative.

High potency biocides that originated and derived from tuba plant extract can be considered as alternative green wood preservatives. These biocides are easily and rapidly broken down in some matrix such as human cell, soil, water and air, and thus, are good and suitable for the environment. Tuba plant is a liana species originating in the tropical rainforest and easily found in Malaysia, Indonesia, Thailand and Myanmar. This plant is widely used as traditional insecticide for controlling pests in crop production. Pictures 1a and 1b show the tuba plant before and after harvesting.

Gambar 1a) Pokok tuba memanjat di batang pokok pinang 1b) pokok tuba selepas tebang
Picture 1a) Tuba plant climbing in white betel nut palm tree and 1b) tuba plant after harvesting



hujan tropika. Ia mudah didapati di Malaysia, Indonesia, Thailand dan Myanmar. Tumbuhan ini digunakan secara meluas sebagai racun serangga tradisional untuk mengawal perosak dalam pengeluaran tanaman. Gambar 1a dan 1b menunjukkan pokok tuba sebelum dan selepas penuaian.

Sehingga kini, tiada kerja-kerja penyelidikan dijalankan untuk mengkaji potensi ekstrak pokok tuba sebagai bahan awet kayu. Tujuan utama kajian ini adalah untuk menguji potensi ekstrak pokok tuba sebagai bahan awet kayu mesra pengguna yang boleh diguna pakai bagi meningkatkan tahap ketahanan kayu Malaysia. Keberkesanan ekstrak pokok tuba sebagai bahan awet kayu telah diuji dengan mendedahkan kayu yang telah dirawat menggunakan ekstrak pokok tuba terhadap tahap serangan anai-anai. Ujian telah dijalankan di makmal dan di lapangan. Keputusan ujian menunjukkan ekstrak pokok tuba bersifat toksik pada anai-anai. Keputusan menunjukkan bahawa ekstrak pokok tuba mempunyai ciri-ciri dan potensi yang tinggi sebagai bahan awet kayu mesra alam untuk melindungi kayu daripada serangan anai-anai. Keputusan dan maklumat yang dihasilkan daripada kajian ini sangat bermanfaat untuk industri kayu tempatan serta individu yang mementingkan kesejahteraan alam sekitar.

Until recently, there was no research work being carried out to evaluate the potential of tuba plant extract as wood preservatives. The aim of the study is to investigate the potency of the tuba plant extract as green wood preservatives to improve the durability of non-durable Malaysian timbers. Laboratory termite test and field termite test were carried out to prove the effectiveness of tuba plant extract as green wood preservative. The result shows that tuba plant crude extract was effective against termites. Based on the research finding, tuba extract has shown to possess the characteristics and potential environmentally friendly wood preservatives against termite. The results and information generated from this study could be very beneficial to the local wood industries as well as those who are concerned about environmental protection and sustainability.

BAHAGIAN BIOTEKNOLOGI PERHUTANAN

PEMBAIKBAKAAN *NYPA FRUTICANS* UNTUK PENGHASILAN NIRA BERKUALITI

Nipah (*Nypa fruticans*) merupakan satu-satunya pokok palma dalam kumpulan hutan bakau. Spesies ini menghasilkan nira yang penting dalam industri perasa, makanan dan minuman. Pembiakbakaan *Nypa fruticans* untuk menghasilkan nira berkualiti adalah perlu untuk mempertingkatkan kualiti dan hasil pengeluaran nira. Oleh itu FRIM telah memulakan R&D bertajuk 'Pembiakbakaan *Nypa fruticans* untuk penghasilan nira berkualiti' dan salah satu objektifnya adalah untuk penubuhan bank gen yang mengandungi 20 genotip terpilih di Kuala Sungai Muda, Kedah.

Sebanyak 120 genotip terpilih telah diambil dari kawasan Ayer Hitam (Kedah), Seberang Perak (Perak), Tumpat (Kelantan) dan Merchang (Terengganu). Pada setiap kawasan, 30 pokok nipah telah dipilih dan pensampelan dibuat selama tiga hari berturut-turut. Kualiti dan kuantiti nira diukur pada setiap enam jam (pagi, tengah hari, petang dan lewat malam). Penentuan kualiti nira dilakukan berdasarkan kandungan gula di dalam nira dengan menggunakan BRIX meter. Genotip-genotip yang terkumpul ini mempunyai julat kualiti antara 15 hingga 17.3% dan mampu menghasilkan nira sebanyak 1000 ml sehari.

FORESTRY BIOTECHNOLOGY DIVISION

BREEDING OF *NYPA FRUTICANS* FOR QUALITY SAP PRODUCTION

Nipah (*Nypa fruticans*) is the only palm tree grouped as mangrove plants. This species produce sap, which is important in flavour, food and beverage industries. Breeding of *Nypa fruticans* for sap production is essential for the improvement of quality and yield of sap. Therefore, FRIM has initiated an R&D entitled, 'Breeding of *Nypa fruticans* for quality sap production' with an objective among others is to establish a gene bank containing 20 selected genotypes in Kuala Sungai Muda, Kedah.

A total of 120 selected genotypes were collected from Ayer Hitam (Kedah), Seberang Perak (Perak), Tumpat (Kelantan) and Merchang (Terengganu). For each area, 30 nipah trees were selected and sampled for three consecutive days in which, the quality and quantity of sap were measured every six hours (morning, afternoon, evening and late at night). Determination of the sap quality was made based on sugar contents of the sap using BRIX meter. Genotypes collected produced sap (quality) in range of 15 to 17.3% and were able to produce sap at 1000 ml/day.

Bank gen atau koleksi genotip nipah ialah peringkat pertama dalam program pembiakan untuk menjana bahan tanaman yang lebih baik. Bank gen ini akan digunakan untuk program pembiakan nipah pada masa hadapan bagi memastikan bekalan bahan tanaman bermutu yang berkekalan untuk meningkatkan produktiviti penghasilan nira sehektar.



Penanaman nipah
Sowing of nipah

The gene bank or collection of nipah genotypes is the first stage of the breeding program for generation-improved plant breeding materials. This gene bank will be used for future breeding programs to ensure sustainable supply of superior *Nypa fruticans* that would increase productivity of sap production.



Bank gen nipah
Nipah gene bank

MENINGKATKAN KUALITI TANAH BAGI PENANAMAN LADANG HUTAN MENGGUNAKAN BIO-ENAPCEMAR DARIPADA KILANG KERTAS

Industri pulpa dan kertas mengeluarkan bahan buangan berbentuk pepejal basah yang mengandungi komposisi sebatian kimia kompleks dan sebahagiannya toksik, dalam bentuk organik dan bukan organik. Kehadiran bahan buangan ini boleh menjurus kepada masalah pencemaran jika tidak ditangani dengan berhemah. Tahap keracunan bahan ini berbeza bagi setiap kilang dan ada yang dikelaskan dalam kategori sisa berjadual oleh Jabatan Alam Sekitar, Malaysia. Sisa berjadual memerlukan kos yang tinggi untuk pelupusan dan ini menambah beban kepada kilang. Tanpa pilihan yang lebih baik, bio-enap cemar kilang kertas kebanyakannya dilupus di tapak pelupusan dan dalam jangka masa panjang boleh mengundang kesan negatif kepada alam sekitar iaitu masalah bau dan bahan larut lesap. Mewujudkan kaedah penggunaan semula yang efektif boleh membantu industri pulpa dan kertas serta negara dalam pengurusan sisa yang menjimatkan kos.

Bio-enap cemar kilang kertas ialah bahan organik aktif dan berpotensi untuk membekalkan nutrien untuk tumbesaran pokok. FRIM telah menjalankan pencirian secara

UTILISING BIOSLUDGE FROM THE PAPER MILLS TO IMPROVE SOIL QUALITY FOR FOREST PLANTING

Pulp and paper production are among the 'contaminated' industries that discharging wet solid waste containing complex composition of chemical compounds, both organic and inorganic. The toxicity level differs between mills to the extent that some are categorised under hazardous toxic waste by the Department of Environment, Malaysia. This waste classification has further increased burden of the paper mill industry because of the high cost of disposal. With no better alternative, paper mill sludge is largely disposed in landfill and this may have negative impact on the environment especially with regard to odour and leachate. Wise reutilisation of this waste would be of great help to the industry and the country in managing the waste.

Paper mill sludge is an active organic material and has potential benefits to supply nutrients for crop growth. Due to concern of its toxicity, thorough characterisation was carried out. From the laboratory analysis, paper mill biosludge contains both major and minor nutrients needed by plants, some in adequate quantity. This is a major advantage for soil amendment, apart from enriching soils

menyeluruh terhadap bahan ini disebabkan kebimbangan terhadap risiko keracunannya. Keputusan analisis makmal menunjukkan bio-enap cemar ini mengandungi nutrien utama dan sekunder yang diperlukan oleh tumbuhan, dalam kuantiti tinggi dan sederhana. Ini merupakan kelebihan utamanya sebagai bahan penyubur tanah, di samping mengayakan tanah dengan bahan organik. Terdapat juga logam berat tetapi dalam kepekatan yang dibenarkan oleh Council of European Communities (CEC) untuk kompos. Sampel bahan larut lesap tanah yang diambil menggunakan 'slim tube water sampler' menunjukkan dalam masa enam bulan selepas aplikasi kompos bio-enap cemar kilang kertas, kuantiti terkumpul luluh larut Cu, Mn, Zn, Pb dan As adalah sangat rendah. Peratusan keseluruhan luluh larut logam berat berbanding dengan kepekatannya dalam kompos asal adalah kurang daripada 1%.

Mengubah bio-enap cemar kilang kertas kepada bahan pemulih tanah yang selamat dan boleh disimpan merupakan satu daripada pendekatan yang boleh mengurangkan masalah pelupusan bahan ini. Ini dilakukan melalui pengkomposan, satu proses penting dalam pengurusan sisa bersepadu yang diiktiraf sebagai kaedah prarawatan yang baik untuk memperoleh bahan yang lebih efisien dan selamat berbanding dengan bahan asal untuk aplikasi di dalam tanah. Melalui pengkomposan, bio-enap cemar kilang kertas dinyah toksik melalui degradasi rantaian organik dan sanitasi patogen. Penggunaan tandan kosong kelapa sawit (EFB) sebagai agen pengudaraan membantu dalam proses pengkomposan dan juga pertumbuhan akar pokok bila kompos diaplikasi di dalam tanah. Uji lari penanaman di beberapa tanah dan lokasi berbeza menunjukkan pertumbuhan pokok yang signifikan dengan aplikasi kompos bio-enap cemar kilang kertas. Produk yang dihasilkan ini telah mendapat beberapa pengiktirafan termasuk Anugerah Emas di ITEX 2010, Anugerah Emas di PRPi12 (Pameran Rekapipta, Penyelidikan dan Inovasi Malaysia) dan Young Technopreneur Award di 4th Technopreneurship and Innovation Symposium and Exhibition (TISE 2012).

PERUBAHAN PARAS PLOIDI DAN KANDUNGAN KIMIA *AQUILARIA MALACCENSIS* (KARAS)

Perubahan ploidi boleh berlaku secara semula jadi atau secara tiruan dalam tumbuhan yang akan menyebabkan pertumbuhan yang lebih pesat. Bagi sesetengah tumbuhan pula, akan berlaku peningkatan pengeluaran metabolit sekunder disebabkan oleh jumlah gen dan aktiviti enzim yang terlibat di dalam sel. Poliploidi kebiasaannya akan mengaruh tumbesaran bahagian vegetatif dan pembiakan. Pembesaran sel berlaku kerana setiap sel mengandungi lebih daripada dua set kromosom. Aruhan poliploidi tiruan telah berjaya dilaksanakan terutamanya pada pokok hiasan dan tanaman bahan makanan. Hasil daripada kajian tersebut telah membuka ruang untuk menggunakan teknik ini ke atas pokok balak. Keputusan yang memberangsangkan diperoleh daripada sesetengah spesies balak seperti peningkatan pertumbuhan, penambahan diameter pokok balak dan peningkatan hasil biojisim pokok. Teknik ini

with organic carbon. Heavy metals were also detected, but at levels within the acceptable values of the Council of European Communities (CEC) for compost. Soil leachate sampling through the use of slim tube water sampler showed that at six months after application of paper mill biosludge compost, the cumulative amount of leached Cu, Mn, Zn, Ni, Pb and As was very low. The percentage of total amount heavy metals leached relative to the corresponding total amount present in the compost added was less than 1%.

Turning paper mill biosludge into a safe and storable soil amendment material could be an approach that may partly solve the disposal problem. This was done through composting, which plays an important role in integrated waste management as the process itself is recognised as one of the most acceptable pre-treatments in order to obtain material which may respond more efficiently and safely than the raw material itself in the soil. Composting of paper mill biosludge can help sanitise the material, and the use of oil palm empty fruit bunch (EFB) as bulking agent can increase aeration for both composting process and root development upon application onto the soil. Field planting trials on different soil types and on different locations showed significant improvement in tree growth with application of paper mill biosludge compost. This product has earned several recognitions such as Gold Medal at ITEX 2010, Gold Medal at PRPi12 (Pameran Rekapipta, Penyelidikan & Inovasi Malaysia) and Young Technopreneur Award at 4th Technopreneurship and Innovation Symposium and Exhibition (TISE 2012).

PLOIDY LEVEL CHANGES AND THE CHEMICAL CONTENTS OF *AQUILARIA MALACCENSIS* (KARAS)

Ploidy changes can occur naturally or induced artificially in plants resulting in more vigor growth rates, and in some plants, enhanced the secondary metabolites due to higher number of genes and enzyme activities in a cell. Polyploidy usually produced bigger vegetative and reproductive parts of the plants due to cell enlargements in order to contain more than two sets of chromosomes. Artificial induction of polyploidisation has been successfully applied in plants especially in ornamentals and food crops. Based on these studies, this technique has been applied in timber trees and showed encouraging results such as enhancement of growth rate, diameter increment and higher biomass yield. These can be another useful approach to address some of the current problems faced by the forest plantations such as long life cycle of timber trees, the need to obtain bigger diameter timber and increased of biomass for biofuel purposes. In the case of *Aquilaria malaccensis* (karas), its resinous secondary metabolites called *gaharu* is the study of interest. *Aquilaria malaccensis* produced highly valued resin at wounded bark following fungal attacks. The quality of the resin is based on the amount impregnated in the cells. The major compounds of the resin are sesquiterpenes and phenylethyl chromones derivatives. A recent study in FRIM using different ploidy level of *A. malaccensis* showed production of sesquiterpenes *in vitro*. In this study, the

boleh membantu menyelesaikan masalah yang dihadapi dalam perladangan hutan seperti kitaran hidup yang panjang, keperluan bagi mendapatkan diameter pokok yang lebih besar dan peningkatan hasil biojisim bagi kegunaan bioteknologi. Dalam kes *Aquilaria malaccensis* (karas), resin metabolit sekunder (*gaharu*) ialah bahan yang dikaji. *Aquilaria malaccensis* membentuk resin berharga ini pada luka batang yang telah dijangkiti kulat. Kualiti *gaharu* diukur berdasarkan kuantiti resin yang terperangkap di dalam sel. Komponen penting di dalam resin tersebut ialah kumpulan seskuiterpena dan hasilan kromon fenil etil. Kajian terkini di FRIM menggunakan *A. malaccensis* yang mempunyai paras ploidi yang berbeza menunjukkan pengeluaran seskuiterpena secara *in vitro*. Dalam kajian tersebut, pengumpulan seskuiterpena (seperti β -guaiaena dan aromadendrena) telah dikesan melalui teknik GC-MS dan SPME pada anak pokok poliploidi terutamanya dari akar, batang dan daun. Selain itu, kajian lanjut seperti kajian morfologi dan sitogenetik ke atas poliploidi *A. malaccensis* juga dijalankan dengan matlamat membangunkan varieti baharu *A. malaccensis* sebagai bahan tanaman yang ditambah baik.

BAHAGIAN BIODIVERSITI HUTAN

EKSPEDISI BOTANI KE GUNUNG KAJANG, PULAU TIOMAN, PAHANG

Gunung Kajang (N2 46.173 E104 09.221) terletak di tengah bahagian selatan Rizab Hidupan Liar Pulau Tioman dan mempunyai ketinggian sehingga 1049 m. Ia merupakan hutan tropika yang terdiri daripada hutan dipterokarpa bukit dan hutan pamah dipterokarpa, pantai berpasir, berbatu dan hutan bakau. Rizab Hidupan Liar Pulau Tioman telah diwartakan pada 28 September 1972 yang meliputi kawasan seluas 8296 ha. Ekspedisi botani ke Gunung Kajang dianjurkan oleh projek Flora of Peninsular Malaysia dari 23 April–3 Mei bagi membuat inventori botani di sekitar Gunung Kajang dan beberapa lokasi tertentu di sekitar Pulau Tioman.

Gunung Kajang, Pulau Tioman dipilih kerana flora kawasan tersebut masih belum dikenal pasti dan direkodkan sepenuhnya. Walaupun terdapat koleksi botani yang terdahulu dari Pulau Tioman, kebanyakannya ialah koleksi dari kawasan barat Pulau Tioman dan kawasan yang mudah diterokai. Ekspedisi botani kali ini terbahagi kepada dua fasa, fasa pertama (23–28 April) menjalankan inventori botani merentasi Gunung Kajang dari Denai Juara di timur ke Denai Paya di barat. Bagi fasa kedua, (29 April–3 Mei) kerja pengutipan sampel tumbuhan dijalankan di beberapa lokasi yang dijangka memberikan hasil yang menarik di sekitar Pulau Tioman dengan tumpuan di bahagian timurnya.

Didapati kepelbagaian flora di sekitar Gunung Kajang dan sekitar Pulau Tioman adalah tinggi. Sebanyak 816 koleksi tumbuhan telah dikutip iaitu 387 spesimen herbarium, 389 spesimen steril yang terdiri daripada pokok, pokok renek dan pepanjat (spesimen baucer) dan kira-kira 40 koleksi

accumulation of sesquiterpenes (such as β -guaiene and aromadendrene) was detected using GC-MS and SPME techniques from polyploidy plantlets specifically in the root, stem and leaf samples. Further research is currently being carried out such as morphology and cytological study of *A. malaccensis* polyploids, with the aim to develop new variety of this species as improved planting materials.

FOREST BIODIVERSITY DIVISION

BOTANICAL EXPEDITION TO GUNUNG KAJANG, PULAU TIOMAN, PAHANG

Gunung Kajang (N2 46.173, E104 09.221) is located in the central southern part of Pulau Tioman Wildlife Reserve and has a height of 1049 m. It is clothed in hill dipterocarp forest, lowland dipterocarp forest, coastal forest and mangrove forest. Pulau Tioman Wildlife reserve was gazetted on 28 September 1972, and covers an area of 8296 ha. A botanical expedition to Gunung Kajang was organized by the Flora of Peninsular Malaysia Project on 23 April–3 May. The main purpose of this expedition was to carry out botanical collection of flowering and fruiting plants on Gunung Kajang and some other localities around the island.

Gunung Kajang was selected for the expedition as the area is still under-collected and has the potential to yield many new records. Although botanical collecting has been conducted on Pulau Tioman previously, it was mostly carried out on the west coast and other more easily accessible areas. This botanical expedition was divided into two phases. During the first phase, (23–28 April) botanical inventories were carried out via a trans Gunung Kajang trail from Kampung Juara on the east coast to Kampung Paya on the west. For the second phase, (29 April–3 May) collection of plant samples was carried out at several locations that were expected to yield interesting findings and focused on sites on the east part of the island.

Results of the expedition revealed high flora diversity around Gunung Kajang and Pulau Tioman in general. A total of 816 plants were collected, including 387 herbarium specimens, 389 vouchers of trees, shrubs and climbers and about 40 living plants. The collection also includes about 110 species of ferns. A large number of herbarium specimens were of species belonging to families Rubiaceae, Gramineae, Orchidaceae, Euphorbiaceae, Cyperaceae, Aspleniaceae, Polypodiaceae, Zingiberaceae, Gesneriaceae and Palmae. Collections also included several new family records for Pulau Tioman, such as species of Actinidiaceae, Dracaenaceae, Fagaceae, Magnoliaceae, Monimiaceae, Myricaceae, Nyssaceae and Pentaphragmaceae. It is estimated that about 50–100 species are new records for the island. The identification process is still on-going in the herbarium of FRIM (KEP).

tumbuhan hidup. Kutipan ini turut merangkumi kira-kira 110 spesies paku-pakis. Sebilangan besar daripada spesimen herbarium yang dikutip terdiri daripada ahli famili Rubiaceae, Gramineae, Orchidaceae, Euphorbiaceae, Cyperaceae, Aspleniaceae, Polypodiaceae, Zingiberaceae, Gesneriaceae dan Palmae. Terdapat banyak rekod baharu kepada tumbuhan Pulau Tioman; antaranya dari famili Actinidiaceae, Dracaenaceae, Fagaceae, Magnoliaceae, Monimiaceae, Myricaceae, Nyssaceae dan Pentaphragmaceae. Dianggarkan terdapat lebih kurang 50–100 spesies rekod baharu ditemui di Pulau Tioman. Proses pengecaman semua koleksi sedang giat dijalankan di herbarium FRIM (KEP) dan status setiap spesies sedang dikenal pasti.



GESNERIACEAE: *Codonoboea tiumanicus* (Ridl.)
CL Lim, endemik di Semenanjung Malaysia
GESNERIACEAE: *Codonoboea tiumanicus* (Ridl.)
CL Lim, endemic to Peninsular Malaysia



ZINGIBERACEAE: *Scaphochlamys sub-biloba*
Burkill ex Ridl., endemik di Pulau Tioman
ZINGIBERACEAE: *Scaphochlamys sub-biloba*
Burkill ex Ridl., endemic to Pulau Tioman



GESNERIACEAE: *Aeschynanthus longicaulis* Wall. ex R.Br.



ORCHIDACEAE: *Coelogyne tiomanensis* M.R.Hend.,
endemik di Pulau Tioman
ORCHIDACEAE: *Coelogyne tiomanensis* M.R.Hend.,
endemic to Pulau Tioman



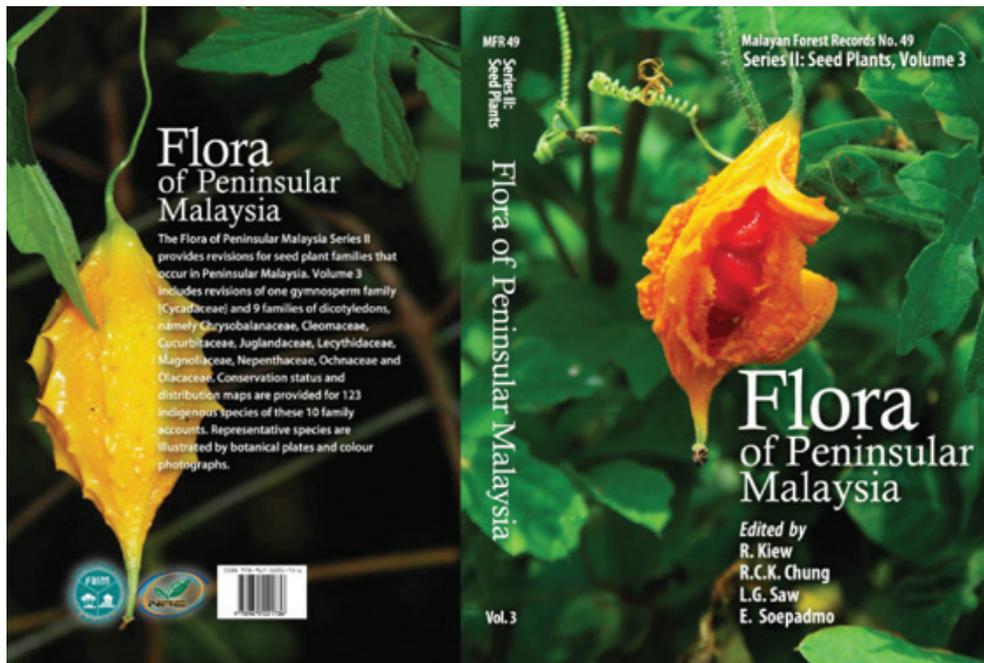
BEGONIACEAE: *Begonia rheifolia* Irmsch.,
endemik di Semenanjung Malaysia
BEGONIACEAE: *Begonia rheifolia* Irmsch.,
endemic to Peninsular Malaysia

THE FLORA OF PENINSULAR MALAYSIA SERIES II SEED PLANTS, VOLUME THREE

Jilid Ketiga bagi Siri Buku Tumbuhan Berbiji bagi Flora Semenanjung Malaysia merangkumi 10 famili, 48 genera dan 127 spesies. Jilid Ketiga ini juga mengekalkan sumbangan usahasama dalam kalangan ahli-ahli taksonomi di FRIM (lima famili) dan institusi antarabangsa (lima famili). Satu spesies baharu *Cycas* (Cycadaceae), tiga spesies *Barringtonia* (Lecythidaceae), satu spesies *Kedrostis* (Cucurbitaceae) dan satu varieti *Strombosia* (Olacaceae) telah ditemui di dalam jilid ini. Sebagai tambahan, terdapat sembilan spesies rekod baharu untuk famili Cucurbitaceae yang belum pernah direkodkan di Semenanjung Malaysia sebelum ini. Flora Semenanjung Malaysia ini juga mengambil kira penemuan baharu dalam bidang biologi molekular yang membawa kepada pemahaman yang lebih baik berkenaan konsep spesies dan genera. Kepentingan tentang jilid ini yang mana mempengaruhi genera dalam famili Cleomaceae, Magnoliaceae (yang mana *Magnolia* kini mengandungi spesies yang dahulunya diletakkan di bawah *Manglietia* dan *Michelia*) dan Lecythidaceae (di mana *Abdulmajidia* terbukti adalah sinonim dengan *Barringtonia*). Keseluruhan jilid ini menunjukkan bahawa 22% (28 spesies) adalah endemik di Semenanjung Malaysia, manakala 24% (31 taksa) adalah dalam kategori terancam. Kategori baru Rare (RA) diwujudkan dalam jilid ini.

THE FLORA OF PENINSULAR MALAYSIA SERIES II SEED PLANTS, VOLUME THREE

The third volume of the Seed Plant Series for the Flora of Peninsular Malaysia includes 10 families, 48 genera and 127 species. This third volume perpetuates collaboration between FRIM taxonomists (five families) and international institutions (five families). One new species of *Cycas* (Cycadaceae), three new species of *Barringtonia* (Lecythidaceae), one new species of *Kedrostis* (Cucurbitaceae) and one new variety of *Strombosia* (Olacaceae) were discovered and scientifically described during the study of these families. In addition, there are new records of nine species for family Cucurbitaceae previously unknown in Peninsular Malaysia. The Flora of Peninsular Malaysia also takes into account recent findings from the field of molecular biology and these have led to a better understanding of species and generic concepts. Most notable for this volume are those affecting genera in Cleomaceae, Magnoliaceae (where the circumscription of *Magnolia* now includes species previously assigned to *Manglietia* dan *Michelia*) and Lecythidaceae (where *Abdulmajidia* has proven to be synonymous with *Barringtonia*). Overall this volume showed that 22% (28 species) are endemic to Peninsular Malaysia and that 24% (31 taxa) fall within threatened categories. A new conservation category of Rare (RA) is introduced in this volume.



REKOD PERTAMA BILANGAN YANG TERTINGGI BAGI KELOPAK BUNGA RAFFLESIA DI DUNIA

Rafflesia ialah genus tumbuhan berbunga holoparasitik dalam famili Rafflesiaceae, mungkin yang paling terkenal untuk salah satu spesies *Rafflesia arnoldii*, yang merupakan bunga terbesar di dunia. Seperti tumbuhan holoparasitik yang lain, *Rafflesia* bergantung pada perumah bagi sumber air dan nutrien. Walau bagaimanapun, ia luar biasa kerana *Rafflesia* merupakan endoparasit yang muncul daripada perumah sebagai bunga yang hanya kekal semasa tempoh pembiakan seksual. *Rafflesia* tidak mempunyai bahagian-bahagian vegetatif (akar, batang dan daun) dan klorofil serta berkembang sebagai sel tertanam di dalam tisu batang dan akar perumah, yang merupakan pepanjat berkayu, iaitu genus *Tetrastigma* daripada keluarga anggur, keluarga Vitaceae. Sehingga kini, 39 spesies *Rafflesia* telah diterbitkan. *Rafflesia* hidup di dalam hutan tropika yang sentiasa lembap di Malesia, bertaburan dari Pergunungan Segenting Kra di bahagian selatan Thailand, sepanjang Sundaland ke Filipina. *Rafflesia* ialah salah satu ikon yang paling menonjol dalam usaha pemuliharaan. Empat spesies, *Rafflesia azlanii*, *R. cantleyi*, *R. kerrii* dan *R. su-meiae* didapati di Semenanjung Malaysia. Biasanya, semua spesies *Rafflesia* mempunyai hanya lima kelopak. Sangat jarang bunga dengan enam kelopak ditemui dan sangat luar biasa dengan tujuh kelopak. Walau bagaimanapun, baru-baru ini, rekod pertama bunga *Rafflesia* dengan 10 kelopak telah ditemui di Taman Negeri Royal Belum, Gerik, Perak. Ini adalah bilangan tertinggi kelopak bunga *Rafflesia* pernah diperhatikan sejak *Rafflesia* ditemui kali pertama pada tahun 1818. Bunga tersebut ialah spesies *Rafflesia azlanii* betina dan mempunyai 10 kelopak. Dengan kebenaran Taman Negeri Royal Belum, ia telah diambil pada 26 Jun 2012 dan dibawa ke Herbarium, FRIM (KEP). Rujukan spesimen, Siti-Munirah FRI 76651, telah diproses, dikering, dilabel

THE FIRST RECORD OF THE HIGHEST NUMBER OF PETALS FOR RAFFLESIA IN THE WORLD

Rafflesia is a holoparasitic flowering plant genus of the family Rafflesiaceae, perhaps most famous for one of its species, *Rafflesia arnoldii*, which produces the world's largest single flower. As for all holoparasitic plants, *Rafflesia* relies upon its host plant for both water and nutrients. However, it is unusual in that it is an endoparasite that emerges from the host only as ephemeral flowers during its sexual reproduction period. *Rafflesia* lacks vegetative parts (roots, stems and leaves) and chlorophyll, and grows as strands of cells embedded within the stem and root tissues of its host, namely woody climbers of the genus *Tetrastigma* from the grape family, Vitaceae family. To date, 39 *Rafflesia* species have been described. They grow in the consistently wet forests of Western Malaysia patchily distributed from the Kra Isthmus Mountains in the southernmost part of Thailand, throughout Sundaland to the Philippines. *Rafflesia* is one of the most prominent icons for conservation efforts. Four species, *Rafflesia azlanii*, *R. cantleyi*, *R. kerrii* and *R. su-meiae* are found in Peninsular Malaysia. Normally, all *Rafflesia* species have only five petals. Very rarely flowers with six petals are found and very exceptionally with seven petals. However, recently, the first record of a *Rafflesia* flower with 10 petals was found in The Royal Belum State Park, Gerik, Perak. This is the highest number of petals for *Rafflesia* ever observed since *Rafflesia* was first discovered in 1818. This particular flower, a female *Rafflesia azlanii*, had 10 petals and with the permission from the Royal Belum State Park, it was harvested on 26 June 2012 and transported to the Herbarium, Forest Research Institute Malaysia (KEP). The specimen, referenced Siti-Munirah FRI 76651 was pressed, dried, labelled and stored in the Herbarium KEP. With proper care, it should last for a long time. In recognition of

dan disimpan di dalam Herbarium KEP. Dengan penjagaan yang betul, ia sepatutnya bertahan untuk jangka masa yang panjang. Sebagai pengiktirafan ke atas ciptaan yang luar biasa ini, FRIM telah berjaya mendaftarkan dalam Malaysia Book of Records bagi memastikan secebis sejarah botani ini akan direkodkan secara rasmi dan merupakan satu cara lain untuk mewujudkan kesedaran terhadap keajaiban alam semula jadi ke arah usaha pemuliharaan warisan kita.



Bunga Rafflesia yang mekar di hutan
Rafflesia Flower blooming in the forest

BAHAGIAN HASILAN SEMULA JADI

PEMBANGUNAN ANTIOKSIDA PRODUK BERASASKAN HERBA DARIPADA *AQUILARIA MALACCENSIS*

Gaharu merupakan hasil hutan bukan kayu yang penting daripada genus *Aquilaria* dan bernilai tinggi untuk kegunaan industri minyak wangi, setinggi dan juga perubatan tradisional. Walau bagaimanapun, arah aliran pasaran kini menunjukkan terdapat permintaan untuk spesies *Aquilaria* dibangunkan sebagai produk penjagaan kesihatan seperti teh dan minuman herba yang berdasarkan amalan pengetahuan tradisional. Menyedari potensi spesies *Aquilaria* (gaharu) sebagai produk penjagaan kesihatan dan pendapatan tambahan untuk penanam *Aquilaria* berskala besar, kajian penyelidikan telah dijalankan terhadap profil bioaktiviti daun *Aquilaria* terutamanya aktiviti antioksidan menerusi aktiviti memerangkap enzim xantina/xantina oksidase dismutase, aktiviti memerangkap radikal DPPH, aktiviti perencatan enzim tirosinase dan kapasiti serapan memerangkap radikal oksigen (ORAC). ORAC kini digunakan sebagai pengukur piawai untuk menilai keupayaan antioksidan bagi sebatian tulen atau campuran daripada makanan, makanan tambahan, kosmeutikal, farmaseutikal dan produk herba semula jadi. Dalam kajian ini, didapati bahawa ekstrak akueus daripada *A. Malaccensis* mengandungi aktiviti memerangkap enzim xantina/xantina oksidase dismutase ($93.04 \pm 2.69\%$), aktiviti memerangkap radikal DPPH ($94.62 \pm 1.13\%$), aktiviti perencatan enzim tirosinase ($87.98 \pm 0.49\%$) dan nilai ORAC ($77,220.0 \pm 5,400.05 \mu\text{M Trolox equivalent per } 100\text{g}$). Berdasarkan penemuan ini, FRIM telah membangunkan formulasi emulsi nano dan dinamakan

this remarkable creation, FRIM has successfully registered it in The Malaysia Book of Records in order to make sure this piece of botanical history is recorded formally and is just another way to create awareness of the wonders of nature to further the conservation effort of our heritage.



Bunga dipulihara di Herbarium FRIM untuk generasi akan datang
Flower preserved for posterity in the FRIM Herbarium

NATURAL PRODUCTS DIVISION

DEVELOPMENT OF ANTIOXIDANT HERBAL BASED PRODUCTS FROM *AQUILARIA MALACCENSIS*

Gaharu (agarwood) is an important non-timber forest product from the genus *Aquilaria* and highly valuable for uses in perfumery, incense and also for traditional medicinal application. Recent market trend has shown an increase in demand of *Aquilaria* species as health care herbal products such as herbal tea and beverages which were based on traditional knowledge practices. Realising the potential of *Aquilaria* species (gaharu) as herbal health care product and as additional income generation for those planting *Aquilaria* in large scale plantations in Malaysia, research studies had been carried out on the bioactivity profiling of *Aquilaria* leaves particularly towards the antioxidant activities which are via xanthine/xanthine oxidase superoxide scavenging activity, DPPH radical scavenging activity, tyrosinase inhibitory activity and oxygen radical scavenging absorbance capacity (ORAC). ORAC is currently a standard tool to measure the antioxidant capacity of pure compounds or mixture from food, supplements, cosmeceuticals, pharmaceutical and natural herbal products. In this study, we have found out that the aqueous extract from *A. malaccensis* contained xanthine/xanthine oxidase superoxide scavenging activity ($93.04 \pm 2.69\%$), DPPH radical scavenging activity ($94.62 \pm 1.13\%$), tyrosinase inhibitory activity ($87.98 \pm 0.49\%$) and ORAC ($77,220.0 \pm 5,400.05 \mu\text{M of Trolox equivalents per } 100\text{ g}$). Based on these findings, FRIM had developed nanoemulsion formulations namely as NanoTranquil that contains 0.3% of the *A. malaccensis* actives which had

sebagai NanoTranquil yang mengandung 0.3% bahan aktif *A. malaccensis* yang telah menjalani penilaian prestasi produk (pemerhatian fizikal, penentuan nilai pH dan saiz partikel), kestabilan (penyimpanan dalam 4 °C, suhu bilik dan 40 °C selama tiga bulan), penerimaan pengguna (kelikatan, kesan melembutkan kulit), keselamatan (ujian had mikrob dan kerengsaan kulit) dan ujian keberkesanan melalui ujian ORAC.

NanoTranquil berwarna perang dan didapati stabil selepas disimpan dalam tiga suhu yang berbeza selama tiga bulan. Produk ini tidak menunjukkan perubahan warna dan tiada pemisahan fasa yang berlaku. Nilai pH produk ini adalah dalam julat 5.0–6.5 yang boleh dianggap sebagai produk mesra kulit. Zetasizer, Malvern Instrumen LTD mengesahkan saiz partikel NanoTranquil ialah 45.30 nm dengan indeks polydispersion (PDI) ialah 0.226 (Rajah 1). Nilai PDI bawah daripada 2.0 menunjukkan darjah yang kecil bagi taburan saiz.

Dalam kaji selidik yang dijalankan ke atas 45 sukarelawan, 95.6% daripada sukarelawan menyatakan bahawa NanoTranquil adalah mudah untuk digunakan, 91.1% mendakwa bahawa produk ini memberi kesan melembutkan kulit dan 51.1% daripada sukarelawan memberikan komen positif terhadap kelikatan (Rajah 2). NanoTranquil memenuhi kriteria keselamatan yang dikawal oleh BPFK melalui ujian beban mikrob dan telah diklasifikasikan sebagai bahan bukan merengsa kulit dengan skor *Human Irritancy Equivalent* (HIE) sebanyak 1.06. Sebagai penentuan keberkesanan, ujian ORAC telah dijalankan dan hasilnya menunjukkan bahawa nilai ORAC NanoTranquil $77,592.50 \pm 4,643.20 \mu\text{M}$ persamaan Trolox per 100 g.

Nilai ORAC yang tinggi bagi bahan aktif dan produk kosmetik menunjukkan keberkesanannya dalam meneutralkan radikal bebas dan dijelaskan dengan nilai kepekatan (μM) Trolox, analog vitamin E bagi setiap 100 g sampel. Nanoemulsi berfungsi sebagai perantaraan yang penting bagi penyampaian bahan aktif secara terkawal untuk produk kosmetik dan penyebaran bahan aktif yang optimum di dalam lapisan kulit. Oleh kerana bahagian dalam nanoemulsi yang bersifat lipofilik, nanoemulsi sangat sesuai untuk mengangkut sebatian/bahan aktif yang bersifat lipofilik, membantu bahan aktif menembusi kulit dan seterusnya menyebabkan kepekatan bahan aktif di dalam kulit menjadi lebih tinggi untuk proses tindak balas biologi.

PEMBANGUNAN PENYELIDIKAN POLISAKARIDA DARIPADA TUMBUHAN UBATAN SEBAGAI SUMBER PRODUK FARMASEUTIKAL DAN MAKANAN BERFUNGSI

Polisakarida atau lebih spesifiknya polisakarida bukan kanji ialah sejenis sebatian karbohidrat. Ia banyak terdapat pada bahagian akar, biji dan buah tumbuh-tumbuhan dan jumlah kandungan biasanya adalah kira-kira 16–25% (berdasarkan berat kering). Dalam bidang pemakanan, polisakarida dicernakan di dalam badan dan digunakan

undergo product performance (physical observation, pH value and particle size determination), stability (storage in 4 °C, room temperature and 40 °C for three months), consumers acceptance (viscosity, softening skin feeling), safety (microbial limit test and dermal irritation) and retested for efficacy via ORAC assay.

The NanoTranquil is brown in colour and was found stable after stored in three different temperatures for three months. The products showed no colour changes and no evidence of phase separation. The pH value of the product is in range of 5.0–6.5 which can be considered as skin friendly. Zetasizer, Malvern Instrument LTD confirms the particle size of NanoTranquil was 45.30 nm with polydispersion index value (PDI) of 0.226. PDI value below than 2.0 indicates that narrow degree of size distribution. From a survey conducted with 45 volunteers, 95.6% of the volunteers claimed that NanoTranquil is easy to apply, 91.1% of the volunteers claimed that the product leaves soft feeling on the skin and 51.1% of the volunteers gave positive comment on the viscosity. NanoTranquil meets the safety criteria regulated by BPFK via microbial enumeration tests and was classified as dermal non irritant with Human Irritancy Equivalent (HIE) score of 1.06. For efficacy evaluation, ORAC test was conducted and the result showed that ORAC value for NanoTranquil is $77,592.50 \pm 4,643.20 \mu\text{M}$ of Trolox equivalents per 100 g.

High ORAC value in the active ingredient and cosmetic product indicated that their effectiveness in neutralizing free radical and this was explained in concentration (μM) of Trolox, a vitamin E analogue available in 100 g of sample. Nanoemulsion had become increasingly important vehicle for controlled delivery of cosmetics and optimised dispersion of active ingredients in particular skin layers. As a result of the lipophilic interior, nanoemulsion is more suitable for transporting lipophilic compounds, support the skin penetration of active ingredients and thus increase their concentration in the skin for better biological reaction.

RESEARCH AND DEVELOPMENT OF POLYSACCHARIDES FROM PLANTS AS SOURCES OF PHARMACEUTICAL AND FUNCTIONAL FOOD BASED PRODUCTS

Polysaccharides or more specifically non-starch polysaccharides are natural chemical constituents under the carbohydrate group found abundantly in plant parts such as the roots, seeds and fruits which constituted typically 16 to 25% (dry basis) of the whole plant. In nutrition, polysaccharides are digested in the body and used as potential energy sources. There are many other benefits of these macro-molecules which include reducing cholesterol level, lowering of blood pressure and stabilising blood sugar level. However, until now only a limited number of rigorous polysaccharide research groups have been reported in Malaysia. In nature, many polysaccharides contain multiple monosaccharides mainly made up neutral sugars and uronic acids with variations in linkage patterns. The structure analysis of polysaccharides is thus a complex

sebagai sumber tenaga. Makro-molekul ini juga mempunyai banyak kelebihan dalam mengawal penyakit antaranya ialah mengurangkan paras kolesterol dalam darah, merendahkan tekanan darah tinggi dan menstabilkan paras gula dalam darah. Walau bagaimanapun, sehingga kini, dilaporkan masih terdapat kekurangan dari segi bilangan kumpulan-kumpulan penyelidik di Malaysia yang menjalankan penyelidikan polisakarida secara menyeluruh. Ciri utama polisakarida ialah dibentuk oleh pelbagai jenis unit monosakarida yang kebanyakannya ialah gula neutral dan asid uronik dengan pelbagai variasi corak penyambungan antara unit-unit. Disebabkan oleh struktur polisakarida yang kompleks ini, kerja-kerja menganalisis sebatian ini memerlukan teknik khas yang rumit dan sangat berbeza dengan kaedah analisis untuk sebatian molekul kecil atau biopolimer yang lain.

Walaupun sukar, sekumpulan penyelidik FRIM telah memulakan aktiviti R&D ke atas polisakarida daripada tumbuh-tumbuhan pada tahun 2008. Percubaan pertama mereka ialah penyelidikan ke atas sampel buahengkudu ataupun noni (*Morinda citrifolia*) dan hasilnya polisakarida daripada buah tersebut berpotensi merendahkan paras gula selepas makan. Seterusnya, kumpulan tersebut meneruskan penyelidikan polisakarida ke atas buah belimbing besi (*Averrhoa carambola*), biji matang petai belalang (*Leucaena leucocephala*) dan tongkat ali (*Eurycoma longifolia*). Polisakarida daripada buah belimbing besi didapati berpotensi untuk merendahkan paras kolesterol di dalam darah dan bahan pembawa ubatan farmaseutikal (*drug carrier*) yang bersaiz nano telah dibangunkan daripada polisakarida petai belalang.

Hasil penyelidikan polisakarida daripada buahengkudu telah difail patenkan (PI2010004077) di Pejabat Perbadanan Harta Intelek Malaysia (MyIPO). Teknologi daripada penyelidikan ini telah digunakan oleh Syarikat Poly-Xtract Sdn Bhd untuk menghasilkan fraksi polisakarida pada skala pandu (pilot scale) dan fraksi polisakarida ini telah digunakan oleh Syarikat Nourish Care Sdn Bhd sebagai bahan aktif untuk penghasilan produk makanan jenama Le'Natura iaitu biskut dan kopi putih mesra diabetes. Produk-produk ini telah pun berada di rangkaian-rangkaian pasar raya besar seperti Aeon Jusco dan OTK dan dijangka akan memasuki rangkaian pasar raya besar yang lain seperti Tesco, Giant dan Mydin mulai tahun hadapan. Hasil penyelidikan ini juga telah dipilih antara 42 projek penyelidikan daripada seluruh negara oleh pihak Agensi Inovasi Malaysia (AIM) dan telah diumumkan oleh Perdana Menteri Malaysia, Datuk Seri Najib Tun Abdul Razak pada 19 April 2012 sebagai peluang perniagaan inovatif (IBO) yang berpotensi menjana pendapatan RM 1 billion selepas tiga tahun. Inovasi daripada projek penyelidikan ini juga telah terpilih ke peringkat akhir Anugerah Inovasi Negara 2012 sempena *National Innovation Conference and Exhibition (NICE)* yang berlangsung pada 5–7 November di KLCC, Kuala Lumpur.

and demanding task which requires specialised techniques that differ significantly from those methods used for small molecules and other biopolymers.

Despite the complexity, a group of FRIM researchers has initiated R&D activities on the polysaccharides of plants in 2008. Their first attempted plant species was mengkudu or noni (*Morinda citrifolia*) and the polysaccharides from the noni fruits were found to have potential to reduce blood sugar levels after meal. Subsequently, the polysaccharide research was initiated on star fruit (*Averrhoa carambola*), mature seeds of petai belalang (*Leucaena leucocephala*) and tongkat ali (*Eurycoma longifolia*). The polysaccharides from star fruit could potentially reduce blood cholesterol levels and a nano-sized drug carrier has been developed from the polysaccharides of petai belalang.

The research output on polysaccharides of noni fruits has been completed with patent filing (PI2010004077) at the Malaysian Intellectual Property Office (MyIPO). Technology from this research has been taken up by Poly-Xtract Sdn Bhd to produce polysaccharide fractions at pilot scale and the polysaccharide fraction was used by Nourish Care Sdn Bhd as the active ingredient for the production of diabetic friendly biscuits and white coffee premix under the brand name Le'Natura. These products are already available in several hypermarkets such as Aeon Jusco and OTK, and are expected to enter other hypermarkets such as Tesco, Giant and Mydin in 2013. On top of that, the research on the polysaccharides of noni has been selected among 42 research projects throughout Malaysia by the Malaysia Innovation Agency (AIM) and was announced by the Prime Minister of Malaysia, Datuk Seri Najib Tun Abdul Razak on 19 April as having innovative business opportunities (IBO) with potential income of RM 1 billion after three years. The same project was also selected as one of the finalists for National Innovation Awards (AIN) 2012 in conjunction with the National Innovation Conference and Exhibition (NICE) on 5–7 November at KLCC, Kuala Lumpur.

OCIMUM SANCTUM—HERBA MUJARAB

Ocimum sanctum berasal dari negara Asia Barat dan Afrika Tengah. Tumbuhan ini juga didapati di Malaysia, India dan Afrika. Ia merupakan tumbuhan yang berbatang lembut dan tumbuh sepanjang tahun di kawasan beriklim sederhana. Daunnya berwarna hijau keungu-unguan dengan haruman yang kuat seperti bunga cengkih kerana kewujudan kandungan eugenol yang tinggi. Daunnya sering digunakan untuk tujuan keagamaan dan sebagai perisa makanan.

Di Malaysia, *O. sanctum* dikenali sebagai selasih hitam. Ia juga lebih popular sebagai 'holy basil' atau Krishna tulsi di arena antarabangsa. Daun *O. sanctum* digunakan sebagai ramuan dalam perubatan tradisional Malaysia, Ayurveda dan Siddha sejak berabad-abad lamanya. Ia digunakan untuk menguat dan mengekalkan kesihatan berkaitan dengan sistem penghadaman, merawat jangkitan pada usus dan menguatkan sistem pernafasan. Daunnya disyorkan sebagai rawatan untuk batuk dan selsema, lelah, bronkitis dan masalah cirit-birit kronik dalam kalangan kanak-kanak.

Ekstrak daun *O. sanctum* secara semula jadi kaya dengan sifat perlindungan terhadap zarah-zarah oksidan yang mampu menguatkan daya sistem imuniti badan dalam melawan dan menyingkirkan radikal bebas. Ia berkesan melindungi badan daripada simptom-simptom penyakit kronik akibat daripada proses penuaan di samping melambatkan proses penuaan. *Ocimum sanctum* digelar sebagai 'wonder herb' atau herba mujarab kerana memiliki pelbagai kebaikan dari segi kesihatan dalam merawat pelbagai jenis penyakit.

Ekstrak air daun *O. sanctum* yang dikeringkan melalui proses sejuk beku diuji untuk aktiviti antioksidan dan kandungan fenol, analisis HPLC dan analisis keselamatan pemakanan. Ekstrak daun tersebut menunjukkan aktiviti antioksidan yang tinggi, contohnya 96.8% DPPH radical scavenging activity dan 94.6% superoxide scavenging activity (Jadual 1). Aktiviti tersebut diikuti dengan kandungan fenol yang tinggi iaitu, 1644.2 mg 100 g⁻¹ GAE. Analisis HPLC menunjukkan kewujudan kumpulan fenol, dan asid rosmarinik. Ekstrak tersebut dijamin selamat untuk dimakan. Analisis menunjukkan ekstrak ini bebas daripada bebanan mikrob, yis dan kontaminasi logam berat (Jadual 2). Ekstrak ini telah dibangunkan sebagai ekstrak piawai antioksidan dalam pembangunan produk kesihatan dan kecantikan.

OCIMUM SANCTUM—THE WONDER HERB

Ocimum sanctum originated from Southeast Asia and Central Africa and is native to Malaysia, India and Africa. It is a tender, herbaceous, annual plant that grows best in warm climate. The leaves are purplish green with a strong, pungent, clove-like odour due to its high eugenol content. The leaves are often used in religious rituals and food flavouring.

In Malaysia *O. sanctum* is commonly known as selasih hitam. It is also called holy basil or Krishna tulsi. For decades, the *O. sanctum* leaves have been extensively used in the Malaysian traditional medicine and the Ayurvedic and Siddha Medicine of India. The leaves are used traditionally to maintain the digestive health, to treat intestinal infections, and to strengthen the respiratory system. The leaves are recommended for the treatment of cough and cold, asthma and bronchitis in children, and chronic diarrhea.

The leaf extract of *O. sanctum* has oxidative protective properties that boost the ability of the body to fight off damaging free radicals. It is effective in protecting the body against chronic diseases' symptoms due to aging and slows down the aging process. *Ocimum sanctum* is called a 'wonder herb' because of its great health benefit and its ability to treat various diseases.



Ocimum sanctum L.

The freeze-dried aqueous extract of *O. sanctum* leaves were tested for antioxidant properties and total phenolic content, and subjected to HPLC analysis and safety evaluation. The leaf extract showed high antioxidant properties i.e., 96.8 % DPPH Radical Scavenging Activity and 94.6% Superoxide Scavenging Activity (Table 1). The activity corresponded with its high phenolic content, 1644.2 mg/100g GAE (Table 1). HPLC analysis showed the presence of phenolic compounds and rosmarinic acid. The extract was found to be safe and free from contamination of yeast, microbes and heavy metals (Table 2). The extract was further developed into a standardised antioxidant extract, for the development of herbal products.

Jadual/Table 1: Antioxidant evaluation of *Ocimum sanctum* leaf aqueous extract

Antioxidant Bioassays	<i>Ocimum sanctum</i> Aqueous Extract (200 ug/ml)			
Shoot		Leaf	Stem	Flower
DPPH Radical Scavenging Activity (%)	97.4 ± 0.1	96.8 ± 0.5	82.3 ± 0.9	70.0 ± 1.7
Superoxide Scavenging Activity (%)	92.6 ± 0.8	94.6 ± 0.1	86.8 ± 0.1	91.1 ± 0.4
Total Phenolic Content (TPC) (mg/100g GAE)	1891.8 ± 4.4	1644.1 ± 31.3	1228.8 ± 19.7	1238.2 ± 23.5

Jadual/Table: Safety Evaluation of *Ocimum sanctum* leaf aqueous extract

Cytotoxicity Evaluation	Median Inhibition Concentration , IC ₅₀ (µg ml ⁻¹)	
Sulforhodamine B Assay	Vero (kidney) normal cell lines	WRL-68 (liver) normal cell lines
<i>O. sanctum</i> Leaf Aqueous Extract	370.95	343.54
Paclitaxel	0.059	0.047
Microbial Load Test	Total Viable Aerobic Count (cfu/g)	
Total Aerobic Microbial Count (TAMC) 35°C, 5days	Not detected (Specification : 2 x 10 ⁴ Max)	
Total Yeast & Mould Count (TYMC) 25°C, 7 days	Not detected (Specification : 2 x 10 ² Max)	
Heavy Metal Analysis		
<i>O. sanctum</i> leaf aqueous extract were tested for arsenic, mercury, plumbum and cadmium content and the test reported that the amount of heavy metals detected were below the permissible level (Malaysia Poison Act 1952).		



Sxanct Gold daripada daun *Ocimum sanctum*, iaitu ekstrak berair berkualiti premium dikering beku yang kaya dengan antioksidan
Sxanct Gold from *Ocimum sanctum* leaf, a premium quality aqueous freeze dried extract with high antioxidant properties



Teh Tulsi dan tonik Santumax daripada ekstrak piawai daun *Ocimum sanctum*
Tulsi tea and Santumax tonic developed from *Ocimum sanctum* leaf standardized extract



Pati piawai *Ocimum sanctum* memenangi pingat emas pada ITEX 2011
Ocimum sanctum standardised extract won a gold medal at ITEX 2011

Pemindahan Teknologi

Technology Transfer

Seminar/Persidangan/Bengkel/Dialog/Forum/Kursus Seminars/Conferences/Workshops/Dialogues/Fora/Courses

Bil. No.	Tajuk Title	Tarikh Date
1	Bengkel Pelaksanaan Projek Pemodelan bagi Perancangan Guna Tanah Inception Workshop on Modelling of Land Use Planning	25 Januari/January
2	Kursus Pemangkasan Pokok dan Keselamatan Alat, Majlis Perbandaran Johor Bahru Tengah (MPJBT) Course on Tree Pruning and Safe Utilisation of Tools, Johor Bahru Tengah Municipal Council (MPJBT)	30–31 Januari/January
3	Seminar Pembangunan Industri Perabot Sarawak Seminar on Development of Sarawak Furniture Industries	14–16 Februari/February
4	Dialog antara FRIM dan Persatuan Industri Kayu-Kayan Sarawak Dialogue between FRIM and Sarawak Timber Industry Association	15 Februari/February
5	Bengkel SATREPS tentang 'Tropical Tree Response to Climate Change' (penganjuran bersama dengan JIRCAS) SATREPS Workshop on Tropical Tree Response to Climate Change (jointly organised with JIRCAS)	29 Februari/February– 2 Mac/March
6	Perundingan Pihak Berkepentingan bagi Projek ITTO dalam Mengurangkan Degradasi Hutan dan Pelepasan Gas Rumah Hijau melalui Pengurusan Hutan Secara Mampan di Semenanjung Malaysia Stakeholder Consultation for ITTO Project on Reducing Forest Degradation and Emissions through Sustainable Forest Management in Peninsular Malaysia	8 Mac/March
7	Program Kesedaran Alam Bersama Sekolah Kebangsaan Kepong sempena Hari Perhutanan Sedunia 2012 Environmental Awareness Program for Kepong Primary School in Conjunction with World Environment Day 2012	21 Mac/March
8	Program Kesedaran Alam: Hutan FRIM Tanggungjawab Bersama Environmental Awareness Program: Taking Care of FRIMs Forest is Our Responsibility	21 Mac/March
9	Kursus Penanaman Karas dan Pengeluaran Gaharu, Sri Aman, Sarawak Course on Karas Planting and Gaharu Production, Sri Aman, Sarawak	21–23 Mac/March, 8–12 Mei/May & 21–23 Jun/June
10	Kursus Penanaman Karas dan Pengeluaran Gaharu, Kuching, Sarawak Course on Karas Planting and Gaharu Production, Kuching, Sarawak	25–28 Mac/March
11	Kursus Pemangkasan Pokok untuk Kontraktor Majlis Perbandaran Johor Bahru Tengah (MPJBT) Course on Tree Pruning Organised for Contractors of Johor Bahru Tengah Municipal Council	26–27 Mac/March
12	Seminar Serantau bagi Penambahbaikan Perisian dan Kaedah untuk Intergrasi Pemeliharaan Kepelbagaian Biologi di dalam Perancangan Hutan Regional Seminar on Improved Tools and Methods for Integrating Biodiversity Conservation into Forest Planning	27–28 Mac/March
13	Bengkel Kesedaran Projek Penanaman Pokok Hutan di Sekolah di Dungun, Terengganu (untuk sekolah-sekolah di Kelantan, Terengganu dan Pahang) Awareness Workshop on Forest Tree Planting in Schools at Dungun Terengganu (for Kelantan, Terengganu and Pahang Schools)	28 Mac/March
14	Bengkel LULUCF Gas Rumah Hijau Semenanjung Malaysia Workshop on Greenhouse Gas for LULUCF for Peninsular Malaysia	29–30 Mac/March
15	Kursus Asas Pengenalan Pokok Basic Tree Identification Course	2–5 April

Bil. No.	Tajuk Title	Tarikh Date
16	Bengkel Pembangunan Modul Sistem Inventori Pengurusan Pokok Putrajaya (SIPP), Perbadanan Putrajaya Workshop on Module Development of Putrajaya Tree Management Inventory System Module (SIPP), Putrajaya Corporation	4–5 April
17	Kursus Pemantauan Kerja-Kerja Pemangkasan untuk Kakitangan Majlis Perbandaran Johor Bahru Tengah Course on Monitoring of Tree Pruning Activities Organised for Johor Bahru Tengah Municipal Council	9–12 April
18	Persidangan Sains Tanah Malaysia 2012 (SOILS 2012) Soil Science Conference of Malaysia 2012	10–12 April
19	Kursus Pengenalan Kepada Spesies dan Tanah Hutan Paya Laut Course on Introductory to Soil and Species of Mangroves	23–26 April
20	Bengkel Pembangunan, Penilaian dan Penggunaan Sistem Tenaga Biojisim (Pembabataan, Pembakaran dan Gasifikasi) Bahan Buangan Pertanian dan Kayu Workshop on Development, Evaluation and Application Biomass Energy System (Briquetting, Combustion and Gasification) of Agricultural and Wood Wastes	23–28 April
21	Bengkel Pengenalan kepada Pengecaman dan Asal-Usul Spesies Kayu Balak (Anjuran bersama dengan Bioversity International) Identification of Timber Species and Origins—Inception Workshop (Jointly Organised with Bioversity International)	24–26 April
22	Kursus Jalan-Jalan Cari Daun Siri 1/2012 Course on Tree Identification Series 1/2012	26–27 April
23	Latihan serta Pemindahan Teknologi dalam Bidang Aplikasi Teknologi Geospasial di bidang Perhutanan Training and Technology Transfer on Geospatial Technology for Precision Forestry Application	15–16 Mei/May
24	Bengkel Guna Tanah dan Perubahan Guna Tanah dan Perhutanan Sarawak Landuse and Landuse Change and Forestry Workshop Sarawak	17–18 Mei/May
25	Kursus Pengenalan Penyakit Pokok Hutan Inception Course on Forest Tree Disease	19–20 Jun/ June
26	Bengkel Guna Tanah dan Perubahan Guna Tanah dan Perhutanan Sabah Landuse and Landuse Change and Forestry Workshop Sabah	24–25 Mei/May
27	Kursus Pengenalan Interpretasi Persekitaran—Politeknik Merlimau, Melaka Inception Course on Environment Interpretation—Politeknik Merlimau, Melaka	28–30 Mei/May
28	Pemindahan Teknologi dalam Bidang Geospasial kepada Penjawat Jabatan Perhutanan Sabah Technology Transfer on Geospatial to the Staff of Sabah Forest Department	15–18 Mei/May
29	Kursus Tapak Semaian Course on Nursery	12–14 Jun/June
30	Kem Alam Sekitar sempena Sambutan Hari Alam Sekitar dan Majlis Perasmian Infrastruktur Kemudahan Ekopelancongan SPF Mata Ayer, Perlis Environmental Camp in conjunction with World Environment Day and SPF Mata Ayer, Perlis Ecotourism Facilities Infrastructure Opening Ceremony	13–14 Jun/June
31	Bengkel Kesedaran Projek Penanaman Pokok Hutan di Sekolah di FRIM, Kepong (untuk sekolah-sekolah di Melaka, Putrajaya, Kuala Lumpur dan Selangor). Awareness Workshop on Forest Tree Planting in Malaysian School, at FRIM, Kepong (for Melaka, Putrajaya, Kuala Lumpur dan Selangor Schools)	18–19 Jun/June

Bil. No.	Tajuk Title	Tarikh Date
32	Kursus Asas Teknik dan Kurasi Herbarium Course on Herbarium Techniques and Curation	18–20 Jun/June
33	Kursus Asas Pengenalan dan Pengecaman Tumbuhan Course on Basic Plants Introduction and Identification	18–20 Jun/June
34	Bengkel Konservasi 2012, Langkawi Workshop on Conservation 2012, Langkawi	2–5 Julai/July
35	Simposium Antarabangsa tentang Penebusgunaan dan Pemulihan ke Arah Penghijauan Asia, Kuala Lumpur The International Symposium on Reclamation, Rehabilitation and Restoration Towards Greener Asia, Kuala Lumpur	4–5 Julai/July
36	Seminar tentang Penyelidikan dalam Ekologi Jangka Panjang Rantau Asia Pasifik Timur Seminar on Long-Term Ecological Research in East Asia Pacific Region (EAP-LTER2012)	4–5 Julai/July
37	Kursus Pengutipan Koleksi Tumbuhan Hidup bagi Konservasi <i>Ex-situ</i> Course on Live Plant Collection for <i>Ex-situ</i> Conservation	9 – 12 Julai/July
38	Kursus Pemangkasan Pokok dalam Amalan Arborikultur untuk Majlis Perbandaran Sepang di Taman Tasik Cyberjaya Training Course on Tree Pruning in Arboriculture Practice for Sepang Municipal Council at Cyberjaya Lake Garden	19–20 Julai/July
39	Kursus Inventori dan Pemetaan Hutan dengan Penggunaan Perisian SVS di SPFJengka, Pahang Training on Forest Inventories and Mapping with Application of SVS software in SPF Jengka, Pahang	7–10 Ogos/August
40	Bengkel dan Latihan tentang MyERNet Information Management, Kasetsart University, Bangkok Workshop and Training on MyERNet Information Management, Kasetsart University, Bangkok	5–9 September
41	Bengkel Kesedaran Projek Penanaman Pokok Hutan di Sekolah Seluruh Malaysia (Wilayah Persekutuan Labuan) Awareness Workshop on Forest Tree Planting in Schools at Labuan, Wilayah Persekutuan	12–13 September
42	Lawatan Kerja ke Bogor, Indonesia bagi Kerajaan Negeri Perlis di Bawah Projek Penyediaan Rancangan Pengurusan Hutan (RPH) Negeri Perlis 2013-2022 Working Visit to Bogor, Indonesia for Perlis State under Project of Forest Management Plan (FMP) of Perlis 2013-2022	18–19 September
43	Program Penanaman Koridor Hijau di Sg. Petekah, Felda Pasoh Dua, Negeri Sembilan Green Corridor Planting Program at Sg. Petekah, Felda Pasoh Dua, Negeri Sembilan	18–21 September
44	Kursus Aplikasi Quantum GIS (QGIS) dalam Pengurusan Sumber Asli dan Alam Sekitar Training on Quantum GIS (QGIS) Application in the Management of Natural Resources and Environment	19 September
45	Pemindahan Teknologi dalam Survei Hutan, KPKKT Technology Transfer on Forest Survey, KPKKT	25–26 September
46	Seminar Tumbuhan Ubatan dan Beraroma 2012 Seminar on Aromatic and Medicinal Plants 2012	25–26 September

Bil. No.	Tajuk Title	Tarikh Date
47	Persidangan Hutan Bandar 2012 Urban Forestry Conference 2012	2–6 Oktober/October
48	Ceramah Teknologi—FRIM Pemangkin Pembangunan Industri Herba Negara Technology Talk—FRIM the Catalyst in the Development of the National Herbal Industries	3 Oktober/October
49	Kursus Jalan-Jalan Cari Daun Siri 2/2012 di Taman Botani Kepong Course on Leaf Identification Series 2/2012 at the Kepong Botanical Gardens	5 Oktober/October
50	Kursus Melatih Forester untuk Melaksanakan Kerja-kerja Pembaikan Pokok Train Forester to Conduct Tree Improvement Work	9–12 Oktober/October
51	Persidangan Antarabangsa tentang “Biomass for Biofuels and Value-Added Products (ICBBVAP 2012)” International Conference on Biomass for Biofuels and Value-Added Products (ICBBVAP 2012)	23–24 October/October
52	Bengkel Konsultasi untuk Pihak Berkepentingan Mengenai Kajian Pengurusan Landskap Kawasan Hijau dan Taman Awam oleh Pihak Berkuasa Tempatan di Semenanjung Malaysia. Stakeholder Consultation Workshop on Urban Green Space and Park Management by local governments	7–8 November
53	Seminar Kayu Getah, Acacia, Palma dan Spesies Perintis (GAPPS) 2012, Kuching, Sarawak Seminar on Rubberwood, Akasia, Palms and Pioneer Species (GAPPS) 2012, Kuching, Sarawak	9 November
54	Lawatan Kerja dan Kursus Pengenalan Interpretasi Persekitaran di Langkawi Official Visit and Inception Course on Environment Interpretation in Langkawi	19–20 November
55	International Symposium on Resource Efficiency in Pulp and Paper Technology (RepTech 2012), Bandung	19–21 November

BENGGEL ‘DEVELOPMENT, APPLICATION AND EVALUATION OF BIOENERGY TECHNOLOGIES THROUGH BRIQUETTING, GASIFICATION AND COMBUSTION OF WOOD AND AGRICULTURE WASTES’

Bengkel yang bertajuk ‘Development, Application and Evaluation of Bioenergy Technologies through Briquetting, Gasification and Combustion of Wood and Agriculture Wastes’ telah dianjurkan oleh FRIM dengan kerjasama Pertubuhan Kayu Tropika Antarabangsa (ITTO) pada 23–28 April 2012 di FRIM, Kepong, dan dirasmikan oleh Pengarah, Bahagian Perancangan Penyelidikan dan Korporat, Dr Norini Haron bagi pihak Ketua Pengarah FRIM.

Bengkel ini merupakan salah satu pencapaian projek tajaan ITTO yang mana objektif utamanya adalah untuk memindahkan dua sistem teknologi biotenaia iaitu teknologi pembakaran biojisim dan teknologi penghasilan briket/pellet kepada pihak Cameroon. *Modus operandi* bengkel ini juga adalah untuk berkongsi pengetahuan dan pengalaman melalui reka bentuk dan pelaksanaan kedua-dua sistem biotenaia daripada pelbagai bahan mentah seperti habuk kayu, sekam padi dan sisa sawit. Empat

WORKSHOP ON DEVELOPMENT, APPLICATION AND EVALUATION OF BIOENERGY TECHNOLOGIES THROUGH BRIQUETTING, GASIFICATION AND COMBUSTION OF WOOD AND AGRICULTURE WASTES

FRIM has organised a workshop on Development, Application and Evaluation of Bioenergy Technologies through Briquetting, Gasification and Combustion of Wood and Agriculture Wastes” on 23–28 April 2012 for International Tropical Timber Organization (ITTO) member country, Cameroon in FRIM, Kepong. The workshop was officiated by FRIM Research Planning and Corporate Division Director, Dr Norini Haron on behalf of FRIM Director General.

The workshop, is one of the milestones of the ITTO funded project with the main objective of transferring two bioenergy system technologies i.e., biomass combustion and briquetting/pelletizing to Cameroon. The *modus operandi* of the workshop was to share knowledge and experiences through the design and execution of both the bioenergy systems from various raw materials such as sawdust, rice husks, palm residues, etc. Four participants from Cameroon

orang peserta dari Cameroon telah menghadiri bengkel ini termasuk dua hari lawatan ke industri yang berkaitan di Malaysia. Peserta lain adalah dari FRIM, Persatuan Pengeksport Kayu Malaysia (TEAM), Yoltan Briket (M) Sdn Bhd, Felda Engineering Services Sdn. Bhd dan Padiberas Nasional Berhad (BERNAS).

INTERNATIONAL CONFERENCE ON BIOMASS FOR BIOFUEL AND VALUE ADDED PRODUCTS (ICBBVAP) 2012

Persidangan Antarabangsa tentang Biojisim untuk Biofuel dan Produk Bernilai Tambah (ICBBVAP) 2012 yang dianjurkan bersama oleh Universiti Malaysia Pahang (UMP), FRIM dan Akademi Kepimpinan Pengajian Tinggi (AKEPT) telah diadakan pada 23–24 Oktober 2012 di Kuala Lumpur. Persidangan yang bertemakan “Teknologi Inovatif ke Arah Komersialisasi Produk Nilai Tambah Berasaskan Biojisim Secara Global” ini bertujuan untuk menyebarkan teknologi terkini, aktiviti dan penemuan R & D dalam penggunaan biojisim bagi penghasilan biofuel dan lain-lain produk nilai tambah untuk sektor swasta, penyelidik, ahli akademik, pengusaha dan pembuat dasar. Persidangan ini telah dihadiri oleh 280 peserta yang terdiri daripada ahli akademik, agensi-agensi kerajaan, industri dan antarabangsa. Inisiatif Penghutanan telah dilancarkan dan pertukaran dokumen perjanjian persefahaman (MOU) antara Universiti Malaysia Pahang (UMP), FRIM, Lembaga Perindustrian Kayu Malaysia (MTIB) dan TESCO Sdn Bhd telah diadakan.

SEMINAR PENYELIDIKAN EKOLOGI JANGKA PANJANG

FRIM telah menganjurkan satu seminar berkenaan penyelidikan ekologi jangka panjang pada 4–5 Julai yang berjaya mengumpul para penyelidik, ahli akademik, perancang dan pengurus dari pelbagai disiplin berkaitan dengan kajian ekologi di rantau ini. Seminar “Long-Term Ecological Research in East Asia Pacific Region” diadakan di FRIM, Kepong bersempena dengan Persidangan *International Long-Term Ecological Research of the East Asia Pacific Regional Network* (ILTER-EAP) yang ke-9 dan dianjurkan bersama-sama JPSM dan Persatuan Institusi-Institusi Perhutanan Asia Pasifik (APAFRI). Ia telah dihadiri seramai 81 orang peserta dari pelbagai negara. Kesemua 15 orang anggota IILTER-EAP telah menghadiri mesyuarat tersebut yang terdiri daripada ahli-ahli dari negara China, Jepun, Korea Selatan, Taiwan, Filipina, Vietnam, Malaysia, Thailand dan Australia.

Lebih daripada 25 kertas kerja telah dibentangkan. FRIM turut mempromosikan penggunaan MyERnet iaitu satu sistem pangkalan data dan maklumat untuk penyelidikan ekologi jangka panjang negara ini yang ditubuhkan oleh FRIM dengan bantuan rakan-rakan pasukan Eko-Informatik IILTER-EAP.

attended the workshop which included two days visit to the relevant industries in Malaysia. Resource persons were from FRIM, Timber Exporters Association Malaysia (TEAM), Yoltan Briquette (M) Sdn Bhd, FELDA Engineering Services and Padiberas Nasional Berhad (BERNAS).

INTERNATIONAL CONFERENCE ON BIOMASS FOR BIOFUEL AND VALUE ADDED PRODUCTS (ICBBVAP) 2012

ICBBVAP 2012 was jointly organised by Universiti Malaysia Pahang (UMP), FRIM and Higher Education Leadership Academy (AKEPT) on 23–24 October 2012 in Kuala Lumpur. The conference themed “Innovative Technologies towards Global Commercialization of Biomass Based Value-Added Products” was designed to disseminate the latest technology, activities and R&D findings in the utilisation of biomass for biofuel and other value-added products to the private sector, researchers, academics, industrialists and policy makers. The conference was attended by 280 participants including academicians, government agencies and industries. During the event, the Forestation Initiative was launched and MoU between Universiti Malaysia Pahang (UMP), FRIM, Malaysian Timber Industry Board (MTIB) and TESCO Sdn Bhd was signed.

SEMINAR ON LONG-TERM ECOLOGICAL RESEARCH

FRIM organised a seminar on long-term ecological research on 4–5 July 2012, which brought together researchers, academicians, planners and managers from various disciplines related to ecological studies in the region. The Seminar on Long-Term Ecological Research in East Asia Pacific Region was held at FRIM, Kepong in conjunction with the 9th Conference of the International Long-Term Ecological Research of the East Asia Pacific Regional Network (ILTER-EAP) and jointly organised by FDPM and Asia Pacific Association of Forestry Research Institutions (APAFRI). There were 81 participants from various countries. All 15 members of the IILTER-EAP attended the meeting including members from Japan, South Korea, Taiwan, the Philippines, Vietnam, Malaysia and Australia.

More than 25 papers were presented. FRIM also promoted the use of MyERnet—a database and information system for the long-term ecological research—in the country which was established by FRIM with the assistance of its partners in IILTER-EAP Eco-Informatics team.

CERAMAH TEKNOLOGI 2012

Penyelidikan dan pembangunan herba negara telah mengalami lonjakan paradigma dengan tercetusnya Program Transformasi Negara. Kerajaan di bawah Rancangan Malaysia ke-10 telah memperkenalkan NKEA (Aktiviti Utama Ekonomi Negara) yang menasarkankan perkembangan dalam beberapa bidang tertentu termasuklah industri/bidang herba negara. FRIM telah bersama-sama dalam menerajui bidang penyelidikan herba negara dengan menumpukan kepada aktiviti penyelidikan dan pembangunan tumbuhan herba terpilih menggunakan teknologi terkini bagi meningkatkan tahap kualiti hasil penyelidikan.

Sehubungan dengan itu, program “Technology Talk” bertemakan “FRIM Pemangkin Pembangunan Industri Herba Negara” diadakan berasaskan objektif-objektif di bawah:

1. Mempromosikan teknologi serta kemampuan FRIM dalam bidang R&D herba kepada industri tempatan
2. Membuka ruang kepada industri herba untuk menjalinkan kerjasama dan mendapatkan perkhidmatan serta nasihat yang berkaitan.
3. Mengetengah dan membincangkan hal berkaitan penentusahan tumbuhan herba dan teknologi terkini bagi perkembangan industri herba negara.

Topik-topik yang disampaikan merangkumi isu-isu penting dalam penghasilan produk herba yang berkualiti termasuklah autentikasi melalui morfologi fizikal dan analisis kimia, kawalan kualiti produk herba, bioprospek/bioaktiviti dan keselamatan herba serta keperluan regulatori negara luar. Teknologi terkini dalam pemprosesan minyak pati dan pemprosesan herba juga telah dibincangkan semasa program ini. Sejumlah 31 orang peserta dari 19 syarikat di Semenanjung Malaysia turut serta dalam program ini.

Pameran

Pada tahun 2012, FRIM telah mengambil bahagian dan menyertai sebanyak 27 pameran di dalam negara. Pameran berperanan sebagai platform pemindahan teknologi menerusi aktiviti penyelidikan. Menerusi pameran, para penyelidik tidak hanya berupaya menguji tahap kepakaran menerusi pertandingan reka cipta dan inovasi, malah berpeluang untuk berkongsi dengan khalayak umum akan manfaat penyelidikan yang telah dijalankan. Sepanjang tahun 2012, FRIM telah merangkul beberapa kejayaan menerusi aktiviti pameran antaranya dua pingat emas, tiga pingat perak dan empat gangsa semasa ITEX dan muncul sebagai Johan Pameran dan Reka Bentuk Hiasan Pameran sempena Hari Inovasi NRE 2012.

TECHNOLOGY TALK 2012

Research and development of the country has experienced a surge of herbs paradigm at the onset of the National Transformation Programme. Under the 10th Malaysia Plan, the government has introduced New Key Economic Activities (NKEA) that target specific development in a number of areas, including herbal industry. FRIM in addition to other agencies lead the country herbal research by focusing on research and development of selected herbal plants using the latest technology to enhance the quality of research output.

In connection with the NKEA a “Technology Talk” themed “FRIM as a Catalyst for the National Herbal Industry Development” was held based on the following specified objectives below:

1. To promote FRIM technology and ability in R&D on herbs to local industry.
2. To give opportunity to the herbal industry to collaborate, use the services and seek for advices from FRIM.
3. To highlight and discuss matters relating to authentication of herbal plants and technologies for the development of the herbal industry.

The topics presented include important issues in the production of quality herbal products such as authentication through physical morphology and chemical analysis, quality control of herbal products, bioprospecting / bioactivity, and safety of herbal and regulatory requirements in other countries. Latest technologies in the processing of essential oils and herbal processing were also discussed during the program. A total of 31 participants from 19 companies in Peninsular Malaysia participated in the program.

Exhibitions

In 2012, FRIM participated in 27 exhibitions held locally. Exhibitions are crucial and they act as a vehicle for FRIM to transfer its technologies. They also serve as a medium for FRIM researchers to gauge their level of expertise by competing in invention and innovation based exhibitions. Exhibitions also serve as a venue for FRIM researchers to disseminate the benefits of their research. In 2012, FRIM won two gold medals, three silver and four bronze at ITEX. FRIM also won the first prize in Creative Decoration and Best Booth Competition and the Propaganda Poster Competition (motivation category) in conjunction with NRE Innovation Day 2012.

FRIM turut menyertai beberapa pameran peringkat antarabangsa seperti MIFF (Malaysian International Furniture Fair), International Invention, Innovation & Technology Exhibition (ITEX), International Biotechnology and Biodiversity Exhibition, Pameran Mengenal Burung Antrabangsa 2012, World Bamboo Day dan Sabah International Expo 2012. Pameran sebegini juga bertindak sebagai “business match maker” seiring dengan hasrat FRIM untuk menuju ke arah komersialisasi.

FRIM participated in several national level exhibitions such as the Malaysian International Furniture Fair (MIFF), the International Invention, Innovation & Technology Exhibition (ITEX), the International Biotechnology and Biodiversity Exhibition, the Bird Identification International Competition 2012, World Bamboo Day and Sabah International Expo 2012. Exhibitions also serve as business match makers in line with FRIM’s aspiration for commercialization.

Pameran yang Dianjur/Disertai **Exhibitions Organised/Participated**

Bil. No.	Nama Name	Tempat Venue	Tarikh Date
1	Ekspo Teknologi Malaysia Malaysia Technology Expo (MTE 2012)	Pusat Dagangan Dunia Putra Putra World Trade Centre (PWTC)	16–18 Februari/February
2	Pameran Sempena Bio-ICT Pahang 2012 Exhibition in Conjunction with Bio-ICT Pahang 2012	East Coast Mall, Kuantan	2–4 Mac/March
3	Pameran Antarabangsa Perabot Malaysia (MIFF 2012) Malaysian International Furniture Fair (MIFF 2012)	Pusat Dagangan Dunia Putra Putra World Trade Centre (PWTC)	6–10 Mac/March
4	Pameran Sempena Hari Perhutanan Sedunia Ke-41, Peringkat Kebangsaan 2012 Exhibition in Conjunction with 41st World Forestry Day, National Level 2012	Pusat Eko-Pelajaran Hutan Paya Laut Matang, Kuala Sepetang, Taiping, Perak Matang Mangrove Eco-education Centre, Kuala Sepetang, Taiping, Perak	21 Mac/March
5	Pameran Sempena Hari Perhutanan Sedunia Ke-41, Peringkat FRIM 2012 Exhibition in Conjunction with 41st World Forestry Day, FRIM Level 2012	FRIM	24 Mac/March
6	Pameran dan Jualan Buku serta Anak Pokok bagi Program “Ini Pokok Apa” Exhibition and Sale of Books and Plants, for “What Tree is This” Programme	Taman Tasik Shah Alam Shah Alam Lake Garden	24–25 Mac/March
7	Pameran Antarabangsa Reka Cipta, Inovasi & Teknologi (ITEX 2012) International Invention, Innovation & Technology Exhibition (ITEX 2012)	Pusat Konvensyen Kuala Lumpur Kuala Lumpur Convention Centre (KLCC)	17–19 Mei/May

Bil. No.	Nama Name	Tempat Venue	Tarikh Date
8	Pameran Sempena Hari Peladang, Penternak dan Nelayan Peringkat Negeri Perlis 2012 (HPPN) Exhibition in Conjunction with Planters, Breeders and Fishermen's Day	Dataran Dato' Sheikh Ahmad, Kangar	24-27 Mei/May
9	Pameran Pelancongan Antarabangsa Malaysia (MITE) 2012 Malaysia International Tourism Exchange (MITE) 2012	Taman Ekspo Pertanian Malaysia, (MAEP), Serdang Malaysia Agro Exposition Park (MAEP), Serdang	31 Mei/May-4 Jun/June
10	Persidangan Antarabangsa Bioteknologi dan Biodiversiti Ke-3 (BioJohor 2012) The 3 rd International Biotechnology and Biodiversity Conference & Exhibition (BioJohor 2012)	Persada Johor International Convention Centre	9-11 Jun/June
11	Hari Alam Sekitar (Majlis Perasmian Infrastruktur Ekopelancongan) World Environment Day (Officiation of the Ecotourism Infrastructure)	Stesen Penyelidikan FRIM Mata Ayer, Perlis FRIM Research Station, Mata Ayer	14 Jun/June
12	Hari Karnival Bestari Bestari Carnival Day	Sek. Sri Bistari, Bandar Sri Damansara	16 Jun/June
13	Pertandingan Mengenal Burung Antarabangsa Sirkuit Pahang 2012 Pahang International Bird Race Circuit 2012	Bukit Fraser Fraser's Hill	23-24 Jun/June
14	Hari Terbuka INSTUN 2012 INSTUN Open Day 2012	INSTUN, Behrang Ulu, Tanjung Malim	7 Julai/July
15	Floria	Putrajaya	30 Jun/June-8 Julai/July
16	Hari Buluh Sedunia World Bamboo Day	Mont Kiara	18-23 September
17	Ekspo Antarabangsa Sabah Sabah International Expo	Sabah	21-24 September

Bil. No.	Nama Name	Tempat Venue	Tarikh Date
18	Woodmart Antarabangsa MTC MTC Global Woodmart	Pusat Konvensyen Kuala Lumpur Kuala Lumpur Convention Centre (KLCC)	4–6 Oktober/October
19	Peluang Perniagaan Antarabangsa International Business Opportunity	Bangunan Parlimen Parliament Building	16 Oktober/October
20	Karnival Sains & Inovasi Zon Tengah Science and Innovation Carnival Centre Zone	Kompleks Belia dan Sukan Paroi, Seremban Paroi Youth and Sports Complex, Seremban	20–21 Oktober/October
21	Persidangan Antarabangsa Biojisim untuk Biotenaga dan Produk Bernilai Tambah International Conference on Biomass for Biofuels and Value Added Products	Double Tree Hotel	22–23 Oktober/October
22	Hari Inovasi NRE NRE Innovation Day	Putrajaya	7–8 November
23	Pameran Bio Malaysia 2012 Bio Malaysia 2012 Exhibition	Pusat Konvensyen Kuala Lumpur Kuala Lumpur Convention Centre (KLCC)	5–7 November
24	Pameran Sempena Seminar Kayu Getah, <i>Acacia</i> , Palma dan Spesies Perintis Sarawak (GAPPS 2012) Exhibition in Conjunction with the Rubberwood, <i>Acacia</i> , Palm and Pioneer Species, Sarawak (GAPPS 2012)	Hotel Pullman, Kuching, Sarawak	19–20 November
25	Hari Inovasi FRIM FRIM Innovation Day	FRIM	28 –29 November
26	Mesyuarat Jawatankuasa Penasihat Penyelidikan Research Advisory Committee Meeting	FRIM	4 Disember/December
27	Satu Daerah, Satu Industri One District, One Industry	Pusat Dagangan Antarabangsa Melaka (MITC) Melaka International Trade Centre (MITC), Melaka	7–9 Disember/December

Pengurusan Penyelidikan dan Pembangunan Management of Research and Development

PENGURUSAN PENYELIDIKAN DAN PEMBANGUNAN

Dana Penyelidikan dan Pembangunan (R&D)

Pada 2012, sebanyak 18 projek R&D baharu berjumlah RM3.2 juta telah diluluskan oleh pelbagai agensi penaja. Daripada jumlah tersebut, lapan projek berjumlah RM1.6 juta merupakan projek ScienceFund di bawah Kementerian Sains Teknologi dan Inovasi (MOSTI); lima projek merupakan Geran Penyelidikan, Prakomersialisasi dan Penerbitan (RPP) di bawah MFRDB berjumlah RM95 375; serta lima projek berjumlah kira-kira RM1.5 juta dibiayai oleh NKEA Research Grant Scheme (NRGS).

Penilaian Cadangan Penyelidikan

Jawatankuasa Penilai Institut (JPI) FRIM telah menilai cadangan-cadangan penyelidikan FRIM menerusi lima mesyuaratnya iaitu pada 27 Februari, 7 Mei, 27 Jun, 1 dan 3 Ogos serta 28 Disember. Sebanyak 31 cadangan penyelidikan telah dihantar kepada pelbagai agensi penaja di dalam dan di luar negara.

Penilaian dan Pemantauan Projek

Seperti pada tahun-tahun yang lepas, FRIM telah mengadakan dua Sesi Penilaian dan Pemantauan Projek (PEM) iaitu pada 16–17 April (sesi viva sahaja) dan pada 31 Oktober–1 November (sesi seminar) dan 21–23 November (sesi viva). Sebanyak 52 projek menjalani sesi viva dan 14 orang ketua projek telah membentangkan hasil penyelidikan masing-masing semasa sesi seminar.

Jawatankuasa Penasihat Penyelidikan (RAC)

Jawatankuasa Penasihat Penyelidikan (RAC) ditubuhkan bertujuan untuk menasihati FRIM dalam pelaksanaan aktiviti-aktiviti penyelidikan, pembangunan dan komersialisasi (R & D & C) di samping mengenal pasti hala tuju dalam tempoh lima tahun yang akan datang. RAC boleh membantu dari segi memberikan syor-syor terutamanya dalam perancangan, pelaksanaan dan pengembangan penyelidikan ke arah mengekalkan kedudukannya sebagai salah sebuah institusi R&D bertaraf dunia. Ahli-ahli panel RAC dilantik dalam kalangan pihak-pihak berkepentingan daripada industri perhutanan di peringkat kebangsaan dan antarabangsa termasuklah ahli akademik, tokoh korporat serta ahli-ahli penting organisasi perhutanan antarabangsa. Mesyuarat RAC telah diadakan pada 4–7 December di FRIM, Kepong dan Bahagian Perancangan Penyelidikan dan Korporat bertindak sebagai sekretariat. Laporan RAC telah diserahkan kepada MFRDB.

MANAGEMENT OF RESEARCH AND DEVELOPMENT

Research and Development (R&D) Funds

In 2012, a total of 18 new R&D projects amounting to RM3.2 million funds were approved by various funding agencies. Eight ScienceFund projects worth RM1.6 million were funded under the Ministry of Science, Technology and Innovations (MOSTI), five Research, Pre-commercialization and Publications (RPP) grants under the MFRDB totaling RM95 375; and five projects amounting to RM1.5 million were funded under NKEA Research Grant Scheme (NRGS).

Evaluation of Research Proposals

The Institute Evaluation Committee (JPI) evaluated FRIM's research proposals through its five meetings i.e. on 27 February, 7 May, 27 June, 1 and 3 August and 28 December. A total of 31 proposals were submitted to various local and international funding agencies.

Project Evaluation and Monitoring

In terms of projects evaluation and monitoring, similar to the previous years, FRIM has organised two Projects Evaluation and Monitoring (PEM) sessions on 16–17 April (viva session) and 31 October–1 November (seminar session) dan 21–23 November (viva session). A total of 52 projects were evaluated and 14 project leaders presented their projects outputs and outcomes during the seminar session.

Research Advisory Committee (RAC)

The RAC was established to advise FRIM on research and development, and commercialisation (R, D & C) activities as well as to identify the way forward for the next five years. RAC is to assist FRIM through recommendations particularly in planning, execution and research extension towards becoming a world class R&D institution. Panel members of the RAC are stakeholders from the forestry industry at national and international levels which include academicians, corporate figures and prominent members of international scientific organisations. The RAC meeting was held from 4-7 December at FRIM, Kepong, with the Research Planning and Corporate Division acted as the secretariat of the meeting. The RAC report was submitted to the MFRDB.



Pembentangan laporan RAC oleh ketua panel, Dato' Shaharudin
Presentation of the RAC reports by the head of RAC panel, Dato' Shaharudin



Pameran sempena mesyuarat RAC
Exhibition during the RAC meeting

PROJEK YANG DILULUSKAN PADA 2012
PROJECTS APPROVED IN 2012

BIL. NO.	TAJUK PROJEK PROJECT TITLE	KETUA PROJEK PROJECT LEADER	DANA FUND (RM)
SCIENCEFUND – MOSTI			
1	Elucidation on the Mechanisms and Therapeutic Target(s) of Cardiac Glycoside Compound (SNA209) from <i>Cerbera odollam</i> in Ovarian Cancer for Discovering its Potential as Anti-Cancer Drug Candidate	Dr Nurhanan Murni Yunos	277,000
2	Development of Natural Preservative for Herbal and Food Product from <i>Syzygium aromaticum</i> and <i>Syzygium grande</i>	Ong Boo Kean	212,000
3	Development of Strategies and Techniques to Control the Asian Subteranean Termite <i>Coptotermes gestroi</i> Wassman in Urban Settlements	Dr Shawn Cheng	218,450
4	Effective Pre-treatment Process to Eliminate Wet Pockets in Conventional Drying of <i>Acacia</i>	Dr Gan Kee Seng	169,640
5	Development of Corrugated Particleboard (CPB) as a New Innovative Product for Structural Application	Mohd Yusouf Abdul Latif	226,000
6	Large Scale Production of <i>Grammatophyllum speciosum</i> Blume (Tiger Orchid) Using Temporary Immersion Bioreactor System	Haliza Ismail	125,880

7	Development of Multi-Purpose Measurement Device and System for Forest Inventory and Mapping	Dr Ismail Harun	147,000
8	Exploitation of Industrial Bio-Residues for the Production of Nano-Sized Cellulose Materials	Dr Rafeadah Rusli	230,000
JUMLAH/TOTAL			1,605,970

RESEARCH, PRE-COMMERCIALIZATION AND PUBLICATIONS (RPP) – MFRDB			
9	Product Performance Test of <i>Tinospora crispa</i> at Different Dosage	Noor Rasyila Mohamed Noor	20,000
10	Determination of Physical and Mechanical Properties of Modified Wood as Engineered Panel (EP) Product	Dr Khairul Awang	20 000
11	Underground Termite Trap: Efficiency in Collecting Large Number of Asian Subterranean Termite, <i>Coptotermes Gestroi</i>	Shahlinney Lipeh	15,375
12	The Effect Of Accelerated Exposure Against Fibreboard From Acacia Hybrid	Dr Suffian Misran	20 000
13	In Vitro Study Of Anti-Atherogenic Properties Of Polysaccharide Extract Of <i>Psidium guajava</i> (Pink Guava)	Ihsan Safwan Kamarazaman	20 000
JUMLAH/TOTAL			95,375

NKEA RESEARCH GRANT SCHEME (NRGS)			
14	Mass Production of Tongkat Ali Plants using Tissue Culture Techniques and Evaluation of Its Growth Performance in the Field	Dr Nor Hasnida binti Hassan	213,000
15	Identification and Production of Elite Planting Materials of <i>Labisia pumila</i> (Kacip Fatimah) for Sustainable Supply	Dr Farah Fazwa Md Ariff	233,000
16	Multi-Locational Assessment and Agro-Ecological Requirements of <i>Eurycoma longifolia</i> across the Climatic Boundaries in Peninsular Malaysia	Dr Wan Rasidah W Ab Kadir	303,000
17	Assessment on the Virulent Strains of Entomopathogenic Fungi Obtained from Natural Forest with Potential for Control of the Economically Important Insect Pests of Tongkat Ali	Dr Mohd Farid Ahmad	250,000
18	Provenance Trial of <i>Eurycoma Longifolia</i>	Dr Mohd Zaki Abdullah	480,000
JUMLAH/TOTAL			1,479,000
JUMLAH BESAR/GRAND TOTAL			3,180,345

Komersialisasi dan Inovasi

Commercialisation and Innovation

KOMERSIALISASI DAN INOVASI

Pada tahun ini, FRIM telah mengendalikan sebanyak 59 khidmat perundingan yang bernilai kira-kira RM 2.2 juta kepada kedua-dua sektor awam dan swasta. Daripada jumlah ini, FRIM menerima sebanyak kira-kira RM461 587 untuk kos pengurusan dan pentadbiran. Hasil penyelidikan FRIM juga berjaya memperoleh 30 pendedahan reka cipta, 11 pemfailan paten (Malaysia: 5, Antarabangsa: 6) dan satu pengiktirafan paten. FRIM juga telah berjaya menandatangani enam perjanjian pelesenan. Senarai khidmat perundingan, pendedahan reka cipta dan perjanjian adalah seperti yang berikut:

COMMERCIALIZATION AND INNOVATION

During the year, FRIM conducted 59 consultancies worth about RM 2.2 million. From these consultancy services, FRIM received about RM 461 587 as management fees. FRIM's new research findings led to 30 invention disclosures, 11 patents filing (Malaysia: 5, International: 6) and one patent granted. FRIM also successfully signed six licensing agreements. The lists of the consultancy services, invention disclosures and agreement are given as follows:

Khidmat Perundingan 2012 Consultancy Services 2012

BIL. NO.	BIDANG FIELD	PENGURUS PROJEK PROJECT MANAGER	PELANGGAN CLIENT
1	Menyediakan gentian tandan kosong dan pelepah kelapa sawit menepati keperluan sebagai <i>fast pyrolysis</i> stok makanan ternakan untuk penghasilan <i>bio-oil</i> <i>Preparing oil palm trunk fiber according to the needs as fast pyrolysis feedstock for bio-oil</i>	Dr Wan Asma Ibrahim	Sahabat Renewable Fuel Ventures Sdn Bhd
2	Tahap 2 RSPO Felda Kompleks Kilang Tementi <i>Stage 2 RSPO Felda Kompleks Kilang Tementi</i>	Dr Lim Hin Fui	SIRIM QAS International Berhad
3	Pengurusan perosak dan penyakit di ladang-ladang Sabah Softwoods Berhad I <i>Pest and disease management in the plantations of Sabah Softwoods Berhad</i>	Dr Lee Su See	Sabah Softwoods Berhad
4	Tahap 2 RSPO Felda Kompleks Kilang Bukit Kepayang <i>Stage 2 RSPO Felda Kompleks Kilang Bukit Kepayang</i>	Dr Lim Hin Fui	SIRIM QAS International Berhad
5	Laporan anggaran nilai ke atas konsesi di Pasir Raja, Dungun Stateland Forest bagi Yee Seng Amalgamated Sdn Bhd <i>Stumpage value estimation repost on concession located at Pasir Raja, Dungun Stateland Forest for Yee Seng Amalgamated Sdn Bhd</i>	Dr Woon Weng Chuen	TropBio Forest Sdn Bhd
6	Khidmat kepakaran penganjuran seminar pembangunan usahawan industri perabot Sarawak 2011 <i>Experties services on organizing the development of Sarawak entrepreneur furniture industry 2011</i>	Abdul Hamid Salleh	Kementerian Perdagangan Antarabangsa dan Industri <i>Ministry of International Trade and Industry</i>
7	Penghasilan dan pengujian kertas dengan penambahan agen kekuatan kering <i>Paper production and testing with added dry strength agent</i>	Dr Sharmiza Adnan	Malayan Adhesives & Chemicals Sdn Bhd

BIL. NO.	BIDANG FIELD	PENGURUS PROJEK PROJECT MANAGER	PELANGGAN CLIENT
8	Uji kaji di makmal FRIM ke atas sampel, penyiasatan ke atas masalah yang dihadapi dan memberi khidmat nasihat bagi penyelesaian masalah Testing on samples, investigating problems and advisory service on problem solving	Dr Salmiah Ujang	Dongwha Fiberboard Board Sdn Bhd
9	FSC FMU Surveillance 4 on Deramakot FR	Dr Lim Hin Fui	SGS (M) Sdn Bhd
10	Penyediaan Rancangan Pengurusan Hutan Negeri Perlis 2013–2022 Preparation of Perlis State Forest Management Plan 2013–2022	Dr Ismail Parlan	Jabatan Perhutanan Negeri Perlis Perlis Forest Department
11	Projek R&D buluh di Selama, Perak Bamboo R&D project in Selama, Perak	Abd Razak Othman	Lembaga Perindustrian Kayu Malaysia (MTIB) Malaysian Timber Industry Board
12	Pengecaman pokok untuk kerja-kerja pindah-tanam pokok di Cyberjaya Tree identification for transplanting works at Cyberjaya	Dr Richard Chung Cheng Kong	Setia Eco Glades Sdn Bhd
13	Demonstrasi, penyediaan dan analisis pemerahan sap dan pemisahan gentian batang kelapa sawit menggunakan kaedah R&D FRIM I Demonstration, preparation and analysis of oil palm trunk sap and separation of oil palm trunk fiber using FRIM R&D methods	Dr Wan Asma Ibrahim	Biological Resources and Post-Harvest Division, JIRCAS
14	Pemantauan, diagnosis dan pengecaman perosak dan penyakit di ladang-ladang Akasia Monitoring, diagnosing and identification of pests and diseases in <i>Acacia</i> plantations	Dr Lee Su See	Grand Perfect Sdn Bhd
15	Projek ITTO PD39/93 Rev.4(1): Pembangunan, penggunaan dan penilaian teknologi tenaga biojisim menerusi pembriketan, gasifikasi dan pembakaran bahan buangan (kayu dan pertanian) ITTO Project PD39/93 Rev.4(1):The development, application and evaluation of biomass energy technologies through briquetting, gasification and combustion of (wood and agriculture) wastes	Dr Wan Asma Ibrahim	International Timber Trade Organisation (ITTO)
16	Inventori pokok di Majlis Perbandaran Kuantan Tree inventory at Kuantan Municipal Council	Adnan Mohammad	Minang Agro Sdn Bhd
17	Demonstrasi penyediaan sap, analisis dan pemisahan gentian batang kelapa sawit menggunakan kaedah R&D FRIM II Demonstration of sap preparation, analysis and fiber separation of oil palm trunk using FRIM R&D methods	Dr Wan Asma Ibrahim	Biological Resources and Post-Harvest Division, JIRCAS

BIL. NO.	BIDANG FIELD	PENGURUS PROJEK PROJECT MANAGER	PELANGGAN CLIENT
18	Pengurusan serangga dan perosak di ladang-ladang Sabah Softwoods Berhad II Pest and disease management in the plantations of Sabah Softwoods Berhad	Dr Lee Su See	Sabah Softwoods Berhad
19	Sistem Inventori Pengurusan Pokok Putrajaya (SIPP) Putrajaya Tree Management Inventory System	Dr Noor Azlin Yahya	Perbadanan Putrajaya
20	Reka bentuk pemasangan <i>fire rated glass</i> Fire rated glass installation design	Khairul Azmi Jabar	Aneka Glass Sdn Bhd
21	Pembuatan dan pengujian kertas dengan penambahan agen kekuatan kanji dan kekuatan kering Paper making and testing with added starch and dry strength agents	Dr Sharmiza Adnan	Malayan Adhesives & Chemicals Sdn Bhd
22	Kerja-kerja pemeriksaan tanah untuk penanaman semula dan penghijauan bekas lombong bijih timah dengan spesies hutan yang terpilih Ground inspection for the replanting and greening of ex-tin mines with selected species	Dr Hj Ahmad Zuhaidi Yahya	Rahman Hydraulic Tin Sdn Bhd
23	Penyediaan penulisan dan borang maklumat pra-projek bagi projek "Promotion of Bamboo as an Energy Crop by Establishment of Solid Biofuels Industry and Off-Grid Small Biomass Power Plant to Strengthen Local Industrial Supply Chain in Rural Malaysia" Preparation of Write-Up and Pre-Project Information Form (PIF) for "Project on Promotion of Bamboo as an Energy Crop by Establishment of Solid Biofuels Industry and Off-Grid Small Biomass Power Plant to Strengthen Local Industrial Supply Chain in Rural Malaysia"	Dr Wan Asma Ibrahim	United Nation Industrial Development Organisation (UNIDO)
24	Pengendalian latihan-kursus interpretasi pelawat berasaskan interpretasi persekitaran Handling of training course on visitors' interpretation based on environment interpretation	Ahmad Nazarudin Mohd Roseli	Politeknik Merlimau Melaka
25	Penilaian ke atas spesifikasi teknikal bagi pulpulpaan dan pelunturan asas <i>Acacia mangium</i> untuk bleached chemi-thermo mechanical pulp (BCTMP) Evaluation on technical specifications for basic pulping and bleaching of <i>Acacia Mangium</i> for bleached chemi-thermo mechanical pulp (BCTMP)	Mahmudin Saleh	Sarawak Timber Industry Development Corporation (STIDC)
26	Pembuatan dan pengujian kertas daripada pulpa kimia kenaf pada suhu pulpulpaan berbeza The paper making and testing from the kenaf chemistry pulp on different pulping temperature	Dr Sharmiza Adnan	Institute of Tropical Forestry and Forest Products (INTROP)

BIL. NO.	BIDANG FIELD	PENGURUS PROJEK PROJECT MANAGER	PELANGGAN CLIENT
27	Penilaian risiko pokok Tree risk assessment	Sreetheran Maruthaveeran	The Royal Selangor Golf Club
28	Penilaian risiko pokok Tree risk assessment	Sreetheran Maruthaveeran	The Royal Selangor Golf Club
29	Khidmat nasihat tentang Produk Lionex (M) Sdn Bhd (Tergao) mengenai serangan serangga perosak kayu dan anai-anai serta perkara-perkara yang berkaitan Advisory service for Lionex (M) Sdn Bhd (Tergao) products on pest and termite attack and other related matters	Dr Roszaini Kadir	Lionex (M) Sdn Bhd
30	Ketahanan semula jadi produk buluh dan balau ke atas penyakit kulat Natural durability for balau and bamboo products against decay fungi	Dr Salmiah Ujang	Lionex (M) Sdn Bhd
31	Pembuatan dan pengujian kertas menggunakan PCC dan polimer I The paper making and testing using PCC and polymer	Dr Rushdan Ibrahim	Jabatan Mineral dan Geosains Malaysia
32	Penghasilan pulpa EFB kelapa sawit melalui pulpulpaan quicklime bagi produk pulpa beracuan Producing oil palm EFB pulp by quicklime pulping for moulded pulp products	Dr Rushdan Ibrahim	Biogreen Process Technologies
33	Kajian penghasilan kertas daripada jerami dan serkam padi Study on paper production from paddy hay and husk	Dr Rushdan Ibrahim	Institut Penyelidikan dan Kemajuan Pertanian Malaysia (MARDI)
34	Demonstrasi proses pengeluaran sap batang sawit dan pemisahan fiber menggunakan kaedah R&D FRIM III Demonstration of oil palm sap production and fiber separation processes using FRIM R&D	Dr Wan Asma Ibrahim	Biological Resources and Post-Harvest Division, JIRCAS
35	Pemantauan, penentuan dan pengecaman serangga perosak di ladang-ladang <i>Akasia</i> Monitoring, diagnosis and identification of pests and diseases in <i>Acacia</i> plantations	Dr Lee Su See	Grand Perfect Sdn Bhd
36	Penyediaan borang maklumat projek bagi Projek Gef5 bertajuk "Stimulating Bamboo Industry for Wealth Creation in Rural Area Malaysia" Preparation of project information form (Pif) for Gef5 project "Stimulating Bamboo Industry for Wealth Creation in Rural Area Malaysia"	Dr Wan Asma Ibrahim	United Nation Industrial Development Organisation (UNIDO)
37	Audit Kts Plantation Sdn Bhd Sagaliud Lokan FMU, Sabah Audit on Kts plantation Sdn Bhd Sagaliud Lokan FMU, Sabah	Dr Lim Hin Fui	SIRIM QAS International Berhad

BIL. NO.	BIDANG FIELD	PENGURUS PROJEK PROJECT MANAGER	PELANGGAN CLIENT
38	Menyediakan rancangan pengurusan kawasan tadahan air bagi Jabatan Perhutanan Negeri Perak To provide water catchment area management plan for Perak Forest Department	Dr Abd Rahman Kassim	Jabatan Perhutanan negeri Perak
39	Impak ekonomi ke atas Geran Dana Komersialisasi R&D (CRDF) dan Dana Perolehan Teknologi (TAF) MTDC di Bawah Rancangan Malaysia ke-9 Economic impacts of MTDC Commercialisation Research & Development Fund (CRDF) and Technology Acquisition Fund (TAF) grants under the 9th Malaysian Plan	Mohd Parid Mamat	Malaysian Technology Development Corporation Sdn Bhd
40	Kesan luluhawa luar bagi produk komposit buluh dan balau (mekanikal, luluhawa semula jadi dan kestabilan dimensi) Outdoor weathering effect on balau and bamboo composites products properties (mechanical, natural weathering and dimensional stability)	Hashim W. Samsi	Lionex (M) Sdn Bhd
41	Menyediakan latihan dalam bidang pemantauan dan penilaian kerja-kerja pemangkasan pokok To provide training on monitoring and evaluation of tree pruning	Mohd Afendi Hussin	Majlis Perbandaran Johor Bahru Tengah
42	Audit pensijilan semula Unit Pengurusan Hutan Negeri Sembilan Recertification audit on Negeri Sembilan State FMU for Forest Management Certification	Dr Lim Hin Fui	SIRIM QAS International Berhad
43	Pelantikan sebagai pakar Kajian Pelan Induk bagi Pembangunan Ekonomi Mapan Expert engagement for the Master Plan Study for Sustainable Economic Development of the Score Interior	Dr Hashim Md Noor	Jurutera Perunding Wahba Sdn Bhd
44	Pemetaan hutan tanah lembap di Perak Darul Ridzuan Wetland forest mapping for the state of Perak Darul Ridzuan	Dr Khali Aziz Hamzah	Institut Darul Ridzuan
45	Audit pensijilan semula Unit Pengurusan Hutan Kedah ke atas Keperluan MC&I 2002 & MC&I (Hutan Asli) Recertification audit on Kedah FMU against requirements of MC&I 2002 & MC&I (Natural Forest)	Dr Lim Hin Fui	SIRIM QAS International Berhad
46	Perundingan dan demonstrasi fasiliti R&D pengestrakan sap OPT FRIM's Consultative & Demonstration of OPT Sap Extraction R&D Facilities	Dr Wan Asma Ibrahim	Biological Resources and Post-Harvest Division, JIRCAS

BIL. NO.	BIDANG FIELD	PENGURUS PROJEK PROJECT MANAGER	PELANGGAN CLIENT
47	Pembuatan dan pengujian kertas menggunakan PCC dan polimer II Paper making and testing using PCC and polymer	Dr Rushdan Ibrahim	Pusat Penyelidikan Mineral
48	Penasihat teknikal, penubuhan, silvikultur dan pengurusan ladang hutan bagi pokok hutan Technical, establishment, silviculture and management of forest plantations for forest trees	Dr Lok Eng Hai	Imbangan Jaya Sdn Bhd
49	Inventori pokok di Majlis Bandaraya Melaka Bersejarah Tree inventory at the Historical Malacca City Council	Adnan Mohammad	Arbor Master Resources
50	Kajian jangka hayat resin bagi produk kertas The study on resin life span for paper products	Dr Sharmiza Adnan	Malayan Adhesives & Chemicals Sdn Bhd
51	Pelan pengurusan industri buluh negeri Perak di kawasan konsesi Hutan Simpan Bintang Hijau The Perak State Bamboo industry management plan in Bintang Hijau Forest Reserve concession area	Abd Razak Othman	Perbadanan Kemajuan Negeri Perak
52	Peningkatan taraf Sistem Pengurusan Gaji MARDI Upgrading of MARDI Salary Management System	Wan Zahiri Hj Wan Yaacob	Institut Penyelidikan dan Kemajuan Pertanian Malaysia (MARDI)
53	Aplikasi sistem slip gaji dan penyata EC Application of payment slip and EC statement	Wan Zahiri Hj Wan Yaacob	Institut Penyelidikan Keselamatan Jalan Raya Malaysia
54	Aplikasi sistem EOT Miros Application of EOT MIROS system	Norul Maslissa Ahmad	Institut Penyelidikan Keselamatan Jalan Raya Malaysia
55	Pemantauan, diagnosa dan pengecaman perosak dan penyakit di ladang <i>Acacia</i> Monitoring, diagnosis and identification of pests and diseases in <i>Acacia</i> Plantations	Dr Lee Su See	Grand Perfect Sdn Bhd
56	Kajian pembuatan dan pengujian kertas menggunakan resin Study on the paper making and testing by using resin	Dr Sharmiza Adnan	Malayan Adhesives & Chemicals Sdn Bhd
57	Kualiti kayu dan kemasan kayu Wood quality and finishing	Dr Hamdan Husain	T.J Civil & Contractor Sdn Bhd
58	Taksiran nilai dirian jati dan gaharu The valuation of jati and gaharu stand	Dr Abd Rahman Kassim	Hock Swee Seng Sawmill Sdn Bhd
59	Penasihat teknikal penubuhan ladang hutan, silvikultur dan penginokulatan spesies pokok <i>Aquilaria</i> Technical advisor, forest plantation establishment, silviculture and inoculation of <i>Aquilaria</i> tree species	Dr Lok Eng Hai	Oji Paper Asia Sdn Bhd

**PELESENAN
LICENSING**

BIL. NO.	TEKNOLOGI TECHNOLOGY	PELESEN LICENSEES
1	Edible Ginger Tissue Culture	Biological Farming Solutions (M) Sdn Bhd
2	Beehive Ginger Cut Flower	Halex Biotechnologies (M) Sdn Bhd
3	1. Engineered Wood From Palm Trunk (E-PaWV) 2. Corrugated Hybrid Palm Wood Veneer (C-HyPaWV)	Sasabina Recreation & Industries Sdn Bhd
4	Timber Processing using High Temperature Drying System (HTD)	Tech-Wood Industries Sdn Bhd
5	Chairs (Seats)	Supreme Tropical Furniture Sdn Bhd
6	Standardised Extract from <i>Baeckea frutescens</i> with Anti-Gout Properties	Alfa Hijauan Emas Sdn Bhd

**PENDEDAHAN REKA CIPTA
INVENTION DISCLOSURE**

BIL. NO.	NO. IDENTITI ID NO.	REKA CIPTA INNOVATION	KETUA PEREKA CIPTA KEY INNOVATOR
1	01/2012	Anti-Gout Compound Isolated from <i>Baeckea frutescens</i>	Dr Fadzureena Jamaludin
2	02/2012	Mud Profile Sample for Mangrove Soil Sampling	Mohamad Fakhri Ishak
3	03/2012	Good Budget System (GBS)	Mohamad Jemain Mohamad Ridhwan
4	04/2012	Micropropagation of Commercial Orchids for Cutflower Industry (<i>Dendrobium</i> Shavin White and <i>Dendrobium</i> Shavin Pink)	Haliza Ismail
5	05/2012	Micropropagation of Tiger Orchid (Orkid Harimau) <i>Grammatophyllum speciosum</i> Blume	Haliza Ismail
6	06/2012	Micropropagation of <i>Aglaonema</i> Hybrid (<i>Aglaonema</i> Lady Valentine)	Haliza Ismail
7	07/2012	Bioactives from <i>Aquilaria</i> Species and Agarwood Oils for Personal Care and Cosmeceutical Uses	Dr Nor Azah Mohd Ali
8	08/2012	C-Hypawv (Corrugated Hybrid Palm Wood Veneer)	Abdul Hamid Salleh
9	09/2012	Super Engineered Lumber Made from Barks of Palm Trees (SELFBOP)	Dr Wan Tarmeze Wan Ariffin
10	10/2012	Method for Synthetic Seed Production from Encapsulated Somatic Embryos of Tongkat Ali (<i>Eurycoma longifolia</i>)	Nashatul Zaimah Noor Azman
11	11/2012	Lazhold 1	Sadali Sahat
12	12/2012	Lazhold 2	Sadali Sahat
13	13/2012	Engineered Veneer Plank (Eveplan) and the System to Manufacture the Products	Dr Wan Tarmeze Wan Ariffin

BIL. NO.	NO. IDENTITI ID NO.	REKA CIPTA INNOVATION	KETUA PEREKA CIPTA KEY INNOVATOR
14	14/2012	Anti-Gout Standardised Extract (SEBF) from <i>Baeckea frutescens</i>	Dr Fadzureena Jamaludin
15	15/2012	Polysaccharide Fraction from Fruit of <i>Averrhoa carambola</i> as Cholesterol Lowering Agent	Dr Zunoliza Abdullah
16	16/2012	Seventeen Microsatellite Markers of <i>Aquilaria malaccensis</i>	Dr Lee Soon Leong
17	17/2012	Dual-Axis Densification Strand Woven Lumber Utilising Pre-Shaped Veneers and Strands (DADSLUV)	Dr Wan Tarmeze Wan Ariffin
18	18/2012	New Processing Method for Plybamboo Manufacturing	Dr Khairun Anwar Uyup
19	19/2012	Microsatellite Markers of <i>Ficus deltoidea</i> (Moraceae) for DNA Profiling	Dr Tnah Lee Hong
20	20/2012	Tissue Culture Protocol for the Production of Mahkota Dewa	Nazirah Abdullah
21	21/2012	Drawers Chest with Electrical Outlet at the Top and Compartment Ready for Speakers (Ghost CHARM)	Dr Wan Tarmeze Wan Ariffin
22	22/2012	Standardised Extract of <i>Prismatomeris malayana</i> with Triterpenoids Contents of at Least 10% Ursolic Acid Equivalent	Nor Hayati Abdullah
23	23/2012	Micro-Propagation of <i>Peperomia malaccensis</i> (Piperaceae), a Highly Endemic Plant with Potential for Ornamental	Joanne Tan Pei Chih
24	24/2012	Microsatellite Markers of <i>Eurycoma longifolia</i> (Tongkat Ali) for DNA Profiling	Dr Lee Chai Ting
25	25/2012	Scrim-Based Engineered Lumber and Board from Young <i>Endospermum malaccense</i> Wood (MySCRIM-Sesenduk)	Dr Wan Tarmeze Wan Ariffin
26	26/2012	Sxanct Gold: Premium Herbal Standardised Extract (<i>Ocimum sanctum</i> Leaf)	Dr Vimala Subramaniam
27	27/2012	Microsatellite Markers of <i>Labisia pumila</i> (Kacip Fatimah) for DNA Profiling	Dr Tnah Lee Hong
28	28/2012	Microsatellite Markers of <i>Shorea platyclados</i> (Meranti Bukit) for DNA Fingerprinting	Dr Ng Chin Hong
29	29/2012	Borapetoside B, Borapetoside C and Syringin form <i>Tinospora crispa</i> Extract as Hypocholesterolemic Agent	Dr Rasadah Mat Ali
30	30/2012	Agarwood Relaxation Indexer	Dr Nor Azah Mohd Ali

**PEMFAILAN PATEN
PATENT FILING**

BIL. NO.	PATEN PATENT	NO. HI IP NO.	KETUA PEREKA CIPTA KEY INNOVATOR
MALAYSIA MALAYSIA			
1	A Method for Producing Paper Pulp from Oil Palm Wastes	PI 2012700146	Dr Mohamed Nor Mohd Yusoff
2	A Process of Producing Bioethanol from Rice Straw	PI 2012700177	Rafidah Jalil
3	Hybrid Corrugated Veneer	PI 2012700466	Abdul Hamid Salleh
4	Microsatellite Markers for DNA Profiling of <i>Aquilaria malaccensis</i>	PI 2012700557	Dr Lee Soon Leong
5	A Method of Manufacturing Engineered Lumber and the Engineered Lumber Produced	PI 2012003865	Dr Wan Tarmeze Wan Ariffin
ANTARABANGSA INTERNATIONAL			
1	High Temperature Drying (HTD) System for Rubberwood and Tropical Hardwoods	1-2012-00182 (Vietnam)	Choo Keng Ten/ Dr Sik Huei Shing
2		W-00201200288 (Indonesia)	
3		1201000385 (Thailand)	
4		201202816-3 (Singapore)	
5		13/504,538 (US)	
6		201080048843.9 (China)	

**PENGIKTIRAFAN PATEN
PATENT GRANTED**

BIL. NO.	PATEN PATENT	NO. MY MY NO.	PEREKA CIPTA INNOVATOR
1	Artificial Lumber Block	MY-144683-A	Dr Wan Tarmeze Wan Ariffin Dato' Dr Marzalina Mansor

Kerjasama Penyelidikan Research Collaborations

Kerjasama penyelidikan antara FRIM dan rakan kongsi dari luar FRIM akan memberi manfaat kepada FRIM terutamanya dalam memperkasa keupayaan R, D & C para penyelidik FRIM. Pada 2012, sebanyak 17 kerjasama penyelidikan (13 memorandum persefahaman (MoU) dan empat perjanjian) telah ditandatangani antara MFRDB dengan pelbagai pelanggan yang terdiri daripada pihak industri bertujuan meningkatkan keupayaan R&D FRIM; serta memenuhi kehendak pasaran dan keperluan pihak-pihak berkepentingan.

Research collaboration between FRIM and external partners is beneficial to FRIM, particularly in strengthening the R, D & C capability of FRIM researchers. In 2012, a total of 17 research collaborations were signed (13 memoranda of understanding (MoU) and four agreements) by MFRDB with various stakeholders and industrial parties to further enhance R&D capacities in FRIM and to meet market demands as well as the needs of stakeholders.

MEMORANDUM PERSEFAHAMAN MEMORANDUM OF UNDERSTANDING

BIL NO.	RAKAN KERJASAMA COLLABORATOR	TAJUK/BIDANG KERJASAMA TITLE/FIELD OF COLLABORATION	KETUA PROJEK PROJECT LEADER	TARIKH T/ TANGAN SIGNING DATE
1	Perbadanan Taman Negara Johor (PTNJ)	Melaksanakan penyelidikan dan pembangunan (R&D) di kawasan PTNJ bagi tujuan konservasi, penyelidikan, pendidikan dan ekopelancongan To conduct R&D in PTNJ area for conservation, research, education and eco-tourism	Dr Shamsudin Ibrahim	11 Februari/ February
2	CIRAD	Pemanjangan tempoh perkhidmatan Dr Roda bagi projek biayaan MTIB (pasaran kayu getah) Extension of Dr Roda's service for the MTIB funded project (rubberwood market)	Dr Ismariah Ahmad / Rohana Abdul Rahman	12 Februari/ February
3	Kangwon National University (KNU), Korea	Kerjasama R&D di bidang perhutanan termasuk pengurusan hutan, geoinformasi, hidrologi, perubahan iklim, ekopelancongan dan produk hutan R&D collaboration in forestry including forest management, geoinformation, hydrology, climate change, eco-tourism and forest products.	Dr Khali Aziz Hamzah	13 Februari/ February
4	Sarawak Timber Industry Development (STIDC)-Universiti Malaysia Sarawak (UNIMAS)	Kerjasama latihan dan penubuhan makmal ujian perabot. Collaboration in training and the establishment of furniture testing laboratory	Dr Rahim Sudin/ Dr Tan Yu Eng/ Abdul Hamid Saleh	14 Februari / February
5	Indonesia Centre of Pulp & Paper	Bidang pembangunan bahan mentah, additiv, pulpa, proses pelunturan, pembuatan kertas dan proses pembuatan derivatif selulosa Development of raw materials, additives, pulp, bleaching process, paper making and cellulose derivative making process	Dr Rushdan Ibrahim	27 Februari / February

BIL NO.	RAKAN KERJASAMA COLLABORATOR	TAJUK/BIDANG KERJASAMA TITLE/FIELD OF COLLABORATION	KETUA PROJEK PROJECT LEADER	TARIKH T/ TANGAN SIGNING DATE
6	Perbadanan Putrajaya (PPj)	Mempertingkatkan kualiti pengurusan hutan bandar dan pokok-pokok landskap di sekitar Putrajaya dan melaksanakan projek R&D dalam bidang pengurusan pokok landskap dan hutan bandar To enhance urban forest and landscape trees management quality in Putrajaya and to conduct R&D projects in landscape and urban forest trees management	Dr Noor Azlin Yahya	14 April
7	Universiti Teknologi Malaysia (UTM)	Kerjasama penyelidikan dalam bidang penghutan semula kawasan ladang getah Research collaboration in replanting of rubberwood plantations	Dr Ahmad Zuhaidi Yahya	30 April
8	Cube Global Sdn Bhd	Kerjasama R&D berkepentingan tinggi dalam bidang perhutanan dan alam sekitar R&D collaboration of high importance in forestry and environment	Dr Shamsudin Ibrahim/Nur Hajar Zamah Shari	8 Mei/May
9	JAXA	Kajian penentuan stok karbon dalam tempoh 20 tahun bagi Semenanjung Malaysia Study on carbon stock in Peninsular Malaysia for 20 years	Dr Khali Aziz Hamzah	30 Mac/March
10	Malaysian Wood Industries Association (MWIA)	Kerjasama R&D dalam projek tajaan TPIKM R&D collaboration in TPIKM funded projects	Dr Gan Kee Seng	8 Jun/June
11	Fibersmith Technology Sdn Bhd	Penghasilan produk pembungkus industri mesra alam secara komersial Production of commercialised industry packaging products	Mahmudin Saleh	8 Jun/June
12	Research Institute of Tropical Forestry, Chinese Academy of Forestry (RITF)	Penyelidikan hutan tropika Tropical forests research	Dr Ahmad Zuhaidi Yahya	1 September
13	UiTM Perak	Kerjasama dalam penyelidikan dan pembangunan biodiversiti dan pemuliharaan flora dan fauna; pengurusan pemuliharaan untuk spesies tumbuhan terancam dan habitatnya; pemindahan teknologi; latihan dan pembangunan kapasiti, serta pendidikan dan kesedaran awam R&D collaboration in biodiversity development and conservation of flora and fauna, conservation management for threatened plant species and habitat, technology transfer, training and capacity building, education and public awareness.	Dr Saw Leng Guan	4 September

PERJANJIAN AGREEMENTS

BIL. NO.	RAKAN KERJASAMA COLLABORATOR	TAJUK/BIDANG KERJASAMA TITLE/FIELD OF COLLABORATION	KETUA PROJEK PROJECT LEADER	TARIKH T/ TANGAN SIGNING DATE
1	TRADA Technology Ltd	Aspek pensijilan dan keluaran hutan Certification and forest products aspects	Dr Tan Yu Eng	22 Julai/ July
2	Agensi Inovasi Malaysia	Komersialisasi harta intelek yang dapat menangani masalah industri dan memberi manfaat kepada negara Commercialisation of intellectual properties that able to handle industry beneficial to the nation	Dr Nur Supardi Md Noor	28 Ogos / August
3	Bumi Amarda	Kerjasama bagi FRIM memelihara stok karbon di hutan FRIM dan sebagai sumbangan syarikat tersebut terhadap pemeliharaan alam sekitar serta perubahan iklim. Collaboration for FRIM to protect carbon stock in FRIM forest and act as the company's contribution towards environmental conservation and climate change	Dr Samsudin Musa	10 Oktober / October
4	Universiti Tun Hussein Onn Malaysia (UTHM)	Pelaksanaan aktiviti-aktiviti penyelidikan dan pembangunan serta latihan dalam bidang perhutanan dan keluaran hutan Implementation of R&D and training activities in forestry and forest products	En Imaludden Abdullah.	15 Oktober / October

Perjanjian antara FRIM dan TRADA Technology Ltd

FRIM akan menjalankan kerjasama dengan TRADA Technology Ltd (TTL) sebagai makmal ujian yang diluluskan bagi produk pembinaan dan kayu untuk tujuan eksport ke Eropah, sebagai memenuhi keperluan untuk kualiti, prestasi dan keselamatan produk. Perkhidmatan ujian merupakan sebahagian daripada proses pensijilan yang membuktikan produk mematuhi keperluan keselamatan dan kualiti bagi pasaran Eropah.

Perjanjian yang membolehkan makmal-makmal FRIM menyertai skim *CE Marking* dan *Q-Mark* ini telah ditandatangani pada 16 Julai 2012 antara FRIM dan TTL, yang merupakan cabang penilaian produk pembinaan BM TRADA Group, di ibu pejabat syarikat tersebut di United Kingdom. Dato' Dr Abd Latif Mohmod, Ketua Pengarah Institut Penyelidikan Perhutanan Malaysia (FRIM), yang mewakili Lembaga Penyelidikan dan Pembangunan Perhutanan Malaysia (MFRDB) telah menandatangani perjanjian tersebut, manakala TTL pula diwakili oleh Pengarahnya, Andrew Abbott. Skop ujian terhadap keperluan BM TRADA Certification (BMTc) Q-Mark/CE mark di bawah perjanjian ini merangkumi: i) ujian ketahanan kayu oleh Makmal Mikologi Kayu FRIM selaras dengan EN 350; dan ii) ujian kekuatan struktur kayu oleh Makmal Kejuruteraan Kayu.

Agreement Between FRIM and TRADA Technology Ltd

FRIM will be working with TRADA Technology Ltd. (TTL) as an Approved Testing Laboratory for timber and construction products, intended for export to Europe, to check compliance to requirements for product safety, performance and quality. The testing services form part of the certification process to demonstrate the product compliance with safety and quality requirements for the European markets and perhaps, the Middle East market.

The agreement to enable FRIM testing laboratories to collaborate on the CE Marking and Q-Mark schemes was signed on 16 July 2012 with TTL—a construction products testing arm of the BM TRADA Group—at the company head office in United Kingdom (UK). FRIM Director General (DG) Dato' Dr Abd Latif Mohmod represented the Malaysian Forestry Research and Development Board (MFRDB) in signing the document, whilst TTL Director Andrew Abbott signed for TTL. The scope of testing against the requirements of BM TRADA Certification (BMTc) Q-Mark/CE mark under this agreement will initially look at two areas: wood durability by the FRIM Wood Mycology Laboratory in accordance with EN 350; and strength testing of structural timber by the Timber Engineering Laboratory.

Salah satu kaedah berkesan bagi meningkatkan rantaian nilai produk Malaysia adalah dengan memastikan pematuhan produk berkaitan kepada piawaian antarabangsa atau serantau walaupun proses pematuhan sesetengah keperluan piawaian ini agak mencabar dari segi teknikal dan kos. Sebagai contoh, produk untuk dieksport ke Eropah perlu diuji oleh makmal-makmal berkelayakan yang kebanyakannya terletak di Eropah, sementara Badan Pemberitahuan pula mesti merupakan syarikat yang berdaftar di Eropah. Sebagai sebuah institut yang memenuhi pematuhan ISO-9001 dengan pengalaman dalam pengujian produk berasaskan kayu, serta mempunyai makmal-makmal ujian yang telah memperoleh akreditasi ISO/IEC 17025, FRIM mempunyai keupayaan untuk membantu dalam proses pengujian dan pensijilan di Malaysia. Usaha FRIM ini akan dapat membantu industri berasaskan kayu di negara ini untuk menjimatkan masa dan kos di samping mengukuhkan kedudukan FRIM di persada antarabangsa. Antara lain, FRIM juga menawarkan perkhidmatan ujian perabot yang diiktiraf oleh Persatuan Penyelidikan Perindustrian Perabot (Furniture Industry Research Association/FIRA) yang merupakan sebuah anak syarikat BM TRADA Group. BM TRADA Certification Ltd merupakan badan pensijilan terkemuka pelbagai sektor yang diiktiraf oleh United Kingdom (UKAS). BM Trada Q-Mark ialah salah satu proses pensijilan yang paling ketat untuk produk pembinaan, yang diiktiraf oleh pihak berkuasa, penyedia jaminan kediaman dan digunakan oleh syarikat dan pengeluar pembinaan bertaraf. Penandaan CE merupakan 'pasport' yang membolehkan sesuatu produk dipasarkan dengan bebas di seluruh Eropah tanpa keperluan menjalankan ujian tambahan atau pensijilan sebagai bukti patuhi keperluan undang-undang setiap negara anggota EU.

Perjanjian antara FRIM dan Bumi Armada

Dalam usaha untuk memelihara hutannya, FRIM mengalukan segala sokongan, sumbangan dan kerjasama dengan pihak kerajaan dan bukan kerajaan termasuk badan-badan korporat. Ketua Pengarah FRIM, Dato' Dr Abd Latif Mohmod yang mewakili MFRDB menandatangani perjanjian antara FRIM dan Bumi Armada sempena majlis pelancarannya di FRIM, Kepong pada 10 Oktober 2012. Bumi Armada diwakili oleh Pengarah Eksekutif dan Ketua Pegawai Eksekutifnya, Hassan Basma dengan disaksikan oleh Pengerusi MFRDB, YB Hajah Nancy Shukri.

Projek kerjasama ini melibatkan pemuliharaan karbon tersimpan di Field 11, iaitu tapak hutan seluas 5.6 ha yang mempunyai kapasiti sebanyak 3938.6 tan CO₂ equivalent (CO₂e) setahun. Sumbangan daripada Bumi Armada berjumlah RM107 000 akan meliputi pemuliharaan kredit karbon di tapak ini untuk tempoh selama lima tahun. Ofset karbon ialah salah satu mekanisme yang membolehkan seseorang individu, syarikat dan negara mengimbangi pengeluaran CO₂ mereka melalui pengurangan atau

One of the effective ways to push the Malaysian products up the value chain is to comply with international or regional standards for relevant products although compliance with many of such requirements may be challenging, both in terms of technicalities and cost. For one such requirement, namely CE Marking for the European Community, products to be exported to Europe must be tested by approved testing laboratories, mostly located in Europe, whereby the Notified Body must be incorporated in Europe. Being a Corporate ISO-9001 compliant institution with decades of experience in the testing of wood-based products and with many of its testing laboratories having recently attained the ISO/IEC 17025 status, it is logical for FRIM to assist in the testing and standards certification process. Once this is successfully executed, it will save the country's wood-based industry both time and money, besides strengthening FRIM position in the international arena. Among others, FRIM also offers furniture testing services accredited by the Furniture Industry Research Association (FIRA), another subsidiary of the BM TRADA Group. BM TRADA Certification Ltd is a leading multi-sector certification body accredited by United Kingdom Accreditation Service (UKAS). BM TRADA Q-Mark is one of the most rigorous certification processes for construction products, recognised by regulatory authorities, home warranty providers and used by world-class construction companies and manufacturers. CE marking is a 'passport' for products to pass freely throughout Europe without manufacturers having to conduct more testing or certification to prove their products comply with the legal requirements of each member country.

Agreement between FRIM and Bumi Armada

In its effort to conserve the forest, FRIM welcomes support, contributions and collaborations with governmental and non-governmental organisations including corporate bodies who share its values and objectives. FRIM Director General, Dato' Dr Abd Latif Mohmod who represented the MFRDB signed the agreement between FRIM and Bumi Armada on the collaborative project at the launching ceremony held at FRIM in Kepong on 10 October. Bumi Armada was represented by Executive Director and Chief Executive Officer, Hassan Basma and the signing ceremony was also witnessed by MFRDB Chair, YB Hajah Nancy Shukri.

The project involves the conservation of carbon stored at Field 11, a 5.6-ha of forest site which has the capacity to store 3938.6 tons of CO₂ equivalent (CO₂e) annually and Bumi Armada's contribution of RM107 000 will cover the carbon credits from this site for over a period of five years. Carbon offsets enable individuals, companies and countries to reduce their CO₂ emissions by offsetting,

penyisihan CO₂ ke tempat lain. Pengurangan pelepasan CO₂ adalah penting dalam usaha untuk mengurangkan potensi kesan buruk perubahan iklim yang dihadapi oleh masyarakat global hari ini. Oleh itu, ia merupakan tanggungjawab semua untuk mengurangkan pengeluaran CO₂ dan menangani masalah perubahan iklim. Kerjasama FRIM-Bumi Armada ini adalah satu kejayaan besar bagi Malaysia kerana ia mencerminkan peranan penting yang boleh dimainkan oleh sektor swasta dalam menangani isu perubahan iklim.

reducing or displacing CO₂ in another place. Reduction of CO₂ is an integral effort in mitigating the potential devastating impacts of climate change facing the global community today. As such it is everybody's responsibility to reduce CO₂ emissions and address climate change. The FRIM-Bumi Armada collaboration is a major milestone for Malaysia as it reflects the important role the private sector can play in addressing climate change issues.

Hal Ehwal Antarabangsa International Affairs

Laporan Komunikasi Kebangsaan Kedua (NC2) kepada UNFCCC

Selaku ahli kepada konvensyen *United Nations Framework Convention on Climate Change* (UNFCCC), Malaysia bertanggungjawab melaporkan inventori gas rumah hijau (GHG) setiap dua tahun melalui laporan terkini dan menyediakan laporan lengkap setiap empat tahun melalui Laporan Komunikasi Kebangsaan. Laporan Komunikasi Kebangsaan Kedua (NC2) telah dihantar pada Januari 2011, bersama dengan maklumat dan metodologi yang ditambah baik daripada Laporan Komunikasi Kebangsaan Pertama (INC). Lima sektor sumber pelepasan GHG yang utama telah dikenal pasti iaitu, Perubahan Guna Tanah dan Perhutanan (LULUCF), Tenaga, Bahan Buangan, Pertanian dan Proses Industri. FRIM telah dipertanggungjawabkan untuk mengetuai sektor LULUCF. Hasil laporan NC2 adalah sebahagian daripada pembiayaan Projek *United Nations Development Programme-Global Environment Facility (UNDP-GEF) on Enabling Activities for the Preparation of Malaysia's Second National Communication to the UNFCCC*.

NC2 mendokumentasi pelepasan dan penyerapan gas rumah hijau (GHG) bagi tahun 2000, dan tiga gas rumah hijau (GHG) utama yang diambil kira ialah karbon dioksida (CO₂), gas metana (CH₄) dan gas nitrus oksida (N₂O). Input data untuk inventori diperolehi daripada kedua-dua statistik kebangsaan dan antarabangsa serta rundingan bersama pihak berkepentingan. Nilai andaian IPCC dan faktor pelepasan tempatan diguna sebagaimana yang diperlukan dan Garis Panduan IPCC 1996 yang digubal juga diguna sepertimana yang dipersetujui dalam Persidangan Parti-Parti UNFCCC yang kelapan (COP8). Dari segi sumber pelepasan gas rumah hijau, sektor Tenaga didapati pengeluar utama bagi gas CO₂, diikuti oleh pelepasan gas CH₄ daripada tapak pelupusan sampah dan pelepasan gas N₂O daripada tanah pertanian. Justeru, Malaysia adalah Penyerap GHG bagi tahun 2000 kerana sumbangan kadar sekuestrasi karbon yang tinggi daripada sektor perhutanan. Hutan di Malaysia dijangka terus kekal sebagai penyerap CO₂ yang berupaya menurunkan jumlah pelepasan gas rumah hijau daripada sektor-sektor lain. Justeru, mengurus hutan secara mampan adalah penting dan perlu diteruskan demi memastikan pelepasan gas rumah hijau negara terkawal.

Selain pengiraan GHG, NC2 juga merangkumi unjuran pelepasan GHG berdasarkan data dahulu dan kini bagi melaksanakan langkah-langkah mitigasi dan adaptasi yang bersesuaian khususnya di Malaysia. Bagi unjuran tersebut, analisis berkala pelepasan GHG merangkumi semua sektor kecuali Proses Industri dari tahun 1990 hingga 2007 diguna. Keputusan jangkaan menunjukkan Malaysia akan menjadi pelepas GHG (net emitter) bagi tahun 2005 dengan jumlah bersih pelepasan sebanyak 38.7 juta tan metrik CO₂ eq. Sektor Tenaga akan meningkat mengikut arus pembangunan GDP negara dan ia menunjukkan bahawa pertumbuhan negara diterajui oleh tenaga bahan api; pelepasan daripada sektor Bahan Buangan juga dilaporkan meningkat secara tetap, manakala peningkatan

Second National Communication (NC2) Report to UNFCCC

As a signatory to the United Nations Framework Convention on Climate Change (UNFCCC), Malaysia is obliged to report its greenhouse gas (GHG) inventory every two years through a biennial update report and prepare a more complete report every four years through a National Communication. The Second National Communication (NC2) was the last inventory report submitted in January 2011, with improved information and methodology built on the Initial National Communication (INC). Based on the five key sources identified, FRIM was entrusted with the responsibility to lead the LULUCF (Land Use, Land Use Change and Forestry) apart from four others including Energy, Waste, Agriculture and Industrial Processes. The NC2 output was part of the funded United Nations Development Programme-Global Environment Facility (UNDP-GEF) Project on *Enabling Activities for the Preparation of Malaysia's Second National Communication to the UNFCCC*.

The NC2 documents the GHG emissions and removals for the year 2000, and the three main GHGs accounted are carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). Data input for the inventory was acquired from both national and international statistics as well as stakeholder's consultations. IPCC default values and local emissions factors were applied where required and Revised IPCC 1996 Guidelines were used in line with Decision at UNFCCC 8th Conference of Parties (COP8). In terms of sources of emissions, energy was the leading emitter of CO₂, followed by landfills in CH₄ emissions and agricultural soils in N₂O emissions. Thus, Malaysia was a net sink for the year 2000 due to the high carbon sequestration accounted from forestry sector. It is anticipated that forests will remain an important sink to continue reducing total emissions from other sectors and hence sustainable forest management policies and practices are deemed crucial to keep our country green.

Aside from GHG accounting, the NC2 also covers future emissions projection based on current and historical data to plan and implement relevant adaptation and mitigation measures in Malaysia. The emission time series analysis covers all sectors except Industrial Processes from 1990 to 2007. Emission estimations showed that Malaysia became a net emitter by 2005 with net emissions of 38.7 Mt CO₂ eq. While energy sector follows the trend of the country's GDP indicating a fossil energy driven growth; emissions from the waste sector is steadily rising and that from LULUCF and Agriculture sectors have stabilised. Further to that point,

dalam sektor LULUCF dan Pertanian kelihatan lebih stabil. Dengan itu, pilihan untuk mengurangkan pelepasan GHG dalam lima sektor telah dikenal pasti berdasarkan analisis mitigasi. Analisis tersebut termasuklah analisis kos, potensi pengurangan pelepasan GHG, pengenalpastian halangan pelaksanaan, penilaian pilihan teknologi untuk pelbagai cadangan mitigasi, dan kerangka perundangan yang berkaitan. Langkah-langkah adaptasi seperti pengurusan air yang lebih baik dicadangkan sebagai tambahan kepada tindakan menangani kesan perubahan iklim.

Walaupun tujuan utama projek ini dilaksanakan adalah untuk memenuhi keperluan Malaysia kepada konvensyen UNFCCC, ia juga membantu memperluas jaringan pakar-pakar tempatan dan memperkukuh daya tahan pembangunan negara terhadap perubahan iklim. Bagi meneruskan kerja inventori yang lepas, Laporan Komunikasi Kebangsaan Ketiga (NC3) telah bermula dengan pelantikan semula FRIM sebagai ketua sektor LULUCF, berserta unsur-unsur penambahbaikan dalam penggunaan metodologi dan perolehan data yang lebih teliti untuk memastikan pengalaman inventori yang lebih baik dan memperoleh keputusan yang lebih tepat.

APAFRI

Dr Xu Daping, Pengarah Institut Penyelidikan Perhutanan Tropika (RITF), Akademi Perhutanan China bersetuju untuk menjadi tuan rumah kepada Mesyuarat Agung APAFRI yang keenam pada tahun ini. Mesyuarat Agung Keenam pada 31 Ogos 2012 telah memilih semula FRIM sebagai pengerusi Jawatankuasa Eksekutif APAFRI untuk penggal kedua. Ahli-ahli lain Jawatankuasa Eksekutif (2012–2015) ialah:

Timbalan Pengerusi: Indian Council for Forestry Research and Education—Dr VK Bahuguna. Ahli-ahli:

- *Forestry and Forest Products Research Institute (Jepun)*—Dr Isamu Okochi
- *Ecosystems Research and Development Bureau (Filipina)*—Dr Aida Baja-Lapis
- *Universiti Putra Malaysia*—Prof Faridah Hanum Ibrahim
- *Korea Forest Research Institute*—Dr Park JungHwan
- *Fiji Forest Department*—Mr Elik Senivasa Sigarugurugu
- *Indian Plywood Industries Research and Training Institute*—Dr CN Pandey

Dr Xu Daping dari RITF dan Dr Ramulo Aggangan dari *Forest Products Research and Development Institute (Filipina)* dilantik sebagai Juruaudit Dalam.

APAFRI telah mewujudkan Anugerah Penyelidikan Perhutanan Dr YS Rao untuk penyelidik muda yang berjaya memberi sumbangan cemerlang dalam penyelidikan dan pembangunan perhutanan dan diberi setiap tiga tahun sekali. Anugerah ini adalah untuk memperingati sumbangan

options for emission reductions in the five sectors were determined based on the mitigation analysis. The analysis including cost analysis, emission reduction potential, identification of barriers to implementation, assessment of technology options for different mitigation proposals and related legal and institutional frameworks. Adaptation measures such as improved water resources management were proposed in addition to actions addressing projected climate change impacts.

While the project process's main purpose was to fulfill Malaysia's obligation to UNFCCC, it also helped to widen the national climate change expert base and strengthen the nation's resilience to climate change. As a continuation of the previous work, a Third National Communication (NC3) was initiated with FRIM being appointed again to lead the LULUCF sector with improvement in the methodology used and much detailed data inputs as to ensure a better inventory experience and more refined results in the end.

APAFRI

Dr Xu Daping, the Director of Research Institute of Tropical Forestry (RITF), Chinese Academy of Forestry has graciously consented to host the General Assembly. The Sixth General Assembly in the afternoon of 31 August 2012 had re-elected FRIM to be the chair of the APAFRI Executive Committee for a second term. The other members of the Executive Committee (2012–2015) are:

Vice-chair: Indian Council for Forestry Research and Education—Dr VK Bahuguna. Members:

- *Forestry and Forest Products Research Institute (Japan)* —Dr Isamu Okochi
- *Ecosystems Research and Development Bureau (Philippines)*—Dr Aida Baja-Lapis
- *Universiti Putra Malaysia*—Prof Faridah Hanum Ibrahim
- *Korea Forest Research Institute*—Dr Park JungHwan
- *Fiji Forest Department*—Mr Elik Senivasa Sigarugurugu
- *Indian Plywood Industries Research and Training Institute*—Dr CN Pandey

Dr Xu Daping of RITF and Dr Romulo Aggangan of the *Forest Products Research and Development Institute (Philippines)* were nominated as the Internal Auditors.

APAFRI has instituted the Dr YS RAO Forestry Research Award for a young researcher who has made outstanding contributions in forestry research and development. It is given once every three years and presented in conjunction with the APAFRI General Assembly. This award was established to commemorate the contribution of the late Dr



Dato' Dr Abd. Latif (lima dari kanan) mempengerusikan APAFRI 6th General Assembly
 Dato' Dr Abd. Latif (fifth from right) chaired the APAFRI 6th General Assembly

mendiang Dr YS Rao dalam bidang perhutanan di rantau ini. Dr Rao juga merupakan Penasihat Kanan untuk Program Sokongan Penyelidikan Perhutanan bagi Asia dan Pasifik (FORSPA), sebuah program FAO yang mencetuskan penubuhan APAFRI. Jawatankuasa Eksekutif telah memilih Dr. Ke Shufa, pensyarah dari Universiti Renmin China—yang telah memberi sumbangan saintifik yang bermakna dalam bidang ekonomi perhutanan sebagai penerima anugerah pada tahun ini. Sebuah plak dan sijil penghargaan telah disampaikan kepada Dr Ke semasa Mesyuarat Agung di Guangzhou pada 31 Ogos 2012.

Pada tahun ini, APAFRI telah memperuntuk bantuan kewangan kepada *Indian Plywood Industries Research and Training Institute* bagi penganjuran *International Conference on the Future of Panel Industry—Challenges and Key Issues* pada 26–28 September 2012 dan Universiti Gadjah Mada Indonesia untuk *International Conference on the Impacts of Climate Change to Forest Pests and Diseases in the Tropics* pada 8–10 Oktober 2012.

Pada awal Jun 2012, APAFRI telah menandatangani memorandum persefahaman dengan *Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet)* untuk kerjasama yang lebih erat. APAFRI telah memperoleh dana dari APFNet untuk projek mengenai kajian peralihan hutan di beberapa negara di rantau ini. Mesyuarat diadakan pada bulan Julai dan berjaya meningkatkan kefahaman peserta mengenai pelbagai komponen projek, dan mempercepat segala aktiviti. Di bawah MoU yang dimeterai dengan Institut Penyelidikan Perhutanan Korea, APAFRI menerima sumbangan dana sebanyak USD50 000 pada 2011. Sebahagian besar daripada sumbangan pertama ini digunakan untuk membiayai satu simposium antarabangsa anjuran FRIM iaitu *Reclamation, Rehabilitation and Restoration Towards a Greener Asia*, 3–5 Julai 2012 di Kuala Lumpur. Sumbangan dana pada tahun 2012 berjumlah USD179000 diperuntukkan bagi beberapa aktiviti termasuk Bengkel *Global Forest Information Services (GFIS)* di Korea dan

YS Rao—a well-known forester in the region—to forestry. Dr Rao was also the Senior Programme Advisor for the Forestry Research Support Programme for Asia and the Pacific (FORSPA), an FAO programme which mooted the establishing of APAFRI. The Executive Committee has voted Dr Ke Shufa, a lecturer from the Renmin University China—who has made significant scientific contributions in the field of forestry economics—to be the recipient of the award this year. A plaque and certificate were presented to Dr Ke during the General Assembly in Guangzhou on 31 August 2012.

This year, APAFRI has provided support to the Indian Plywood Industries Research and Training Institute for the International Conference on the Future of Panel Industry—Challenges and Key Issues, 26–28 September; and the Gadjah Mada University Indonesia for the International Conference on the Impacts of Climate Change to Forest Pests and Diseases in the Tropics, 8–10 October.

APAFRI has in early June 2012 signed a Memorandum of Understanding with the Asia-Pacific Network for Sustainable Forest Management and Rehabilitation (APFNet) for closer collaboration. APAFRI has also secured funding from APFNet for a project on studying forest transition in a number of countries in the region. The project had its first full-member meeting in July and had greatly enhanced the participants' understanding of the various components of the project, and contributed to accelerate the progress of its various activities.

Under an MOU with the Korean Forest Research Institute, APAFRI has received a financial contribution of USD50 000 in 2011. A large portion of this first contribution had been used to fund the international symposium: *Reclamation, Rehabilitation and Restoration Towards a Greener Asia*, 3–5 July, organised by FRIM in Kuala Lumpur. The contribution for 2012 amounted to USD179 000 has been allocated for several activities including GFIS Workshops in Korea and Japan (postponed to 2013); a meeting on Forest Fire

Jepun (ditunda pada 2013); mengenai Pengurusan Kebakaran Hutan di Nepal (20–22 November 2012), persidangan antarabangsa mengenai *Traditional Forest-related Knowledge* di China (5-8 November 2012); bengkel Timurlaut Asia yang juga di China (akan diadakan pada 2013); sokongan kewangan kepada Penyelaras Serantau dan Pemudah Cara Teknikal IUFRO-GFIS di Korea; dan beberapa aktiviti APAFRI yang lain (termasuk Mesyuarat Agung Keenam APAFRI).

Keahlian APAFRI telah meningkat kepada 68 pada penghujung 2012 dengan penyertaan institut: *Institute of Forest Genetics and Tree Breeding (IFGTB)* dan *Institute of Wood Science and Technology (IWST)*, kedua-duanya dari India.

Pada 2012, APAFRI menerbitkan *Extended Abstracts from the Asia and the Pacific Workshop on Multinational and Transboundary Conservation of Valuable and Endangered Forest Tree Species, 5–7 December 2011, Guangzhou, China. IUFRO World Series Volume 30.*

Management in Nepal (20–22 November); an international conference on Traditional Forest-related Knowledge in China (5–8 November 2012); a Northeast Asia Workshop also in China (to be held in 2013); support to IUFRO-GFIS Regional Coordinator and Technical Facilitator in Korea; and other APAFRI activities (including the APAFRI Sixth General Assembly).

APAFRI membership increased to 68 as of end 2012, with the joining of the institute: Institute of Forest Genetics and Tree Breeding (IFGTB) and the Institute of Wood Science and Technology (IWST), both from India.

In 2012, APAFRI has published extended abstracts from the Asia and the Pacific Workshop on *Multinational and Transboundary Conservation of Valuable and Endangered Forest Tree Species*, 5–7 December 2011, Guangzhou, China as IUFRO World Series Volume 30.

Aktiviti yang dianjurkan/disertai oleh APAFRI pada 2012 **Activities Organized/Participated by APAFRI in 2012**

Tarikh/Date	Aktiviti/Activity	Tempat/Venue
3–5 Julai/July	International Symposium on Reclamation, Rehabilitation and Restoration Towards a Greener Asia	Kuala Lumpur, Malaysia
9–11 Julai/July	Second Training Workshop on Transitions to Sustainable Forest Management and Rehabilitation in Asia-Pacific Region	Kuala Lumpur, Malaysia
30 Ogos/August	APAFRI Eighteenth Executive Committee Meeting	Guangzhou, China
30 Ogos/August	APAFRI Sixth General Assembly	Guangzhou, China
1–3 September	International Symposium on Sustainable Management of Tropical Forests	Guangzhou, China
12–14 September	Regional Workshop on Forest Genetic Resources in Asia	Kuala Lumpur, Malaysia
26–28 September	International Conference on Future of Panel Industry – Challenges and Key Issues	Bangalore, India
8–10 Oktober/ October	International Conference on the Impacts of Climate Change to Forest Pests and Diseases in the Tropics	Yogyakarta, Indonesia
30–31 Oktober/ October	Seventh Carbon Forum Asia	Bangkok, Thailand
5–8 November	International Conference on Traditional Forest-related Knowledge and Culture for Green Economy	Yangling, China
20–22 November	Regional Pan-Asia / Pacific Consultation on Building Advanced National and Regional Capacities in Integrated Fire Management based on Participatory Involvement of Local Communities	Kathmandu, Nepal

Sistem Pengurusan Kualiti

Quality Management System

Pelaksanaan Audit Dalam

Audit dalam MS ISO 9001:2008, MS ISO/IEC 17025, QE/5S dan Penarafan Bintang telah dilaksanakan sebanyak dua kali pada tahun ini iaitu 19 Mac–12 April dan 5–28 September. Pada Siri 2/2012 audit MS ISO 9001 hanya dilaksanakan ke atas 63 CUMBS yang terpilih sahaja berbanding pada Siri 1/2012 sebanyak 95 CUMBS terlibat. Audit MS ISO/IEC 17025 dilaksanakan ke atas 15 makmal ujian FRIM dan 16 CUMBS telah diaudit Penarafan Bintang. Audit QE/5S pula melibatkan 31 Zon di FRIM. Secara keseluruhannya, kesemua jenis audit menunjukkan peningkatan yang positif dan amalan pengurusan kualiti semakin diterima pakai oleh warga FRIM.

Internal Audit

Internal auditing from MS ISO 9001:2008, MS ISO/IEC 17025, QE/5S and Star Rating were conducted twice this year; i.e. on 19 March–12 April and 5–28 September. Only 63 CUMBS were assessed in series 2/102 compared to 95 CUMBS in Series 1/2012. MS ISO/IEC 17025 auditing involved 15 testing laboratories for both series and 16 CUMBS for star rating. Meanwhile for QE/5S auditing, 31 zones were involved. Overall, there were positive improvements and all FRIM's staff adapted quality management system as part of their work culture.

Siri/ Series	Jumlah Penemuan Audit Dalam MS ISO 9001:2008 Mengikut Klausu MS ISO 9001:2008 Internal Audit Finding by Clause					
	Klausu/ Clause 4	Klausu/ Clause 5	Klausu/ Clause 6	Klausu/ Clause 7	Klausu/ Clause 8	Jumlah/ Total
1/2012	115	70	36	86	60	367
2/2012*	55	58	21	57	40	231

* hanya 63 CUMBS diaudit/only 63 CUMBS been audited

Siri/ Series	Jumlah Penemuan Audit Dalam MS ISO/IEC 17025 (15 Makmal Ujian) MS ISO/IEC 17025 Internal Audit Finding (15 Testing Laboratories)															Jumlah/ Total
	MAAK	WCB	CPK	FPL	WDL	WEL	FTL	MKK	WLL	WML	TEL	MKT	MBIO	NPQC	FK	
1/2012	5	1	3	5	2	3	1	5	2	8	2	6	5	4	4	56
2/2012	1	2	6	2	3	10	5	1	4		2	6	4	3	3	55

Siri/ Series	Purata Skor Penemuan Audit Dalam QE/5S Bagi 31 Zon/ Average Score QE/5S Internal Audit Finding for 31 zone						
	Utama/ Main	Guna sama/ Sharing	Individu	Simpanan/ Store	Umum/ General	Persekitaran/ Surrounding	Purata / Average
1/2012	76	80	82	75	81	80	78
2/2012	82	83	86	72	87	84	82

Audit Dalam Penarafan Bintang pula menunjukkan peningkatan pada siri 2/2012 dengan markah 81.34% (4 bintang) berbanding pada siri 1/2012 dengan markah 79.76 % (3 Bintang).

Star Rating internal audit showed improvement in series 2/2012 with 81.34% (4 stars) compared to 79.76% (3 stars) in Series 1/2012.

Audit Luar (Pemantauan) MS ISO 9001:2008/ MS ISO 9001:2008 External Audit (Surveillance)

Tarikh/ Date:	9 & 10 Oktober/ October
Jenis Audit/ Audit Type:	Pemantauan/ Surveillance 2
Juruaudit/ Auditors:	Moody International (Dr Ooi Cheng Lee, Mohd Nazib Marwan, Lim Hock Yam)
Jumlah/ Total CUMBS	50
Penemuan/ Findings:	Tiada sebarang penemuan ketidakpatuhan. Hanya enam pemerhatian dan tiga peluang penambahbaikan diberikan. FRIM berjaya mengekalkan pensijilan. There was no non-conformity complied. Only six observations and three opportunities for improvement were given. FRIM maintained the certification successfully.

Audit Luar MS ISO/IEC 17025

Sejumlah 11 audit luar MS ISO/IEC 17025 telah dilaksanakan sepanjang 2012. Pengauditan ini melibatkan tujuh makmal ujian di Bahagian Keluaran Hutan (WCTL, WDL, MAAK, WLL, FTL, WEL & PTL), satu makmal ujian di Bahagian Hasil Semula jadi (NPQC) dan satu makmal di Bahagian Bioteknologi Perhutanan (MKT). Penilaian telah dilaksanakan oleh juruaudit dari Jabatan Standard Malaysia. Secara keseluruhan tiada penemuan major yang diberikan dan berjaya mengekalkan akreditasi. NPQC pula berjaya melepasi compliance audit dan menjadi makmal yang kesebelas memperolehi akreditasi MS ISO/IEC 17025. Manakala WEL dan MKT telah melepasi Adequacy Audit.

External MS ISO/IEC 17025 Audit

A total of ten MS ISO/IEC 17025 external audit were conducted in 2011. Eight testing laboratories from Forest Product Division (WCTL, WDL, TEL, MAAK, WLL, MKK, FTL d& FPL) and one testing laboratory from Natural Product Division (NPQC) were assessed. There was no major non-conformity found and all the laboratories from Forest Product Division maintained the accreditation. Meanwhile, the WEL and MKT passed the Adequacy Audit.

Pelaksanaan audit luar 5S/QE (Pensijilan Semula)/QE/5S External Audit (Re-Certification)

Tarikh/ Date:	11 Oktober/ October
Jenis Audit / Type of audit:	Pensijilan Semula/ Recertification
Juruaudit/ Auditors:	Malaysian Procutivity Corporation (Pn. Marziah Ahmad)
Penemuan/ Findings:	Tiada sebarang ketidakpatuhan diberikan. Namun proses penambahbaikan menerusi aktiviti kaizen perlu dilakukan. Mendapat skor 89% dan disyorkan untuk pensijilan semula. There was no major or minor non-conformance. Continual improvement through kaizen need to be maintained. Total marks of 89% and successfully retained the certifications.

Petunjuk Prestasi Utama

Key Performance Indicators

PENCAPAIAN/TAHUN ACHIEVEMENT/YEAR	2011	2012
1. PENGURUSAN PENYELIDIKAN RESEARCH MANAGEMENT		
Projek penyelidikan (bilangan) Research projects (number)	188	184
Dana penyelidikan (RM juta) Research funds (RM million)	18.6	24.0
Kertas kerja dalam jurnal Papers in journals	515	118
Kertas kerja dalam jurnal (faktor impak) Papers in journals (impact factor)	na	45
Buku mewah Coffee table book	na	2
Buku rujukan Reference book	na	5
Kertas teknikal dan saintifik (bukan jurnal) Technical and scientific papers (non-journal)	105	468
Kertas teknikal dan saintifik yang dibentangkan Technical and scientific papers (presented)	143	220
Penerbitan rasmi FRIM (bilangan) Official publications (number)	37	30
Pendedahan reka cipta Invention disclosure	35	30
Menandatangani MoU/perjanjian MoU/agreement signed	17	19
2. PROMOSI PROMOTIONS		
Pameran/Exhibitions	24	14
Penghasilan artikel/rencana media massa Mass media articles/features produced	97	184
Penganjuran seminar/persidangan/bengkel/dialog/pemindahan teknologi Organising of seminars/conferences/workshops/dialogues/technology transfers	60	86

PENCAPAIAN/TAHUN ACHIEVEMENT/YEAR	2011	2012
3. AKTIVITI KOMERSIALISASI COMMERCIALISATION ACTIVITIES		
Hasil/output penyelidikan Research outcome/output	18	20
Menandatangani pelesenan pemindahan teknologi Signing of technology transfer licensing	1	6
Pemfailan paten Patent filing	10	11
4. PERKHIDMATAN SERVICES		
Ujian/Testing	na	112
Perundingan ikhtisas/Profesional consultancies	47	59
Latihan industri kepada pelajar IPT dalam bidang perhutanan Industrial training to students of higher learning institutions in forestry	210	203
Menganjurkan bengkel/dialog/pemindahan teknologi/program latihan kepada orang awam/industri dalam bidang-bidang kepakaran FRIM Organising workshops/dialogues/technology transfer/training programmes to the public/industries	na	16
5. PENDAPATAN (RM) INCOME (RM)		
Ujian/Testing	898,330	1.3 juta
Perundingan ikhtisas/Profesional consultancies	2.1 juta	4.3. juta
Ekopelancongan/Eco-tourism	na	1.4 juta
Penjualan bahan/Sales of materials	na	391,858
Perkhidmatan bukan teknikal (seminar, latihan dll) Non-technical services (seminars, trainings etc.)	na	1.4 juta
Royalti dan yuran pelesenan Royalty and licensing fee	na	3,000
6. PELAWAT VISITORS		
Rasmi/Official	na	683,946
Tidak rasmi/Non-official		

PENCAPAIAN/TAHUN ACHIEVEMENT/YEAR	2011	2012
<p>7. PENGIKTIRAFAN RECOGNITIONS</p> <p>Makmal yang mendapat pengiktirafan antarabangsa (Akreditasi ISO/IEC 17025/CARB/ift/FIRA) Laboratories that obtain international recognitions (ISO/IEC 17025/CARB/ift/FIRA accreditations)</p> <p>Makmal yang mendapat pengiktirafan kebangsaan (GMP/SOM/HALAL/BioNexus/IKM) Laboratories that obtain national recognitions (GMP/SOM/HALAL/BioNexus/IKM)</p>	na	14
<p>8. SUMBANGAN KEPAKARAN DI PERINGKAT KEBANGSAAN DAN ANTARABANGSA EXPERTIES CONTRIBUTIONS AT THE NATIONAL/INTERNATIONAL LEVELS</p> <p>Penghasilan kertas kerja melibatkan polisi Negara Paper works involving national policies produced</p> <p>Penglibatan dalam rundingan termasuk input teknikal di forum antarabangsa berkaitan dengan perhutanan dan alam sekitar yang memberi impak kepada Negara Involvement in consultancies including technical inputs at the international fora on forestry and environment that gave impact to the nation</p> <p>Sumbangan dan keanggotaan dalam organisasi kebangsaan/antarabangsa berkaitan dengan perhutanan dan alam sekitar Contributions and memberships in the national/international organizations</p> <p>Penjawat awam yang terlibat dalam membangunkan standard Malaysia dan antarabangsa berkaitan dengan bidang perhutanan dan keluaran hutan Staff involved in developing the Malaysian and international standards on forestry and forest product fields</p>	na	3
<p>9. KECEKAPAN EFFICIENCY</p> <p>Mencapai sasaran 95% penjawat awam yang mengikuti sekurang-kurangnya tujuh (7) hari latihan dalam setahun 95% of staff attending at least seven (7) days trainings in a year's target achieved</p> <p>Memberi maklum balas aduan pelanggan 100% tidak melebihi lima (5) hari bekerja Giving 100% respond to customers' complaint not later than five (5) working days</p> <p>Indeks kesejahteraan pelawat Visitors' peaceful index</p>	na	97.51
	na	100%
	na	84

Nota/Note:

na=tidak diperolehi kerana baru dipilih sebagai KPI/not available due to newly chosen as KPI

Anugerah dan Pengiktirafan Awards and Recognitions

1 Anugerah Buku Negara

FRIM telah memenangi Anugerah Buku Negara 2012 dalam kategori “Buku Teknikal Terbaik” buat kali kedua untuk buku penerbitan FRIM yang bertajuk “*Wild Orchids of Peninsular Malaysia*”. Ketua Pengarah FRIM, Dato’ Dr Abd Latif Mohmod telah menerima trofi yang disampaikan oleh Datuk Mohd Khalid Yunus, Pengerusi Yayasan Pembangunan Buku Negara, di Majlis Anugerah Buku Negara 2012 yang diadakan pada 2 Februari di Pusat Dagangan Dunia Putra (PWTC), Kuala Lumpur.

Buku *Wild Orchids of Peninsular Malaysia* yang dihasilkan oleh Ong Poh Teck, Peter O’ Byrne, Wendy Yong dan Dr Saw Leng Guan adalah komprehensif dan padat dengan gambar-gambar menarik yang menceritakan tentang kekayaan kepelbagaian flora orkid negara kita. Penerbitan ini merupakan sebahagian daripada hasil usaha ahli-ahli botani FRIM yang terlibat dalam pelaksanaan projek dokumentasi “Flora of Peninsular Malaysia” yang telah mula dilaksanakan oleh FRIM sejak tahun 2005. FRIM telah memenangi Anugerah Buku Negara untuk pertama kalinya pada tahun 2010 bagi penerbitannya yang bertajuk *FRIM Tapak Warisan Semula Jadi Negara*.

1 The National Book Award

FRIM received the National Book Award 2012 for the Best Technical Book category for its book entitled, “*Wild Orchids of Peninsular Malaysia*”. FRIM Director General Dato’ Dr Abd Latif Mohmod received the award presented by the National Book Development Foundation (YPBN) Chairman, Datuk Mohd Khalid Yunus, at the National Book Award 2012 Ceremony on 2 February at Dewan Merdeka, Putra World Trade Centre (PWTC), Kuala Lumpur.

The *Wild Orchids of Peninsular Malaysia*, co-authored by Ong Poh Teck, Peter O’ Byrne, Wendy Yong and Dr Saw Leng Guan, is a comprehensive, richly illustrated book showcasing the diversity of the country’s orchid flora and featuring more than 450 indigenous orchid species. It represents the summation of work by distinguished FRIM botanists who have been working on the Flora of Peninsular Malaysia documentation project implemented by FRIM since 2005. FRIM won the award for the first time in 2010 for its publication entitled, *FRIM Tapak Warisan Semula Jadi Negara*.



Dato’ Dr Abd Latif (kanan) menerima trofi dan medal yang disampaikan oleh Datuk Mohd Khalid Yunus
Dato’ Dr Abd Latif (right) receiving the trophy and the medal from Datuk Mohd Khalid Yunus

2 Malaysia Book of Records

FRIM telah menerima 10 sijil pengiktirafan rekod Nasional daripada Malaysia Book of Records (MBR) pada 2012 iaitu:

- Denai mesra orang kelainan upaya yang pertama—Denai Razak, sepanjang 400 m, yang dibuka secara rasmi kepada orang ramai pada 14 Januari 2008,
- Koleksi sampel kayu yang tertua (Xylarium FRIM)—Berusia 107–112 tahun, diasaskan pada tahun 1918,
- Koleksi sampel kayu yang terbesar (Xylarium FRIM)—Koleksi berjumlah 10 036 spesimen kayu daripada 108 famili dan 1587 spesies,
- Rotan manau ditanam yang terpanjang—120 m; berusia 33 tahun,
- Yang pertama menggunakan pengecapjarian DNA untuk pengesanan balak pada tahun 2009, dengan pangkalan data: pemprofilan DNA yang komprehensif untuk cengal (*Neobalanocarpus heimii*), dan
- Yang pertama menanam pokok bakau sebagai penampan dengan menggunakan teknik Comp-Mat dan Comp-Pillow bagi spesies *Rhizophora apiculata*, *Rhizophora mucronata* dan *Avicennia alba* di Kampung Sungai Haji Dorani, Sungai Besar, Selangor.
- Koleksi terbesar pokok dipterokarpa hidup—23 April 2012
- Koleksi terbesar klon jati di Malaysia—24 September
- Makmal rintangan api yang pertama—24 September
- Kelopak bunga Rafflesia terbanyak—24 September

Pada Januari 2003, FRIM berjaya mendaftarkan “the first light weight oil palm fibre reinforced cement composite panel” dalam MBR.

2 The Malaysia Book of Records

FRIM has received 10 National Records certificates from the Malaysia Book of Records (MBR) for the following:

- The first physically-challenged-friendly nature trail—Razak Walk, 400 m, officially opened to the public on 14 January 2008—3 Mac,
- The oldest wood sample collection (FRIM Xylarium)—age: 107–112 years, founded in 1918—3 Mac,
- The largest wood sample collection (FRIM Xylarium)—total collection: 10 036 wood specimens from 108 families, 1587 species—3 Mac,
- The longest planted rattan manau line—Length 120 m, aged: 33 years old—3 Mac,
- The first to use DNA fingerprinting for timber tracking—in 2009, database: comprehensive DNA profiling of cengal (*Neobalanocarpus heimii*)—3 Mac,
- The first to plant mangrove buffer in mud using Comp-Mat and Comp-Pillow planting techniques—mangrove species: *Rhizophora apiculata*, *Rhizophora mucronata* and *Avicennia alba*, at Kampung Sungai Haji Dorani, Sungai Besar, Selangor—3 Mac,
- The largest collection of living dipterocarp trees—23 April,
- The largest collection of teak clones in Malaysia—24 September,
- The first fire protection laboratory—24 September and
- The most petal for a rafflesia—24 September.

In January 2003, FRIM has successfully registered “the first light weight oil palm fibre reinforced cement composite panel” in the MBR.



Dato' Dr Abd Latif (keempat dari kanan)
bersama-sama wakil dari FRIM selepas majlis tersebut
Dato' Dr Abd Latif (fourth from right) with
the rest of the FRIM representatives after the ceremony

3 Anugerah IDB

FRIM menerima Anugerah Sains dan Teknologi Bank Pembangunan Islam (IDB) 2012 bagi “Institusi yang telah mencapai kecemerlangan dari segi sumbangan saintifik atau teknologi terhadap pembangunan sosio-ekonomi negara anggota” di Khartoum, Sudan pada 3 April. Ketua Pengarah, Dato’ Dr Abd Latif Mohmod, telah menerima hadiah plak, sijil pengiktirafan dan wang tunai berjumlah US\$100,000 yang disampaikan oleh Presiden Republik Sudan, Omar Hassan Ahmed al-Bashir dengan diiringi oleh Presiden IDB, Dr Ahmad Mohamed Ali Al-Madani di majlis khas yang diadakan bersempena dengan Mesyuarat Lembaga Gabenor IDB yang ke-37.

Anugerah ini merupakan satu pengiktirafan terhadap kecemerlangan pencapaian FRIM dalam menerajui bidang perhutanan, bioteknologi perhutanan, alam sekitar dan biodiversiti hutan serta sumbangannya kepada pembangunan sains dan teknologi dalam sektor perhutanan di Malaysia. Usaha FRIM untuk berkongsi teknologi dan hasil R&D dengan orang ramai melalui penerbitan artikel-artikel saintifik dan bukan saintifik; kejayaannya dalam komersialisasi hasil R&D; serta penerimaan pelbagai anugerah dan pengiktirafan lain juga telah melayakkan FRIM untuk menerima anugerah ini. IDB merupakan sebuah institusi kewangan antarabangsa yang menggalakkan pembangunan ekonomi dan sosial negara-negara anggota khususnya komuniti Islam dunia. Gabenor Bank Negara Malaysia, Tan Sri Dr Zeti Akhtar Aziz menerima Anugerah IDB dalam Perbankan dan Kewangan Islam.

3 The IDB Award

FRIM received the Islamic Development Bank (IDB) Science and Technology Prize 2012 on 3 April at a ceremony held in Khartoum, Republic of Sudan, for “having achieved outstanding scientific or technological contribution to the socio-economic development of a member country”. Its Director General, Dato’ Dr Abd Latif Mohmod, received the award comprising a plaque, a certificate and US\$100 000 from the President of the Republic of Sudan, Omar Hassan Ahmed al-Bashir, who was accompanied by the IDB Group President, Dr Ahmad Mohamed Ali Al-Madani, held in conjunction with the 37th Annual Meeting of the IDB Board of Governors.

FRIM was selected as the winner in recognition of its outstanding work in the field of forestry, biotechnology, environment and forest biodiversity thus contributing to scientific and technological development in the Malaysian forestry sector. The Institute’s efforts to share its research findings with the public through scientific and non-scientific articles and publications; its success in commercialisation; as well as the many other awards and recognitions it has received also contributed to its selection for the IDB Prize. The IDB is an international financial institution established to foster the economic development and social progress of member countries and Muslim communities. The same ceremony also saw the presentation of the IDB Prize in Islamic Banking and Finance to Bank Negara Malaysia Governor, Tan Sri Dr Zeti Akhtar Aziz.



Dato’ Dr Abd Latif (kanan) menerima plak Anugerah IDB daripada Presiden Sudan (kiri), diperhatikan oleh Presiden IDB di Khartoum
Dato’ Dr Abd Latif (right) receiving the award from the President of Sudan (left) while the IDB President (middle) looks on

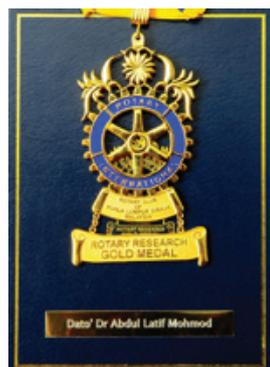
4 Anugerah Rotary

Yayasan Penyelidikan Rotary, Kelab Rotary Diraja Kuala Lumpur telah memilih Dato' Dr Abd Latif Mohmod, Ketua Pengarah FRIM sebagai salah seorang penerima Anugerah Pingat Emas Penyelidikan Rotary bagi menghargai sumbangan cemerlang beliau dalam bidang 'Sains Perhutanan'. Anugerah ini disampaikan oleh Penaung Diraja Kelab Rotary Diraja Kuala Lumpur, DYMM Sultan Selangor, Sultan Sharafuddin Idris Shah Alhaj di Majlis Penganugerahan Yayasan Amal Rotary pada 13 April di Kuala Lumpur. Yayasan Penyelidikan Rotary Kelab Rotary Diraja Kuala Lumpur ditubuhkan pada 1982 untuk mempromosi serta mengiktiraf usaha-usaha penyelidikan dan pembangunan (R&D) yang berfaedah di Malaysia, khususnya dalam bidang kesenian, kebudayaan, sains, perubatan, kejuruteraan, pertanian, teknologi dan sains sosial yang dijalankan dalam tempoh 15 tahun yang lalu.

Pencapaian Abd Latif adalah bukti kepakaran dan visi ke arah kecemerlangan sektor perhutanan di Malaysia. Bakat, kreativiti serta dedikasi beliau sepanjang berkhidmat selama 26 tahun di FRIM telah menyumbang ke arah pencapaian cemerlang dalam bidang penyelidikan, pembangunan dan komersialisasi (R, D & C) sektor perhutanan di Malaysia. Antara hasil R&D beliau ialah penghasilan 50 mesin pemprosesan hasil hutan bukan kayu seperti rotan, buluh dan palma; mengendalikan 59 kursus kemahiran dan teknikal bagi 1500 usahawan; serta merintis penubuhan 47 perusahaan kecil dan sederhana (SME) bagi rotan dan buluh. Hasil pencapaian R&D beliau juga telah diterbitkan dalam lebih daripada 300 penerbitan yang berbeza antaranya dalam jurnal, laporan persidangan, buku panduan, garis panduan dan manual.

Dato' Dr Abd Latif adalah antara 11 penerima pingat emas yang tersenarai serta satu-satunya penerima Anugerah Pingat Emas Penyelidikan Rotary dalam bidang 'Sains Perhutanan' bagi 2012. Penerima-penerima lain termasuk Prof. Emeritus Dato' Dr CP Ramachandran, Dato' Khoo Kah Lin, Prof. Dato' Ir Dr Chuah Hean Teik, Prof Dr Fun Hoong Kun, Prof Abdul Latif Ahmad, Prof Dr Ng Soon, Prof Ir Dr Mohd Sapuan Salit, Dr C. Devendra dan Dr Tee Ee Siong.

Pingat Emas
Penyelidikan Rotary
The Rotary Research
Gold Medal



4 The Rotary Award

The Rotary Research Foundation of the Rotary Club of Kuala Lumpur Diraja has chosen the Director-General of FRIM, Dato' Dr Abd Latif Mohmod, as one of its Rotary Research Gold Medal Award recipients in recognition of his outstanding research and development (R&D) contributions in the area of 'Forestry Science'. Dato' Dr Abd Latif received the award on 13 April at the Rotary Charity Foundation Research Awards Presentation from the DYMM Sultan of Selangor, Sultan Sharafuddin Idris Shah Alhaj, the Royal Patron of the Royal Rotary Club of Kuala Lumpur, in Kuala Lumpur. The Rotary Research Foundation honours people who have made excellent contribution in R&D carried out in any discipline of arts, culture, science, medicine, engineering, agriculture, technology and social science. Founded in 1982, it was established to promote and recognise worthwhile research efforts carried out in the country in the past 15 years.

Dato' Dr Abd Latif's foresight and dedication throughout his 26-year service at FRIM has contributed significantly to the achievements in research, development and commercialisation (R, D & C) for the forestry sector in Malaysia. Amongst his notable achievements were 50 inventions produced on the processing of rattan, bamboo and palms; 59 related industrial training and technical courses for 1500 entrepreneurs; and 47 small and medium scale rattan/bamboo mills (SME) established. His research findings have been published in about 300 different publications in various refereed journals, conference proceedings, handbooks, guidelines and manuals. He was one of the 11 awardees at the presentation ceremony and the only one to receive the award in 'Forestry Science'. Other recipients included Prof. Emeritus Dato' Dr CP Ramachandran, Dato' Khoo Kah Lin, Prof. Dato' Ir Dr Chuah Hean Teik, Prof Dr Fun Hoong Kun, Prof Abdul Latif Ahmad, Prof Dr Ng Soon, Prof Ir Dr Mohd Sapuan Salit, Dr C Devendra and Dr Tee Ee Siong.



Dato' Dr Abd Latif (empat dari kiri) bersama-sama pegawai-pegawai FRIM selepas majlis penyampaian anugerah
Dato' Dr Abd Latif (fourth from left) with other FRIM officers
after the award presentation ceremony

5 Anugerah BrandLaureate

FRIM sekali lagi telah memenangi Anugerah BrandLaureate untuk Jenama Terbaik dalam Perhutanan dan Pemuliharaan Alam Sekitar. Ketua Pengarah FRIM, Dato' Dr Abd Latif Mohmod, menerima anugerah tersebut daripada Jeneral (B) Tan Sri Dr Mohammad Hashim Ali di Majlis Penyampaian Anugerah BrandLaureate Bestbrands 2011–2012 yang berlangsung di Petaling Jaya pada 8 Mei. FRIM yang memenangi Anugerah BrandLaureate 2010–2011 untuk kategori yang sama dipilih sekali lagi pada tahun ini kerana keupayaannya berada di kedudukan pertama sebagai institusi penyelidikan hutan tropika dunia; dan di tempat ke-546 daripada 4000 institusi penyelidikan seluruh dunia.

FRIM berjaya mengekalkan kecemerlangan secara tekak yang terbukti melalui rentetan anugerah dan pengiktirafan yang diterima dalam dua tahun berturut-turut seperti Anugerah Buku Negara 2012 (bagi kategori Buku Teknikal Terbaik), Anugerah IDB untuk Sains dan Teknologi 2012, Rotary Gold Medal Research Award 2012; Anugerah EBA/International Socrates bagi kategori “Best Enterprise 2011” dan “Best Manager of the Year 2011”, serta pengiktirafan Bionexus Referral Centre pada 2011. FRIM yang merupakan satu-satunya institusi penyelidikan perhutanan di dunia yang diiktiraf sebagai Tapak Warisan Semula Jadi juga mampu mengekal dan meneruskan usahanya dalam pemuliharaan alam sekitar. Kriteria lain yang menyumbang kepada kemenangan anugerah ini ialah peningkatan dalam faktor impak penerbitan *Journal of Tropical Science* daripada 0.3 kepada 0.519; peningkatan sebutan media bernilai lebih daripada RM11 juta pada 2011, penerbitan jurnal dan buku-buku saintifik secara berterusan serta penghasilan beberapa buku mewah (*coffee table books*) sejak tahun 2008.

5 The BrandLaureate Award

FRIM has won The BrandLaureate Awards again consecutively for the Best Brand in Forestry-Environment Conservation. Its Director General, Dato' Dr Abd Latif Mohmod, received the award which was presented by General (Rtd) Tan Sri Dr Mohammad Hashim Ali at the BrandLaureate Bestbrand Awards 2011–2012 ceremony held in Petaling Jaya on 8 May. FRIM, which won the BrandLaureate Award 2010–2011 for the same category, was selected again this year based on its rating as the top tropical forest research institute and the 546th research institute out of 4000 research institutions in the world.

FRIM has also been able to maintain its excellent performance, evidenced in the string of awards and recognitions received over the past two years including the National Book Award for 2012; the Islamic Development Bank (IDB) Award for Science and Technology 2012; Rotary Gold Medal Research Award 2012; the status of Bionexus Referral Centre, 2011, the EBA / International Socrates “Best Enterprise 2011”; and EBA / International Socrates “Best Manager of the Year 2011” Award. FRIM, which is the only forestry research institution in the world to be recognised as a natural heritage site, has also managed to sustain its efforts in protecting and conserving the environment. Other criteria contributing to its selection for this year award included the improvement in the impact factor of its *Journal of Tropical Sciences* from 0.3 to 0.519; its public awareness activities generating mentions of FRIM with total publicity worth of over RM11 million in 2011; and its continued production of scientific journals and books as well as several coffee table books since 2008.



6 Warisan Kebangsaan

FRIM sekali lagi melakar sejarah apabila diisytihar sebagai Warisan Kebangsaan oleh YB Dato' Seri Utama Dr Rais Yatim, Menteri Penerangan, Komunikasi dan Kebudayaan, pada Majlis Perisytiharan Warisan Kebangsaan 2012 di Kuala Lumpur pada 10 Mei. Pengiktirafan sebagai Warisan Kebangsaan dapat memberi lebih perlindungan kepada FRIM, serta membantu dalam kesinambungan kejayaan dan aktiviti cemerlangnya yang membolehkannya bertindak sebagai mercu tanda bukan sahaja di dalam malah di luar negara. FRIM menerima pengisytiharan ini atas ketelusan usaha pemuliharaan dan pemeliharaan kawasan hutan tropika buatan manusia yang terbesar dan tertua di dunia selain merupakan satu-satunya institusi R&D perhutanan tropika di Malaysia.

6 The National Heritage

FRIM has been declared as a National Heritage by the Minister of Information, Communication and Culture, Dato' Seri Utama Dr Rais Yatim, at the National Heritage Declaration Ceremony 2012 held in Kuala Lumpur on 10 May. The recognition as a National Heritage will provide more protection for FRIM and help to ensure the continuation of all its excellent achievements and activities and thus enabling it to serve as a national and international landmark. FRIM is accorded the National Heritage status in recognition of its conservation efforts, its historical significance and legacy, being the largest and oldest man-made tropical forest in the world as well as the one and only tropical forest research institute in Malaysia.



Dato' Dr Abd. Latif (tengah) bersama-sama warga FRIM bergambar di hadapan plak Warisan Kebangsaan (kiri) dan plak Tapak Warisan Semula Jadi (kanan)
Dato' Dr Abd. Latif (middle) together with FRIM staff posing in front of the National Heritage (left) and the Natural Heritage Site (right) plaques

7 Anugerah Badan Berkanun

FRIM dipilih sebagai penerima Anugerah Badan Berkanun Kategori Penyelidikan bagi tahun 2012 oleh Persatuan Badan Berkanun Malaysia (PBBM). Anugerah ini disampaikan oleh Tun Dr Ahmad Fairuz Dato' Sheikh Abdul Halim, Pro-Canselor Universiti Utara Malaysia yang juga bekas Ketua Hakim Negara, kepada Dato' Dr Abd. Latif Mohmod, Ketua Pengarah FRIM, pada 23 Jun di Majlis Penyampaian Anugerah 2012 yang julung-julung kalinya diadakan sempena Mesyuarat Agung PBBM ke-29 di Langkawi, Kedah. Selain itu, FRIM juga menerima Anugerah Penghargaan Keahlian PBBM Lebih 20 Tahun yang disampaikan oleh Yang Dipertua PBBM, Prof Dato' Dr Mohamed Mustafa Ishak kepada Dato' Dr Abd Latif.

7 The Statutory Bodies Association Award

FRIM was conferred with the Excellence Award for Research by the Malaysian Statutory Bodies Association (PBBM) for year 2012 on 23 June. This award was presented to the FRIM Director General Dato' Dr Abd Latif Mohmod by the Pro-Chancellor of Universiti Utara Malaysia, Tun Dr Ahmad Fairuz Sheikh Abdul Halim also a former Chief Justice, at the PBBM Awards Presentation Ceremony held for the first time in conjunction with the association's 29th Annual General Meeting in Langkawi, Kedah. Apart from that, FRIM also received the PBBM Appreciation Award for being a member for over 20 years, presented by the PBBM President, Prof Dato' Dr Mohamed Mustafa Ishak.



Tun Dr Ahmad Fairuz (kiri) menyampaikan trofi anugerah kepada Abd Latif
Tun Dr Ahmad Fairuz (left) presenting the trophy to Abd Latif at the award ceremony

8 **Pelancongan**

FRIM merupakan salah sebuah organisasi yang terpilih untuk menerima pengiktirafan Kerajaan Negeri Selangor kerana sumbangan terhadap pembangunan industri ekopelancongan negeri tersebut. FRIM yang diwakili oleh Ketua Unit Pengurusan Korporatnya, Puan Norhayati Nordin, telah menerima sijil penghargaan yang disampaikan oleh Menteri Besar Selangor, Tan Sri Abd Khalid Ibrahim, pada Majlis Apresiasi Pelancongan Selangor 2012 yang berlangsung di Shah Alam pada 8 Julai. Majlis tersebut diadakan bagi memberi penghargaan kepada pengusaha atau pihak-pihak yang banyak menyumbang kepada perkembangan industri pelancongan Selangor.

8 **Tourism**

FRIM was one of the organisations selected to be accorded recognition by the Selangor Government for having contributed to the development of the state's ecotourism industry. The institute, represented by its Corporate Management Unit Head, Mdm Norhayati Nordin received the certificate of appreciation presented by the Menteri Besar, Tan Sri Abd Khalid Ibrahim at the Selangor Tourism Appreciation Ceremony 2012 held in Shah Alam on 8 July. The objective of the event was to show appreciation to tour operators and other relevant parties who have made significant contribution to the development of the state's ecotourism industry.



Puan Norhayati menunjukkan sijil yang diterima
Mdm Norhayati showing the certificate

9 Anugerah “The Name in Science”

Jawatankuasa Pencalonan Socrates untuk Europe Business Assembly (EBA), Club of Rectors of Europe (CRE) dan International Club of Leaders (ICL) telah memilih Ketua Pengarah FRIM sebagai penerima anugerah ‘The Name in Science’ bagi mengiktiraf sumbangan beliau kepada dunia sains. Dato’ Dr Abd Latif Mohmod telah menerima anugerah yang disampaikan oleh Prof. Wil Goodheer, President CRE, dan Prof. John WA Netting, Ketua Pengarah EBA, di majlis penyampaian anugerah yang diadakan pada 12 Julai di Dublin, Ireland, bersempena dengan Forum Terbuka EuroScience (ESOF) 2012. Pengiktirafan ‘The Name in Science’ dianugerahkan kepada kumpulan atau komuniti sains, pihak berkuasa, organisasi awam, struktur perniagaan, saintis, ahli politik, dan tokoh masyarakat sebagai penghargaan atas sumbangan peribadi atau pencapaian cemerlang penerima dalam memartabatkan penyelidikan sains. EBA, CRE dan ICL merupakan organisasi-organisasi bebas yang bertujuan menggalakkan pembangunan dan pengurusan ekonomi, sosial serta kerjasama kemanusiaan.

9 The Name in Science Award

The Europe Business Assembly (EBA) Socrates Nomination Committee, Club of Rectors of Europe (CRE) and the International Club of Leaders (ICL) have chosen FRIM Director-General as one of the recipients of ‘The Name in Science’ Award for his contribution to the science world. Dato’ Dr Abd Latif received the award from CRE President Prof. Wil Goodheer and EBA DG Prof. John W A Netting at a ceremony held in conjunction with the EuroScience Open Forum (ESOF) 2012 in Dublin, Ireland, on 12 July . ‘The Name in Science’ award is given to scientific teams, scientific societies, authorities, public organisation, business structures, scientists, politicians and public figures for their personal contribution to or professional achievements in the advancement of scientific research. EBA, CRE and ICL are independent bodies for the development and management of economic, social and humanitarian collaboration.



Dato’ Dr Latif (tengah) bersama-sama Goodheer (kiri) dan Netting (kanan)
di Majlis Penyampaian Anugerah tersebut

Dato’ Dr Latif (middle) posing with Prof Goodheer (left)
and Prof Netting (right) at the ceremony

10 **Anugerah Penghargaan Pengguna Malaysian Standards 2012**

FRIM menerima Anugerah Penghargaan Pengguna *Malaysian Standards* 2012 dari Jabatan Standard Malaysia (Standards Malaysia) atas sumbangan dalam meningkatkan aktiviti standardisasi di Malaysia. Anugerah disampaikan oleh Pengerusi Majlis Standard dan Akreditasi Malaysia (MSDAM), Tan Sri Datuk Dr Ahmad Tajuddin Ali, kepada Ketua Pengarah FRIM, Dato' Dr Abd Latif Mohmod, di Majlis Anugerah Standard dan Akreditasi Kebangsaan 2012 di Putrajaya International Convention Centre (PICC) pada 22 November. Majlis tersebut dirasmikan oleh Datuk Fadillah Yusof, Timbalan Menteri Sains Teknologi dan Inovasi. Anugerah ini merupakan pengiktirafan kebangsaan ke atas FRIM sebagai pengguna utama *Malaysian Standards* dalam operasi, modal insan dan aktiviti R&D sehingga berjaya meningkatkan kualiti penyampaian perkhidmatan proses utama FRIM. Penggunaan *Malaysian Standards* di FRIM bermula pada 1998 dengan beberapa makmal ujiannya mendapat akreditasi Skim Akreditasi Makmal Malaysia (SAMM) MS ISO/IEC G25 (dinaik taraf kepada MS ISO/IEC 17025 pada tahun 2000).

Anugerah ini turut menghargai sumbangan FRIM dalam pembangunan, penggunaan dan pelaksanaan *Malaysian Standards* (MS) seawal tahun 1975. Sehingga kini, sejumlah 245 MS telah dibangunkan dengan penglibatan kepakaran FRIM khususnya dalam Jawatankuasa Pembangunan Standard. Selain itu, terdapat program-program pensijilan dan standardisasi lain yang telah menyumbang kepada keberkesanan perkhidmatan yang ditawarkan FRIM. Antaranya pengiktirafan Standard Skim Organik Malaysia (SOM) ke atas pengusahasilan ladang herba di Stesen Penyelidikan FRIM (SPF) Maran; Amalan Pengilangan Baik (GMP) di Pusat Teknologi Herba (HTC) dalam penghasilan dan pengeluaran produk kesihatan/herba serta enam buah makmal FRIM yang berstatus BioNexus Partners (BNP) bagi menyokong keperluan industri dan usahawan herba di Malaysia.

Tahun ini, FRIM juga menerima anugerah sijil penghargaan akreditasi SAMM MS ISO/IEC 17025 bagi dua buah makmalnya iaitu Makmal Mikologi Kayu dan Makmal Kawalan Kualiti Hasil Semula Jadi.

11 **Anugerah Pencapaian Sains dan Teknologi**

Ketua Pengarah FRIM, Dato' Dr Abd Latif Mohmod dipilih untuk menerima anugerah berprestij Persatuan Saintifik Malaysia (MSA) atas sumbangan cemerlang beliau dalam Sains, Teknologi dan Inovasi di Malaysia. Anugerah disampaikan oleh Timbalan Menteri Sains, Teknologi dan Inovasi, YB Datuk Fadillah Yusof di Malam Anugerah Sains dan Teknologi (MSA) 2012 pada 29 November di Royal

10 **The Appreciation Award for Users of the Malaysian Standards**

FRIM received the Appreciation Award for Users of the Malaysian Standards (MS) from the Department of Standards Malaysia (STANDARDS MALAYSIA) for its contributions and standardisation initiatives. The award was presented by the Malaysian Standard and Accreditation Council (MSAC) Chairman, Tan Sri Datuk Dr Ahmad Tajudin Ali, to FRIM Director General, Dato' Dr Abd Latif Mohmod, at the National Standard and Accreditation Award 2012 Ceremony held at the Putrajaya International Convention Centre (PICC) on 22 November. The ceremony was officiated by the Deputy Minister of Science, Technology and Innovation, Datuk Fadillah Yusof. The award was a national recognition for FRIM being an effective user of the Malaysian Standards in the development of its operations and human resource to improve the quality of FRIM's service delivery and R&D activities. FRIM's implementation of the Malaysian Standards started in 1998 with its testing laboratories acquiring the accreditation of *Skim Akreditasi Makmal Malaysia* (SAMM) MS ISO/IEC G25 (upgraded to MS ISO/IEC 17025 in year 2000).

The award also honoured FRIM's contributions to the development, application and implementation of Malaysian Standards as early as in the 1975. To date, a total of 245 MS had been developed with the involvement of FRIM especially in the Standards Development Committees. Most of the developed MS are used voluntarily while selected ones are mandatory. There are other certification and standardisation programmes which had contributed to the enhancement of FRIM services; including the certification of Malaysian Organic Scheme (SOM) for the planting of medicinal herbs at FRIM Research Station (SPF) Maran; the Good Manufacturing Practices (GMP) certification scheme for the production and manufacturing of nutritious/herbal products by the FRIM Herbal Technology Centre and its six BioNexus Status Laboratories that sustain the needs of the herbal industry in Malaysia.

This year, FRIM also received the certificates of appreciation for two additional laboratories, the Wood Mycology Laboratory and the Natural Products Quality Control Laboratory, for the accreditation of SAMM MS ISO/IEC 17025.

11 **The Outstanding achievement in Science and Technology Awards**

FRIM Director General, Dato' Dr Abd Latif Mohmod received a prestigious award from the Malaysian Scientific Association (MSA) for outstanding achievement in Science, Technology and Innovation in Malaysia. The award was presented by the Deputy Minister of Science, Technology and Innovation, YB Datuk Fadillah Yusof at the Presentation of

Selangor Club, Dataran Merdeka, Kuala Lumpur. Penerima lain bagi Anugerah Pencapaian Sains dan Teknologi yang sama termasuk mantan Presiden MSA, Prof. Dato' Dr Khairul Anuar Abdullah dan Ketua Pengarah Lembaga Minyak Sawit Malaysia (MPOB), Datuk Dr Choo Yuen Ming.

S&T Achievement Awards held in conjunction with the MSA Annual Dinner on 29 November 2012 at the Royal Selangor Club, Dataran Merdeka, Kuala Lumpur. The other recipients of the MSA S&T Achievement Awards were the Immediate Past President of MSA, Prof. Dato' Dr Khairul Anuar Abdullah, and the Malaysia Palm Oil Board (MPOB) Director General, Datuk Dr Choo Yuen Ming.



Presiden MSA, Prof. Emeritus Dr CP Ramachandran (kiri) mengucapkan tahniah kepada Dato' Dr Abd Latif (kanan)
MSA President, Prof. Emeritus Dr CP Ramachandran (left) congratulating Dato' Dr Abd Latif (right)

12 International Diamond Prize for Excellence in Quality

FRIM telah menerima satu lagi anugerah bagi tahun 2012, iaitu International Diamond Prize yang disampaikan oleh Persatuan Eropah untuk Penyelidikan Kualiti (ESQR) pada 2 Disember sebagai pengiktirafan ke atas usaha, pencapaian dan kecemerlangan dalam pengurusan kualiti. Majlis penyampaian anugerah yang diadakan bersempena dengan Konvensyen ESQR di Brussels, Belgium, telah dihadiri oleh Dr Nur Supardi Md Noor, Ketua Cawangan Dasar dan Perancangan Penyelidikan FRIM. Dr Nur Supardi telah menyerahkan anugerah dan sijil tersebut kepada Ketua Pengarah FRIM, Dato' Dr Abd Latif Mohmod pada 7 Disember semasa Mesyuarat Jawatankuasa Penasihat Penyelidikan FRIM (RAC) yang diadakan di kampus FRIM, Kepong. FRIM merupakan salah sebuah daripada 31 organisasi dan syarikat terkemuka dari seluruh dunia yang dipilih oleh ESQR untuk menerima anugerah tersebut.

12 The International Diamond Prize for Excellence in Quality

FRIM also received the International Diamond Prize for Excellence in Quality, presented by the European Society for Quality Research (ESQR) in recognition of its efforts, achievements and excellence in quality management on 2 December. The award presentation ceremony, held in conjunction with the ESQR Convention in Brussels, Belgium, was attended by FRIM's Policy and Research Planning Branch Head, Dr Nur Supardi Md Noor. Nur Supardi handed over the award and certificate to the FRIM Director General, Dato' Dr Abd Latif Mohmod during FRIM Research Advisory Committee (RAC) meeting held in FRIM, Kepong, on 7 December. FRIM was one of the 31 top companies and organisations from all over the world picked by ESQR to receive the award in recognition of its outstanding results in quality management.



Dr Nur Supardi (kiri) menyerahkan trofi yang diterima kepada Dato' Dr Abd. Latif (kanan)
 Dr Nur Supardi (left) handing over the trophy to Dato' Dr Abd. Latif (right)

13 **Anugerah Merdeka**

Ahli botani FRIM, Prof Dr Engkik Soepadmo, felo penyelidik yang telah berkhidmat 17 tahun di Bahagian Biodiversiti FRIM menerima Anugerah Merdeka yang berprestij untuk sumbangan cemerlang beliau kepada rakyat Malaysia. Soepadmo menerima anugerah yang berbentuk sijil, trofi dan hadiah wang tunai berjumlah RM 500 000 daripada Perdana Menteri, YAB Dato' Sri Najib Tun Razak, di Majlis Anugerah Merdeka 2012 pada 3 Disember di Dewan Filharmonik Petronas, Kuala Lumpur. Turut hadir ialah Raja Muda Perak, DYMM Raja Dr Nazrin Shah Ibni Sultan Azlan Muhibbuddin Shah, yang merupakan Pengerusi Lembaga Pemegang Amanah Anugerah Merdeka.

13 **The Merdeka Award**

FRIM botanist, Prof. Dr Engkik Soepadmo, a research fellow based at the FRIM Biodiversity Division for 17 years, received the prestigious Merdeka Award for outstanding contributions to the people of Malaysia. Soepadmo was presented with the award, comprising a certificate, trophy and prize money totaling RM 500 000, by Prime Minister YAB Dato' Sri Najib Tun Razak at the Merdeka Award 2012 Ceremony held at Petronas Philharmonic Hall in Kuala Lumpur on 3 December. Also present was the Regent of Perak, HRH Raja Dr Nazrin Shah Ibni Sultan Azlan Muhibbuddin Shah, who is the Chairman of the Merdeka Award Board of Trustees.



Soepadmo (kiri) menerima trofi daripada Dato Sri Najib (tengah) dan diperhatikan oleh Raja Dr Nazrin
 Soepadmo (left) receiving the award presented by Dato Sri Najib (middle) while Raja Dr Nazrin (right) looks on

Sejak tahun 1993, beliau telah menjadi Penyelaras dan Ketua Editor bagi Projek *Tree Flora of Sabah and Sarawak* di FRIM. Soepadmo telah menemui 56 spesies tumbuhan dan pokok hutan tropika. Sebagai pengiktirafan terhadap sumbangan beliau ke arah peningkatan pengetahuan berkenaan flora dan kepelbagaian biologi di rantau Asia Tenggara, rakan sepejuangannya telah menamakan enam spesies tumbuhan sempena dengan nama beliau, iaitu *Actinodaphne soepadmoi* Julia (Lauraceae), *Aglaia soepadmoi* CM Pannell (Meliaceae), *Cinnamomum soepadmoi* Kostermans (Lauraceae), *Ficus soepadmoi* Kochummen (Moraceae), *Syzygium soepadmoi* PS Ashton (Myrtaceae), dan *Vatica soepadmoi* P.S. Ashton (Dipterocarpaceae).

Turut menerima anugerah tersebut ialah Prof. Emeritus Tan Sri Datuk Dr Augustine Ong Soon Hock dan Tan Sri Prof. Dr Syed Muhammad Naguib Al-Attas.

Since 1993, Dr Soepadmo has been the Coordinator and Chief Editor of the Tree Flora of Sabah and Sarawak Project in FRIM. Soepadmo had discovered 56 species of tropical plants and trees. In recognition of his contribution towards the enhancement of knowledge of the flora and plant biodiversity of the Southeast Asia region, his peers had named six species of plants after him, i.e. *Actinodaphne soepadmoi* Julia (Lauraceae), *Aglaia soepadmoi* C.M. Pannell (Meliaceae), *Cinnamomum soepadmoi* Kostermans (Lauraceae), *Ficus soepadmoi* Kochummen (Moraceae), *Syzygium soepadmoi* P.S. Ashton (Myrtaceae), and *Vatica soepadmoi* P.S. Ashton (Dipterocarpaceae).

The award was also presented to Tan Sri Emeritus Prof. Datuk Dr Augustine Ong Soon Hock and Tan Sri Prof. Dr Syed Muhammad Naguib Al-Attas.

Pengurusan Korporat Corporate Management

PENGURUSAN KORPORAT

Perhubungan Awam

Pos Malaysia telah bekerjasama dengan FRIM untuk melancarkan koleksi baharu setem dan barangan filateli bertemakan tumbuhan beraroma iaitu limau purut, kesum dan pudina yang akan dijual kepada orang ramai. Koleksi menampilkan tiga tumbuhan beraroma ini dalam bentuk setem RM5 pada lembaran mini (limau purut), setem RM1 (pudina) dan 60 sen (kesum). Lembaran mini yang dicetak di negara Belanda yang memaparkan imej limau purut ini adalah yang pertama seumpamanya yang mengeluarkan wangian segar pati limau purut apabila permukaannya digosok.

FRIM, menerusi Unit Pengurusan Korporatnya (CCU) juga telah melaksanakan program dan aktiviti untuk pelanggan dalaman bagi mengeratkan semangat kerja bersepasukan dalam kalangan penjawat awam FRIM.

CORPORATE MANAGEMENT

Public Relations

Pos Malaysia collaborated with FRIM in launching a new collection of stamps and philatelic items on aromatic plants featuring kaffir lime, kesum and peppermint to be sold to the public. The collection features the three aromatic plants on RM5 miniature sheet (kaffir lime), RM 1 stamps (peppermint) and 60 sen (kesum). The miniature sheet, printed in the Netherlands, featuring the kaffir lime is the first of its kind that produces scent when the surface is scratched.

FRIM, through its Corporate Management Unit (CCU) had also organised programmes and activities for internal clients with the aim of strengthening team work spirit amongst FRIM staff.

Aktiviti lain anjuran CCU 2012 Other activities organised by CCU in 2012

BIL NO.	AKTIVITI ACTIVITY	TARIKH DATE
1	Lawatan berpandu sempena Hari kraf Kebangsaan 2012 Guided visit in conjunction with the National Craft Day 2012	22 Mac 22 March
2	Promosi Subsidi Mamogram (LPPKN WP & Putrajaya) kepada penjawat awam wanita FRIM di Damai Service Hospital Kuala Lumpur. Promotion of Subsidised Mammogram (FT & Putrajaya NPFDB) for FRIM's female staff at Damai Service Hospital in Kuala Lumpur.	24-25 April
3	Lawatan ke Putrajaya Floria 2012 untuk penjawat awam FRIM. Visit to Putrajaya Floria 2012 for FRIM staff.	5 Julai 5 July
4	Lawatan sambil belajar ke Promosi kraf Malaysia 2012 Study visit to the Malaysian Craft Promotion 2012	9 November



Lawatan berpandu sempena Hari kraf Kebangsaan
Guided visit in conjunction with the National Craft Day

Tanggungjawab Sosial Korporat

FRIM telah melaksanakan 11 aktiviti tanggungjawab sosial korporat pada tahun 2012 yang melibatkan 2303 penyertaan termasuk penjawat awam FRIM, jurupandu berdaftar, guru-guru dan murid-murid sekolah, para pelajar kolej dan universiti, warga korporat, orang awam dan wakil media. Berikut ialah beberapa aktiviti utama yang dilaksanakan:

Corporate Social Responsibility

FRIM has conducted 11 corporate social responsibility (CSR) activities in 2012 involving a total of 2303 participants including FRIM staff, registered tour guides, school teachers and pupils, university and college students, corporate citizens, members of the public and media representatives. The following are some of the main CSR activities:

BIL. NO.	AKTIVITI ACTIVITY	TARIKH DATE
1.	Kursus Jurupandu Alam FRIM FRIM Nature Guide Course	8–9 Februari/February
2.	Program “Beauty and The Beasts of Our Forests” Sekolah Alam Shah Beauty and The Beast of Our Forests Programme of Sekolah Alam Shah	10 Mac/March
3.	Sambutan Hari Perhutanan Sedunia World Forestry Day Celebration	24 Mac/March
4.	Sambutan Hari Bumi Earth Day Celebration	21 April
5.	Program “The Next Science Camp” Sekolah Alam Shah The Next Science Camp Programme of Sekolah Alam Shah	3–5 Julai/July
6.	Sumbangan Raya kepada pesara FRIM Raya Contribution for FRIM Retirees	13–15 Ogos/August
7.	Pertandingan Fotografi 2012 bertemakan “Uniknya FRIM” Photography Competition 2012 themed, “Uniquely FRIM”	1 September–15 Oktober/October
8.	Bengkel Asas Fotografi Alam di FRIM, Kepong Nature Photography Workshop in FRIM, Kepong	8 September
9.	Bengkel Asas Fotografi Alam di SPF Mata Ayer, Perlis Nature Photography Workshop at FRIM Research Station in Mata Ayer, Perlis	15 September
10.	Roadshow Tanggungjawab Sosial Korporat (CSR) Corporat Social Responsibility Roadshow	27–28 November
11.	Bulan Bahasa Peringkat FRIM FRIM Level Bahasa Month	30 November



Kursus Jurupandu Alam
FRIM Nature Guide Course

Liputan Media

FRIM telah melaksanakan aktiviti promosi media dan juga membantu serta menyertai pelbagai aktiviti NRE untuk mempereratkan hubungan FRIM dengan pengamal media pada sepanjang tahun 2012, seperti yang disenaraikan di bawah:

Media Coverage

FRIM has organized various activities as well as assisted and participated in relevant activities organised by the NRE at strengthening FRIM's relationship with media practitioners, as listed below:



BIL. NO.	AKTIVITI ACTIVITY	TARIKH DATE
1.	Menghantar kad perayaan kreatif Tahun Baru Cina, Hari Raya Aidil Adha dan Deepavali yang dihasilkan oleh CCU kepada pihak media melalui e-mel dan pos. Sent the CCU's creative e-cards for celebrations of Chinese New Year, Hari Raya Aidil Adha and Deepavali via post and/or e-mail.	Sepanjang tahun Throughout the year
2.	Menganjurkan aktiviti yang menarik minat pihak media dan masyarakat awam bersempena dengan sambutan seperti Hari Hutan Sedunia serta Hari Bumi bagi peningkatan kesedaran awam tentang kepentingan pemuliharaan hutan dan alam semula jadi. Organised activities of interest to the media & the public, in conjunction with various relevant celebrations such as the World Forest Day and World Earth Day for public awareness purposes.	Februari-Mac / February-March
3.	Mengadakan program Lawatan Media ke SPF Mata Ayer, Perlis, bersempena dengan Hari Alam Sekitar Sedunia, yang disertai oleh 14 orang wartawan dan jurukamera dari 11 organisasi media (The Star, RTM, Bernama, Kosmo, Sinar Harian, Sin Chew Daily, Utusan Malaysia, Kosmo!, Berita Harian, Harian Metro & Guang Ming Daily). Conducted a Media Visit to SPF Mata Ayer, Perlis, in conjunction with the World Environment Day celebration on 13 June 2012, involving 14 journalists and cameramen from 11 different media organisations (namely, The Star, RTM, Bernama, Kosmo, Sinar Harian, Sin Chew Daily, Utusan Malaysia, Kosmo!, Berita Harian, Harian Metro & Guang Ming Daily).	13 Jun / June

BIL. NO.	AKTIVITI ACTIVITY	TARIKH DATE
4.	Menyokong Program Lawatan Media bersempena “Explore Perlis Fun Ride” yang dianjurkan oleh Kementerian Pelancongan dan disertai oleh 8 orang wakil media. Supported the Media Visit Programme in conjunction with “Explore Perlis Fun Ride” organised by Ministry of Tourism, which attracted the participation of eight media representatives.	7 Oktober / October
5.	Menganjurkan Majlis Penghargaan Media dan Penanaman Pokok yang dihadiri oleh 18 orang wakil media dari 8 buah organisasi media termasuk penerima anugerah penghargaan FRIM. Media Appreciation and Tree Planting Ceremony which was attended by 18 representatives from eight selected media organisations including recipients of the FRIM appreciation awards.	24 November
6.	Menyertai program “Lawatan Mesra ke Jabatan Penyiaran Malaysia, Angkasapuri Kuala Lumpur, yang dianjurkan oleh NRE. Participated in the “Lawatan Mesra ke Jabatan Penyiaran Malaysia, Angkasapuri, Kuala Lumpur” programme organised by NRE.	6 Disember / December
7.	Membantu menguruskan lebih daripada 103 permintaan daripada pihak media untuk mendapatkan maklumat atau gambar, mengadakan temuramah, menaja lokasi dan membuat rakaman program berita, rencana atau dokumentari di kampus FRIM. Assisted in handling over 100 media requests for information or pictures, for interviews, location sponsorship and shooting at the FRIM campus for news, features or documentary programmes.	Sepanjang 2012 / Throughout 2012

Berita terpilih dan artikel rencana/laporan yang mengandungi maklumat mengenai FRIM daripada media cetak atau siaran bagi tahun 2012 berjumlah 363 dengan anggaran nilai perhubungan awam (PR) sebanyak RM 9.5 juta. Sekiranya diambil kira laporan media yang menyebut nama FRIM termasuk oleh agensi lain berkenaan usahasama dengan FRIM mahupun pelaksanaan aktiviti mereka di FRIM, jumlah keseluruhan telah meningkat kepada 590 laporan dengan nilai PR sebanyak RM 17.7 juta. Jumlah ini ialah berita yang dimuat naik ke laman sesawang FRIM. Agensi lain atau orang perseorangan yang menyebut FRIM turut dikira kerana membawa nilai positif.

Daripada semua artikel dan laporan yang dipantau, sebanyak 85% (iaitu akhbar 78% & majalah 7.1%) diperoleh daripada media cetak, manakala televisyen (8.6%) dan radio (6.3%). Akhbar yang paling banyak membuat liputan tentang FRIM masih merupakan The Star (15.9%); diikuti oleh Sinar Harian (11.5%); New Straits Times (8.6%); Berita Harian (6.7%); Utusan Malaysia (6.3%); Borneo Post (6%); Sin Chew Daily (5.8%) dan Nanyang Siang Pau (4.5%).

Terdapat peningkatan ketara berita dari akhbar Sarawak dan Sabah ke 102 (70, Sarawak dan 32, Sabah) pada tahun 2012 berbanding 72 (46, Sarawak dan 26, Sabah) pada 2011. Ini disebabkan oleh peningkatan pemantauan akhbar di kedua-dua negeri tersebut serta jalinan kerjasama yang baik antara FRIM dan agensi-agensi kerajaan negeri, terutamanya dalam pelaksanaan program seminar dan bengkel perhutanan.

Aktiviti-aktiviti yang dianjurkan oleh FRIM atau dengan kerjasama pihak lain masih merupakan sumber publisiti yang baik, (terutamanya bila terdapat maklumat

The number of media reports containing substantial information on FRIM from both the print or broadcast media for the year 2012 totaled 363 with an estimated public relations (PR) value of RM 9.5 million.

Taking into account all media reports with mention of FRIM by individuals or other agencies regarding collaborations with FRIM or about events held at the FRIM campus, the total number of reports has increased to 590 with PR Value of RM 17.7 million. These were reports filtered and uploaded on the FRIM website.

Out of the total media reports recorded, 78% were newspaper articles; 7.1% magazine articles; 8.6% television reports and 6.3% were radio reports. Of all the newspapers, The Star published the most number of articles on FRIM (15.9%); followed by Sinar Harian (11.5%), New Straits Times (8.6%); Berita Harian (6.7%); Utusan Malaysia (6.3%); Borneo Post (6%); Sin Chew Daily (5.8%); dan Nanyang Siang Pau (4.5%).

There is a significant increase in the number of reports published by newspapers from Sarawak and Sabah to 102 (70, Sarawak and 32, Sabah) in 2012 from 72 (46, Sarawak and 26, Sabah) in 2011. This may be due to the increased media monitoring coverage for the two states and the good cooperation between FRIM and state agencies especially in co-organising forestry-related seminars and workshops.

The various activities organised by FRIM or in collaboration with other parties continued to be the main source of publicity for FRIM, especially when there were interesting information to offer the media, contributing a total of RM4.43 million worth of publicity.

menarik untuk dikongsi dengan pihak media) dengan menyumbangkan sejumlah RM4.43 juta nilai publisiti.

Terdapat 14 program/aktiviti utama yang menarik minat pihak media dan acara FRIM yang mendapat paling banyak liputan media adalah seperti yang berikut:

1. Seminar Pembangunan Perabot 2012—14 Februari;
2. Majlis Menandatangani MOU antara FRIM dan Cube Global—8 Mac;
3. Hari Perhutanan Sedunia—24 Mac;
4. Majlis Pelancaran Infrastruktur Eko-Pelancongan di SPF Mata Ayer, Perlis, bersempena dengan sambutan Hari Alam Sekitar Sedunia—14 Jun;
5. Simposium Antarabangsa mengenai Penebusgunaan, Rehabilitasi dan Pemulihan Tanah ke arah Menghijaukan Asia—3 Julai;
6. Persidangan Perhutanan Bandar 2012—3 Oktober; dan
7. Majlis Penghargaan Media dan Penanaman Pokok—24 November.

Daripada keseluruhan laporan/artikel mengenai FRIM, terdapat 189 artikel berkenaan penyelidikan yang dijalankan oleh FRIM; dan 20 orang penjawat awam FRIM mendapat sebutan dalam laporan media pada tahun 2012.

Penyebaran maklumat melalui kenyataan akhbar mengenai aktiviti atau pencapaian FRIM meningkat pada tahun 2012, dan berjaya mendapat 73 laporan media (termasuk artikel dalam talian).

Promosi penggunaan portal FRIM sebagai sumber maklumat media (News & Announcements, serta Colours of FRIM) membuahkan hasil dengan sejumlah 19 laporan akhbar dipetik dari portal FRIM.

There were 14 programs / activities of interest to the media and the events which attracted the most media coverage were as follows:

1. Seminar Pembangunan Perabot 2012 - 14 Februari;
2. MOU signing ceremony between FRIM and Global Cube – 8 March;
3. World Forestry Day – 24 March;
4. Launching of Eco-Tourism Infrastructure at the FRIM Research Station (SPF) in Mata Ayer, Perlis, in conjunction with World Environment Day – 14 June;
5. International Symposium on Reclamation, Rehabilitation and Restoration Towards a Greener Asia – 3 July;
6. Urban Forestry Conference 2012 – 3 October; and
7. Media Appreciation and Tree Planting Ceremony – 24 November.

Of the total reports / articles on FRIM, 189 articles were research-related, and some 20 FRIM staff were quoted in the media reports of 2012.

There were also more press releases issued regarding FRIM activities or achievements in 2012, and this resulted in a total of 73 media reports (including on-line articles).

Efforts to promote the use of the FRIM portal (News & Announcements and Colours of FRIM) as a source of information for the media also resulted in 19 news reports.

Hari Anugerah Awards Day

FRIM telah mengadakan Majlis Hari Anugerah 2012 pada 18 Mei di Dewan Alwy untuk menyampaikan anugerah dan sijil penghargaan kepada kakitangannya sebagai pengiktirafan ke atas khidmat cemerlang mereka pada tahun 2011. Majlis tersebut dirasmikan oleh Pengerusi MFRDB, YB Hajah Nancy Hj Shukri. Majlis turut dihadiri oleh Timbalan Ketua Setiausaha 2 NRE, Datuk Dr Abdul Rahim Nik, dan Timbalan Ketua Pengarah (Dasar dan Perancangan) Jabatan Perhutanan Semenanjung Malaysia (JPSM), Dato' Masran Md Salleh.

Walaupun tiada penerima bagi Anugerah Saintis Terbaik, terdapat empat kumpulan diberi Anugerah Penyelidikan Terbaik FRIM bagi projek-projek yang berikut:

- Chemical and biological evaluation of water-soluble polysaccharide extracts from *Morinda citrifolia* fruits as anti-diabetic candidate/s (Ketua: Abd Rashid Li);
- Engineered palm wood veneer (E-PaWV) for furniture component and interior products (Ketua: Abdul Hamid Saleh);
- Genetics study of ramin melawis (*Gonystylus bancanus*) in Malaysia for generating information on population genetic structure and establishment DNA database to track smuggling activities (Ketua: Dr Kevin Ng);
- Generation of spatial distribution maps of ramin (*Gonystylus* spp.) using hyperspectral technology and determination of sustainable level of harvest of ramin in production forest of Peninsular Malaysia (Ketua: Dr Khali Aziz Hamzah);

Dr Khali Aziz menerima Anugerah Pekerja Terbaik Tahunan bagi Kategori Pengurusan dan Profesional. Penerima Anugerah Pekerja Terbaik Tahunan untuk Kumpulan Pelaksana 1 ialah Mohd Radzi Ahmad dan Pelaksana 2, Angan Atan.

Anugerah Ketua Pengarah 2011 dimenangi oleh dua kumpulan, iaitu kumpulan yang diketuai Dr Norini Haron bagi penyediaan *Buku Projek Penyelidikan dan Pembangunan (R&D) serta Impaknya Kepada Negara* dan kumpulan diterajui Puan Norhara Hussein untuk penyediaan *Manual Sistem Arahan Pengurusan dan Pentadbiran FRIM (SAPP)*.

- Seramai 30 orang kakitangan telah menerima Anugerah Khidmat Cemerlang 2011 (Individu) berbanding dengan 21 orang pada 2010, manakala anugerah bagi kategori Kumpulan dimenangi oleh tiga pasukan iaitu, Makmal Laminasi Kayu (Ketua: Ong Chee Beng); CBioD RBA Team (Ketua: Dr Serafina Christine Fletcher); dan Mangrove Observer (Ketua: Hamdan Omar).

Selain itu, Anugerah Khidmat Masyarakat 2011 diberikan kepada Md Zain Mazlan dan seramai 27 orang kakitangan yang telah berkhidmat selama 25 tahun di FRIM menerima Anugerah Khidmat Setia.

FRIM held its annual awards ceremony this year on 18 May at Dewan Alwy to present awards and certificates of appreciation to its hardworking staff in recognition of their excellent services, good individual performance as well as group achievements during 2011. The ceremony was officiated by the MFRDB Chairperson, YB Hajah Nancy Shukri and was also attended by the NRE Deputy Secretary General II, Datuk Dr Abdul Rahim Nik and the Forestry Department Peninsular Malaysia (FDPM) Deputy Director General, Dato' Masran Md Salleh.

There was no recipient for the Best Scientist Award, but four teams received the FRIM Best Research Award for the following projects:

- "Chemical and biological evaluation of water-soluble polysaccharide extracts from *Morinda citrifolia* fruits as anti-diabetic candidate/s" led by Abd Rashid Li;
- "Engineered palm wood veneer (E-PaWV) for furniture component and interior products", headed by Abdul Hamid Saleh;
- "Genetics study of ramin melawis (*Gonystylus bancanus*) in Malaysia for generating information on population genetic structure and establishment DNA database to track smuggling activities", led by Dr Kevin Ng; and
- "Generation of spatial distribution maps of ramin (*Gonystylus* spp.) using hyperspectral technology and determination of sustainable level of harvest of ramin in production forest of Peninsular Malaysia", led by Dr Khali Aziz Hamzah.

Dr Khali Aziz, who heads the FRIM Geoinformation Programme, won the Annual Best Employee Award for the Management and Professional Category. The recipient of the Annual Best Employee Award for Support 1 was Mohd Radzi Ahmad and Support 2, Angan Atan.

The Director General's Award 2011 was given to two groups instead of individuals, one led by Dr Norini Haron for the production of *Buku Projek Penyelidikan dan Pembangunan (R&D) serta Impaknya Kepada Negara* and the other, by Mdm Norhara Hussein for *Manual Sistem Arahan Pengurusan dan Pentadbiran FRIM (SAPP)*.

- A total of 30 staff received the Excellence Service Award 2011 (Individual); while the award for the Group category went to three teams: namely, the Wood Lamination Laboratory led by Ong Chee Beng; the CBioD RBA Team, headed by Dr Serafina Christine Fletcher; and the Mangrove Observer, led by Hamdan Omar.

The Community Service Award went to Md Zain Mazlan and 27 staff received the Loyal Service Award for completing their 25th year of service in FRIM.

Majlis juga menyaksikan penyampaian anugerah-anugerah lain termasuk untuk tesis terbaik (PhD dan MSc), penerbitan teknikal serta separa teknikal/bukan teknikal, serta insentif penerbitan dalam jurnal berimpak dan terkemuka untuk kategori individu dan Bahagian.

The ceremony also witnessed the presentation of awards for best thesis (PhD and MSc), best technical and semi technical/non-technical publications, as well as incentives for publication in renowned or high impact journals for individuals and groups.

A. Anugerah Lembaga MFRDB/MFRDB Award

Tiada penerima/No recipient

B. Anugerah Ketua Pengarah/Director General Award



Penerima-penerima Anugerah Ketua Pengarah, Dr Norini (kiri) dan Puan Norhara (kanan) bersama-sama TKSU 2 NRE (dua dari kiri), Ketua Pengarah FRIM (tengah) dan YB Nancy (dua dari kanan)
 The Director General Award's recipients, Dr Norini (left) and Mdm Norhara (right) together with NRE TKSU 2 (second from left), FRIM Director General (middle) and YB Nancy (second from right)

BIL. NO.	NAMA NAMES
1	<p>Dr Norini Haron—Pengerusi & Kumpulan Kerja Penyediaan Buku Projek Penyelidikan dan Pembangunan (R&D) serta Impaknya Kepada Negara</p> <p>Ahli kumpulan/Team members: Dr Rahim Sudin Dr Nur Supardi Md Noor Rosniza Rawi Nik Zanariah Nik Mahmood Abdul Hafiz Mohmad Zakuan Mohd Safuan Abdullah Zamri Mohd Nor Abd. Razak Othman</p>
2	<p>Norhara Hussein—Pengerusi & Kumpulan Kerja Penyediaan Manual Sistem Arahan Pengurusan dan Pentadbiran FRIM (SAPP)</p> <p>Ahli kumpulan/Team members: Suharti Samod Nik Zanariah Nik Mahmood Liza Ismail Mastura Buang Praveena Balai Kerishnan Zahari Othman Saizatul Maheran Ramle Mohd Asmawee Ismail Norul Maslissa Ahmad</p>

C. Anugerah Saintis Terbaik FRIM/FRIM Best Scientist Award

Tiada penerima/No recipient

D. Anugerah Penyelidikan Terbaik FRIM/FRIM Best Research Award

BIL. NO.	PROJEK PENYELIDIKAN RESEARCH PROJECTS	AHLI KUMPULAN GROUP MEMBERS
1	Chemical and biological evaluation of water soluble polysaccharide extracts from <i>Morinda citrifolia</i> fruits as anti-diabetic candidate/s	Abd. Rashid Li (Ketua), Dr Nik Musaadah Mustapha, Mohamad Jemain Mohamad Ridhwan, Mohd Radzi Ahmad, Ahmad Shukri Abdullah, Azman Mohamed, Rohana Sahdan & Nurdalila Zailan
2	Engineered palm wood veneer (E-PaWV) for furniture component and interior products	Abdul Hamid Salleh (Ketua), Yanti Abdul Kadir, Dato' Dr Marzalina Mansor, Khairul Maseat, Dr Hamdan Husain, Dr Khairul Awang, Ab Jalil Muhamad & Othman Desa
3	Genetics study of ramin melawis (<i>Gonystylus bancanus</i>) in Malaysia for generating information on population genetic structure and establishment the DNA database to track smuggling activities	Dr Kevin Ng Kit Siong (ketua), Dr Lee Soon Leong, Dr Ng Chin Hong, Dr Tnah Lee Hong, Nurul Farhanan Zakaria, Dr Lee Chai Ting, Nurul Hudaini Mamat, Mariam Din, Ghazali Jaafar, Yahya Marhani, Ramli Ponyoh, Yasri Baya & Sharifah Talib
4	Generation of spatial distribution maps of ramin (<i>Gonystylus</i> spp.) using hyperspectral technology and determination of sustainable level of harvest of ramin in production forest of Peninsular Malaysia	Dr Khali Aziz Hamzah (Ketua), Dr Shamsudin Ibrahim, Dr Ismail Harun, Mohd Azahari Faidi, Dr Ismail Parlan & Dr Abd Rahman Kassim

E. Anugerah Pekerja Terbaik Tahunan/Best Employee Award

Kumpulan Pengurusan & Profesional/ Management & Professional Group
Dr Khali Aziz Hamzah, Pegawai Penyelidik/Research Officer Q54, Bhg Perhutanan & Alam Sekitar/Forestry & Environment Division
Kumpulan Pelaksana 1/ Implementor Group 1
Mohd Radzi Ahmad, Penolong Pegawai Penyelidik/Assistant Research Officer Q32, Bhg Hasil Semula Jadi/Natural Products Division
Kumpulan Pelaksana 2/ Implementor Group 2
Angan Atan, Pekerja Awam Khas/Special General Worker R3



Penerima Anugerah Pekerja Terbaik, Dr Khali Aziz (a), Mohd. Radzi (b) dan Angan Atan (c) menerima hadiah sijil dan cek daripada YB Nancy (kanan)
 The Best Employee Award recipients, Dr Khali Aziz (a), Mohd. Radzi (b) and Angan Atan (c) receiving the certificates and cheques from YB Nancy

F. Anugerah Perkhidmatan Cemerlang – Individu/Excellent Service Award – Individual



Dr Lee Chai Ting (a), Rosniza Rawi (b) dan Sahrol Ab Lah (c), antara penerima Anugerah Perkhidmatan Cemerlang Individu
 Dr Lee Chai Ting (a), Rosniza Rawi (b) and Sahrol Ab Lah (c), among the Individual Excellent Service Award recipients

BIL. NO.	NAMA NAME	SKIM PERKHIDMATAN SCHEME OF SERVICE
1	Dr Rahim Sudin	Pegawai Penyelidik Khas C VK 7 Research Officer C VK 7 Special
2	Dr Mohd Noor Mahat	Pegawai Penyelidik Q54 Research Officer
3	Dr Wan Asma Ibrahim	
4	Dr Khali Aziz Hamzah	
5	Salamah Selamat	

BIL. NO.	NAMA NAME	SKIM PERKHIDMATAN SCHEME OF SERVICE
6	Dr Hamdan Husain	Pegawai Penyelidik Q52 Research Officer
7	Norsham Suhaina Yaakob	Pegawai Penyelidik Q48 Research Officer
8	Dr Lee Chai Ting	
9	Dr Nik Musa'adah Mustapha	
10	Nik Zanariah Nik Mahmood	Pegawai Penyelidik Q44 Research Officer
11	Mohd Jamil Abdul Wahab	Pegawai Penyelidik Q41 (K) Research Officer (C)
12	Rosniza Rawi	Peg. Teknologi Maklumat F41 (K) Info. Technology Officer (C)
13	Nor Haliyan Tan Shilan	
14	Abdull Rashih Ahmad	Pen. Pegawai Penyelidik Q32 Assistant Research Officer
15	Zainorasri Yahya	Pen. Akauntan W27 Assistant Accountant
16	Normah Basir	Pembantu Penyelidik Q22 Research Assistant
17	Mariam Din	
18	Norul Hasni Abdul Razak	Pembantu Tadbir (P/O) N17 Administrative Assistant
19	Samsol Bohari	Pembantu Penyelidik Q17 Research Assistant
20	Saifulhazlin Abd Rahim	
21	Mohammad Faizal Jaafar	Pembantu Penyelidik Q17 (K) Research Assistant (C)
22	Mohamad Fadzlan Husain	
23	Imin Kamin	
24	Sailesuze Mohd Salim	Pembantu Akauntan W17 Accountant Assistant
25	Sahrol Ab. Lah	Pembantu Am Pejabat N4
26	Ahmad Marhani	Pekerja Awam R4 General Worker
27	Noordin Ahmad	Pemandu Kenderaan R3 Driver
28	Yusniza Md Yusof	Pekerja Awam R1 General Worker
29	Rukiah Mirin	
30	Ahmad Norsidar Abd Halim	Pekerja Awam R1 (K) General Worker (C)

G. Anugerah Perkhidmatan Cemerlang – Kumpulan/Excellent Service Award – Group

BIL. NO.	NAMA KUMPULAN NAMES	AHLI KUMPULAN TEAM MEMBERS
1	Makmal Laminasi Kayu Bhg Keluaran Hutan Wood Lamination Laboratory Forest Products Division	Ong Chee Beng (Ketua), Zamri Zainudin, Muhd Faizullah Ngah Ibrahim & Mohd Muhaimin Mat Yaacob
2	CBioD RBA Team Bhg Perhutanan & Alam Sekitar Forestry & Environment Division	Dr Serafina Christine Fletcher (Ketua), Dr Ab. Rahman Kassim, Nur Zati Akma Mustafa, Joann Christine Luruthusamy, Aminuddin Aziz, Ahmad Shahar Mohamad Yusof, Mohamad Rozaini Nayan, Mohd Nizam Achin, Sadali Sahat, Rauf Razak, Helmi Awang, Nanyan Ismail & Shahrizal Samudin
3	Mangroves Observer Bhg Perhutanan & Alam Sekitar Forestry & Environment Division	Hamdan Omar, Dr Khali Aziz Hamzah, Dr Shamsudin Ibrahim, Dr Raja Barizan Raja Sulaiman, Dr Wan Rasidah Wan A. Kadir, Tariq Mubarak Husin, Azian Mohti, Mohd Azahari faidi, Mohd Fakhri Ishak, Suhaimi Wan Chik, Mohd Parid Mamat, Dr Lim Hin Fui, Huda Farhana Mohamad Muslim, Intan Nurulhani Baharudin, Norshakila Yusof & Mohd Nasir Husin

H. Anugerah Tesis Terbaik/Best Thesis Award

KATEGORI/CATEGORY: PhD.

Tesis Terbaik/Best Thesis

Dr Rafeadah Rusli

Interfacial micromechanics of natural cellulose whisker polymer nanocomposites using raman spectroscopy

KATEGORI/CATEGORY: MSc.

Nada Badruddin

Ecology and behavior of fireflies (Coleoptera: Lampyridae) along the Selangor River, Kuala Selangor, Peninsular Malaysia

Hadiah Merit/Merit Prize

Pemenang Bersama/Double Winner

1 Mohamad Haafiz Mohamad Kassim

Cellulose phosphate from oil palm biomass as potential biomaterial

2 Jaime Castillo Garcia

Ranging patterns and group kinship composition of wild Malaysian slow loris (*Nycticebus coucang coucang*) using radio telemetry and mitochondrial DNA analysis

I. Augerah Penerbitan FRIM/FRIM Publication Award

KATEGORI/CATEGORY A: PENERBITAN TEKNIKAL/TECHNICAL PUBLICATION

Pemenang Pertama/First

Dr Khali Aziz Hamzah, Mohd Azahari Faidi, Tan Sek Aun & Hamdan Omar

Generation of spatial distribution maps of *Gonystylus bancanus* (ramin) using hyperspectral technology— Proceedings of the Regional Workshop on the Sharing of Findings from the Activities Implemented in Indonesia and Malaysia under the ITTO-CITIES Project on Ensuring International Trade in CITES-listed Timber Species is Consistent with their Sustainable Management and Conservation

Pemenang Kedua/Second

Hamdan Omar, Dr Khali Aziz Hamzah & Dr Abd Rahman Kassim

Remotely sensed L-Band SAR Data for Tropical Forest Biomass Estimation— Journal of Tropical Forest Science 23(3): 318–327

Pemenang Ketiga/Third

Dr Tnah Lee Hong, Dr Lee Soon Leong, Dr Kevin Ng Kit Siong, Subha Bhassu & Rofina Yasmin Othman
DNA extraction from dry wood of *Neobalanocarpus heimii* (Dipterocarpaceae) for forensic DNA profiling and timber tracking— Wood Science and Technology DOI 10.1007/s00226-011-0447-6

KATEGORI/CATEGORY B: PENERBITAN SEPARA/BUKAN TEKNIKAL/SEMI/NON-TECHNICAL PUBLICATION

Pertama/First

Dr Norini Haron, Dato' Dr Abd. Latif Mohmod, K. Nagulendran & Lim Hin Fui

Traditional Knowledge on Medicinal and Aromatic Plants as an Important Source of Culture and Heritage of the Orang Asli, Peninsular Malaysia— Proceedings of the 12th International Joint World Cultural Tourism Conference

Kedua/Second

Azharizan Mohamad Norizan, Dr Ismail Harun & Tariq Mubarak Husin

Pensijilan Rantaian dan Penjagaan Produk Kayu— Dewan Ekonomi

Ketiga/Third

Sharmiza Adnan, Latifah Jasmani, Mahmudin Saleh & Dr Mohamed Nor Mohd. Yusoff

Establishment of Proficiency Testing (PT) Scheme for Paper Products: A Malaysian Experience— APPITA Journal 64(1):30-35

KATEGORI/CATEGORY C: BUKU/BOOKS

Ong Poh Teck, P O'Bryne, Wendy Yong Sze Yee & Dr Saw Leng Guan
Wild Orchids of Peninsular Malaysia

KATEGORI D: BUKU PANDUAN /HANDBOOKS

Pemenang Bersama/Co-Winners

Thi Bee Kin, Dr Lee Su See, Nazura Zainuddin & Chan Hong Twu
A Guidebook to the Macrofungi of Fraser's Hill

Wendy Yong Sze Yee, Dr Lillian Chua Swee Lian, Suhaida Mustafa & Aslina Baharum
Forest Research Institute Malaysia: A Sanctuary for Threatened Trees

J. Insentif Penerbitan dalam Jurnal Berimpak Faktor & Terkemuka
Incentive for Publications in Impact Factored & Renowned Journals

KATEGORI: INDIVIDU/CATEGORY: INDIVIDUAL



Dr Rafeadah Rusli (kiri), antara penerima Insentif Penerbitan dalam Jurnal Berimpak Faktor dan Terkemuka (Individu)
 Dr Rafeadah Rusli (left), among the recipients of the Incentive for Publications in Impact Factored and Renowned Journals (Individual)

Bil. No.	Nama/Name	Faktor Impak Kumulatif Cumulative Impact Factor	Hadiah/Prize (RM)
1	Dr Rafeadah Rusli	8.969	2250
2	Tan Hooi Poay	5.346	1250
3	Dr Tnah Lee Hong	4.330	1000
4	Dr Lee Chai Ting	3.571	750
5	Dr Ling Sui Kiong	3.447	750
6	Dr Nurhanan Murni Yunos	3.831	750
7	Khairul Kamilah Abdul Kadir	2.816	500
8	Dr Laurence G. Kirton	2.717	500
9	Dr Lee Soon Leong	2.671	500
10	Dr Mohd Khairun Anwar Uyup	2.507	500
11	Nada Badruddin	2.717	500
12	Adiana Mohamed Adib	1.599	250
13	Mazura Md Pesar	1.599	250
14	Nur Zati Akma Mustafa	1.456	250
15	Dr Pin Kar Yong	1.263	250
16	Dr Wan Asma Ibrahim	1.038	250

KATEGORI : BAHAGIAN
CATEGORY: DIVISION

Bil. No.	Bahagian/Divisions	Faktor Impak Akumulatif Accumulative Impact Factors	Hadiah/Prize (RM)
1	Tempat Pertama/First Prize Hasilan Semula Jadi/Natural Products	19.969	2000
2	Tempat Kedua/Second Prize Keluaran Hutan/Forest Products	12.514	1000
3	Tempat Ketiga/Third Prize Bioteknologi Perhutanan/Forestry Biotechnology	10.572	500

K. Saguhati Penulisan dalam JTFS 2011
Consolation Prize for Publication in JTFS 2011

Bil. No.	Nama Names	Artikel Articles
1	Dr Rahim Sudin	Effects of wood:cement ratio on mechanical and physical properties of three-layered cement-bonded particleboards from <i>Leucaena leucocephala</i>
2	Siti Syarifah Mohd Mutalip	Potential anticancer compound from <i>Cerbera odollam</i>
3	Dr Zaihan Jalaludin	Analysis of the water vapour sorption isotherms of oil palm trunk and rubberwood
4	Dr Ismail Parlan	Phenology of <i>Gonystylus bancanus</i> in Pahang, Peninsular Malaysia
5	Dr Ahmad Fauzi Puasa	Assesment costs of chain of custody certification for sawnwood manufacturers in Peninsular Malaysia Comparison of wood properties of planted big-leaf mahogany (<i>Swietenia macrophylla</i>) in Martinique Island with naturally grown mahogany from Brazil, Mexico and Peru
6	Chan Yoke Mui	Reproductive biology of the endangered and endemic <i>Johannesteijsmannia lanceolata</i> J. Dransf (Arecaceae)
7	Nordahlia Abdullah Siam	S. Fibre morphology and physical properties of 10 years old sentang (<i>Azadirachta excelsa</i>) planted from rooted cuttings and seedlings
8	Rafidah Jalil	Effects of different gasifying agents on syngas production from oil palm trunk
9	Hamdan Omar	Remotely-sensed L-band SAR data for tropical forest biomass estimation
10	Dr Norwati Adnan	Expression of Bt protein in transgenic teak
11	Dr Lee Chai Ting	Estimation of the outcrossing rates in <i>Koompassia malaccensis</i> from an open-pollinated population in Peninsular Malaysia using microsatellite markers
12	Dr Wan Asma binti Ibrahim	Effects of mulching and fertilizer on nutrient dynamics of sand tailings grown with <i>Acacia</i> hybrid seedlings
13	Mahanim Sarif@Mohd Ali	Production of activated carbon from industrial bamboo wastes
14	Jeyanny Vijayanathan	Effects of arbuscular mycorrhizal inoculation and fertilization on the growth of <i>Acacia mangium</i> seedlings
15	Dr Ahmad Zuhaidi Yahya	Growth response and yield of plantation-grown teak (<i>Tectona grandis</i>) after low thinning treatments at Pagoh, Peninsular Malaysia
16	Mohamad Jemain Mohamad Ridhwan	In vitro antihyperglycaemic effects of some Malaysian plants

L. Anugerah Khidmat Masyarakat/Community Service Award

BIL. NO.	NAMA NAMES	SKIM PERKHIDMATAN SCHEME OF SERVICE	BHG/PROGRAM DIV/PROG.
1	Md. Zain Mazlan	Tukang K2 Gred R22 Carpenter K2 Grade R22	Pentadbiran Administration

M. Anugerah Khidmat Setia/Loyal Service Award



Nor Azian Kasby (a) dan Afendi Husin (b); antara penerima Anugerah Khidmat Setia
Nor Azian Kasby (a) and Afendi Husin (b); among the Loyal Service Award recipients

BIL. NO.	NAMA NAMES	SKIM PERKHIDMATAN SCHEME OF SERVICE	BHG/PROGRAM DIV/PROG.
1	Dr Nor Azah Mohamad Ali	Pegawai Penyelidik/Research Officer Q54	Hasilan Semula Jadi Natural Products
2	Dr Ismail Harun	Pegawai Penyelidik/Research Officer Q54	Perhutanan & Alam Sekitar Forestry & Environment
3	Wan Zahiri Wan Yaacob	Pegawai Penyelidik/Research Officer Q52	Keluaran Hutan/Forest Products
4	Dr Hamdan Husain	Pegawai Penyelidik/Research Officer Q52	Keluaran Hutan/Forest Products
5	Dr Mohd Tamizi Mustafa	Pegawai Penyelidik/Research Officer Q48	Keluaran Hutan/Forest Products
6	Puad Elham	Pegawai Penyelidik/Research Officer Q48	Keluaran Hutan/Forest Products
7	Dr Lok Eng Hai	Pegawai Penyelidik/Research Officer Q44	Bioteknologi Perhutanan Forestry Biotechnology
8	Rozita Ahmad	Pegawai Penyelidik/Research Officer Q41	Bioteknologi Perhutanan Forestry Biotechnology
9	Mohd Afendi Husin	Pen. Pegawai Penyelidik/Ass. Research Officer Q36	Perhutanan & Alam Sekitar Forestry & Environment
10	Nor Azian Mohd Kasby	Pen. Pegawai Penyelidik/Ass. Research Officer Q36	Keluaran Hutan/Forest Products

BIL. NO.	NAMA NAMES	SKIM PERKHIDMATAN SCHEME OF SERVICE	BHG/PROGRAM DIV/PROG.
11	Rozaida Latip	Pen. Pegawai Penyelidik/Ass. Research Officer Q32	Keluaran Hutan/Forest Products
12	Shahrulzaman Idris	Pen. Pegawai Penyelidik/Ass. Research Officer Q32	Perhutanan & Alam Sekitar Forestry & Environment
13	Norli Raja Mohamad	Pen. Akauntan/Ass. Accountant W32	Kewangan/Finance
14	Mohd Hasan Buang	Pemb. Penyelidik/Research Assistant Q22	Keluaran Hutan/Forest Products
15	Mohamad Shapie Jusoh	Pemb. Penyelidik/Research Assistant Q22	Pentadbiran/Administration
16	Othman Mohd. Desa	Pemb. Penyelidik/Research Assistant Q22	Keluaran Hutan/Forest Products
17	Abd Razal Abd Latif	Pemb. Penyelidik/Research Assistant Q22	Perhutanan & Alam Sekitar/ Forestry & Environment
18	Nordin Puteh	Pemb. Penyelidik/Research Assistant Q22	Keluaran Hutan/Forest Products
19	Siti Roshidan Saidin	Pemb. Setiausaha Pejabat/ Office Secretary Assistant N22	Dasar Pengurusan/ Management Policy
20	Madzlan Zainuddin	Pemb. Penyelidik/Research Assistant Q17	Bioteknologi Perhutanan Forestry Biotechnology
21	Faridah Ismail	Pemb. Setiausaha Pejabat/ Office Secretary Assistant N17	Peranc. Penyelidikan & Korporat Research Planning & Corporate
22	Wan Zahari Wan Yaacob	Tukang/Carpenter K2 R22	Keluaran Hutan/Forest Products
23	Salen Ismail	Tukang/Carpenter K2 R22	Pentadbiran/Administration
24	Suffian Hamsan	Tukang/Carpenter K2 R22	Keluaran Hutan/Forest Products
25	Zainal Abidin Mansor	Tukang/Carpenter K2 R22	Pentadbiran/Administration
26	Mohammad Hj. Sahak	Tukang/Carpenter K2 R22	Keluaran Hutan/Forest Products
27	Jamal Abd Ghani	Operator Loji R8	Keluaran Hutan/Forest Products

N. Anugerah Sukan/Sports Award

Bil. No.	Anugerah Awards	Penerima Recipients
1	Pasukan Terbaik/The Best Team	<i>Futsal lelaki/Men futsal</i> Mohamad Nasir Mat Arip (K) Ahmad Norsidar Ab. Halim Azam Shah Mat Rata Azizi Abd. Jalil Khaironl Ishak Mohamad Faizal Sharuddin Mohd Aidil Ramley Mohd Firdaus Toharuddin Mohd Ismul Azam Noor Hakimi Mohd Noriarullah Mohd Nor Roshidi Rosmaidi
2	Pengurus Pasukan Terbaik/ Best Team Manager	<i>Mountain Bike Team</i> Mohd Zain Mazlan
3	Olahragawan/Sportsman	Ahmad Norsidar Ab Halim
4	Olahragawati/Sportswoman	Suhaida Mustafa

Laporan Kewangan dan Aktiviti Utama Projek Pembangunan Financial Report and Highlights of Development Projects

PENGURUSAN KEWANGAN

Pendahuluan

Laporan ini bertujuan untuk menganalisis Penyata Kewangan Lembaga bagi tahun berakhir 31 Disember 2012. Penurunan peruntukan geran daripada Kerajaan memberi kesan yang ketara kepada prestasi kewangan Lembaga bagi tahun kewangan 2012. Jumlah keseluruhan perbelanjaan telah melebihi pendapatan sebanyak RM3.3 juta berbanding lebih pendapatan sebanyak RM9.0 juta pada tahun 2011, perbezaan sebanyak RM12.3 juta. Ini adalah disebabkan walaupun jumlah besar perbelanjaan teras dan operasi meningkat sebanyak 6%, tetapi jumlah pendapatan diterima menurun sebanyak 7% berbanding tahun 2011.

Pendapatan

Pada tahun 2012, Lembaga memperoleh pendapatan sebanyak RM92.4 juta iaitu berkurangan sebanyak RM6.9 juta berbanding RM99.3 juta pada tahun 2011. Pengurangan tersebut sebahagian besarnya disebabkan oleh pengurangan sumbangan daripada Kerajaan Malaysia sebanyak RM69.5 juta berbanding RM81.7 juta pada tahun 2011. Walaupun terdapat juga peningkatan dalam jenis pendapatan yang lain berbanding tahun 2011 seperti sumbangan dan bayaran organisasi luar RM9.2 juta, bayaran perkhidmatan RM9.3 juta, sewaan RM0.7 juta dan keuntungan atas simpanan tetap perbankan Islam RM1.7 juta, ia tidak dapat mengimbangi jumlah penurunan penerimaan geran Kerajaan yang dinyatakan.

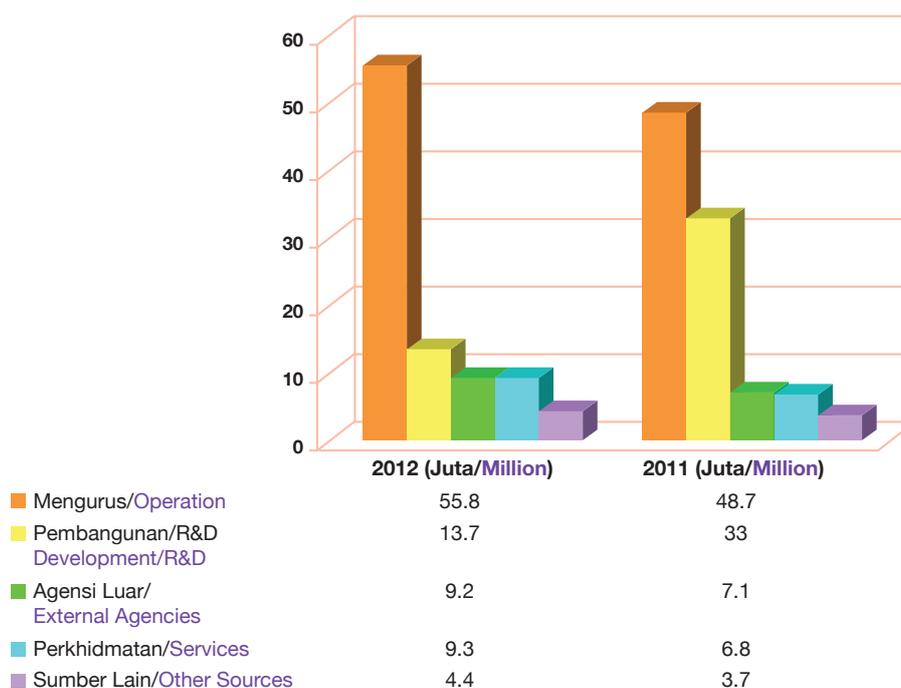
FINANCIAL MANAGEMENT

Introduction

This report is to analyse the Board's Financial Statement for the year ended 31 December 2012. The decreased in grant allocation received from the Government had affected the Board's financial performance for the year 2012. Total expenditure had exceeded over its revenue by RM3.3 million against a surplus of revenue amounting to RM9.0 million in 2011, a difference of RM12.3 million. This is because although total operating and major expenditure had increased by 6%, total revenue had dropped by 7% compared with 2011.

Revenue

In year 2012, total revenue received by the Board was RM92.4 million decreasing by RM6.9 million compared with RM99.3 million in 2011. The decreased was mainly caused by the drop in allocation received from the Government amounting to RM69.5 million compared with RM81.7 million in 2011. Although there is an increase in other types of revenue compared with 2011 such as contribution from external agencies RM9.2 million, payment for services provided RM9.3 million, rental RM0.7 million and profit from islamic banking fixed deposit RM1.7 million, it was not enough to offset the decrease in the amount of the government grant received as stated earlier.



Jadual 1: Perbandingan Pendapatan Tahun 2012 dan 2011
Table 1: Comparison of Revenue for 2012 and 2011

Perbelanjaan

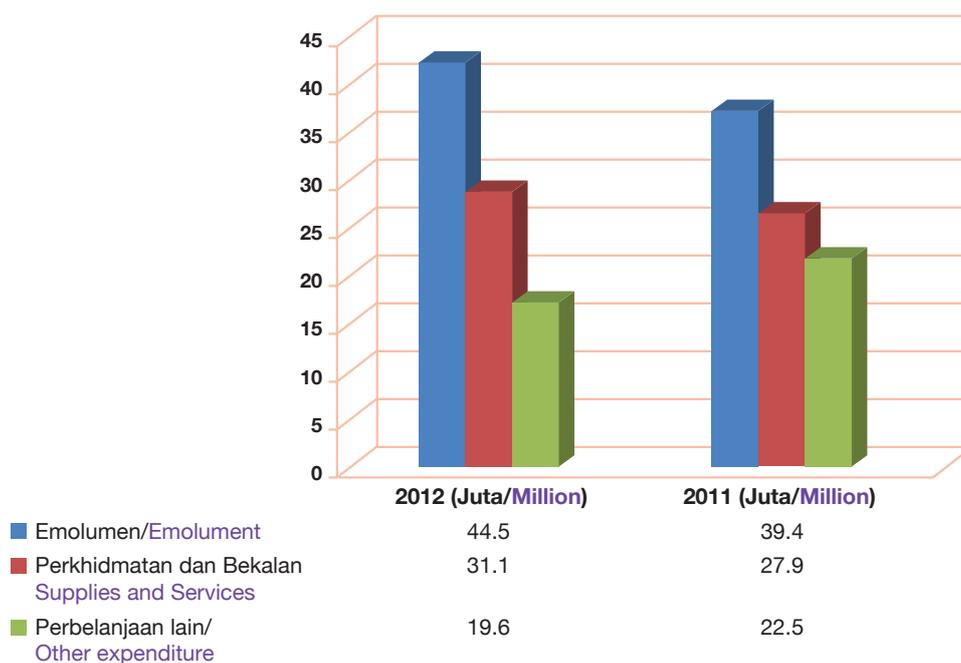
Jumlah keseluruhan perbelanjaan Lembaga dalam tahun 2012 telah meningkat kepada RM95.2 juta berbanding RM89.8 juta pada tahun 2011. Lembaga telah membelanjakan sebanyak RM44.5 juta pada tahun 2012 untuk pembayaran gaji dan emolument iaitu meningkat sebanyak 11% berbanding RM39.4 juta pada tahun sebelumnya. Ini adalah kerana keputusan Kerajaan untuk pemberian bonus separuh gaji kepada penjawat awam pada bulan Ogos dan Disember serta penyelarasan gaji penjawat awam pada tahun 2012.

Perbelanjaan bagi perkhidmatan dan bekalan mencatatkan peningkatan sebanyak RM3.2 juta iaitu daripada RM27.9 juta pada tahun 2011 kepada RM31.1 juta pada tahun 2012. Peningkatan tersebut disebabkan oleh peningkatan kos perkhidmatan dan bekalan. Perbelanjaan-perbelanjaan lain pula menunjukkan penurunan sebanyak RM3.0 juta iaitu daripada RM22.5 juta pada tahun 2011 kepada RM19.6 juta pada tahun 2012 atau penurunan sebanyak 15.4% kerana pengurangan kenaaan susut nilai dan jumlah penyaluran berbentuk geran kepada agensi-agensi lain.

Expenditure

Total Board' s expenditure in 2012 had increased to RM95.2 million as compared with RM89.8 million in 2011. The Board had spent RM44.5 million for salaries and emolument, which is an increased by 11% compared to RM39.4 million in the previous year. This was as a result of the Government decision to pay half month bonuses in August and December and also the salary adjustment made in 2012.

The expenditure for supplies and services recorded an increase of RM3.2 million, that was RM27.9 million against RM31.1 million in 2012. The increase was as a result of the increasing cost of supplies and services. For other expenses, it shows a significant decrease by RM3.0 million, that is from RM22.5 million in 2011 to RM19.6 million in 2012, or a decrease of 15.4% due to the decrease in expenses for depreciation and payment in the type of grants to other agencies.



Jadual 2: Perbandingan Perbelanjaan Tahun 2012 dan 2011
Table 2: Comparison of Expenditure for 2012 and 2011

Aliran Tunai dan Pelaburan

Lembaga tidak mengalami masalah aliran dan kecairan tunai dan telah dapat menjelaskan semua tanggungjawab kewangan pada masa yang ditetapkan. Lembaga juga telah melaburkan tunai yang belum digunakan dalam simpanan tetap di bank-bank tempatan dan instrumen lain yang diluluskan oleh Kementerian Kewangan.

Kunci Kira-Kira

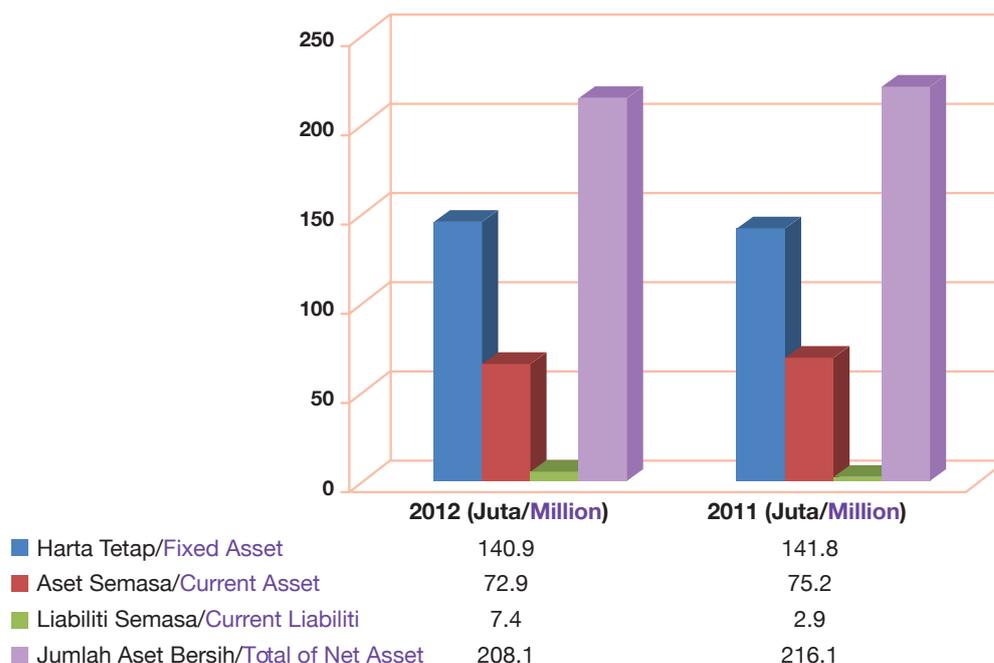
Nilai buku aset tetap bersih FRIM mencatatkan penurunan sebanyak RM1.2 juta daripada RM141.8 juta pada tahun 2011 kepada RM140.6 juta. Simpanan tetap juga menurun sebanyak RM2.9 juta iaitu daripada RM63.3 juta pada tahun 2011 kepada RM60.4 juta pada tahun 2012. Keseluruhan aset Lembaga bagi tahun berakhir 31 Disember 2012 ialah sebanyak RM208.1 juta menurun berbanding RM216.1 juta pada tahun 2011.

Cash Flow and Investment

The Board did not have any cash flow or liquidity problem and had always been able to fulfill all financial obligations on time. The Board had also invested of the cash still not be used in fixed deposit in local banks and financial instrument approved by the Ministry of Finance.

Balance Sheet

The Board's fixed asset book value recording a decrease of RM1.2 million from RM141.8 million in 2011 to RM140.6 million. Fixed deposit, also showing a decrease of RM2.9 million, that is from RM63.3 million in 2011 to RM60.4 million in 2012. Board's total asset value for the year ended 31 December 2012 showing a figure of RM208.1 million, a decrease compared with RM216.1 million in 2011.



Jadual 3: Perbandingan Kunci Kira-Kira Bagi Tahun 2012 dan 2011

Table 3: Comparison of Balance Sheet for 2012 and 2011

Laporan Ketua Audit Negara

Ketua Audit Negara telah memperakukan penyata kewangan Lembaga tahun 2012 dengan memberi sijil bersih dan berpendapat bahawa Penyata Kewangan tersebut memberi gambaran yang benar dan saksama terhadap kedudukan kewangan Lembaga Penyelidikan dan Pembangunan Perhutanan Malaysia pada 31 Disember 2012, hasil operasi dan aliran tunainya untuk tahun tersebut berdasarkan piawaian perakaunan yang diluluskan.

Auditors General's Report

The Auditor General had certified the Board's Financial Statement for 2012 with a clean audit report and their opinion the statement had given a true and fair view of the financial position of Malaysian Forestry Research and Development Board as at 31 December 2012, its operation and cash flows for that year in accordance with approved accounting standard.

AKTIVITI UTAMA PROJEK PEMBANGUNAN

Perasmian Kediaman Berpusat Meranti

Projek pembinaan 60 unit kuarters penjawat awam FRIM siap pada bulan Mac dan seramai 46 keluarga telah mendapat kunci untuk mula berpindah ke kuarters tersebut. Majlis Perasmian Kediaman Berpusat Meranti disempurnakan oleh Menteri NRE, YB Dato Sri Douglas Uggah Embas, pada 9 Mei. Kerja-kerja pembinaan kuarters Meranti, yang dibiayai oleh Kerajaan Persekutuan dengan peruntukan sebanyak RM14.7 juta, bermula pada 9 Julai 2009. Projek ini termasuk pembinaan rumah pengawal keselamatan, kawasan pengumpulan sampah berpusat dan infrastruktur luaran yang lain. Daripada 60 unit pangsapuri baharu di dua blok Kuarters Kediaman Berpusat Meranti, dua unit dijadikan Rumah Tetamu, dua lagi untuk pegawai dan 56 untuk kakitangan sokongan.

HIGHLIGHTS OF DEVELOPMENT PROJECTS

Official Launching of the Meranti Quarters

The project to construct a 60-unit quarters for the FRIM staff has been completed in March this year, with 46 families receiving the keys to move into the Meranti Staff Quarters to date. The official launching of the two-four-storey-block Meranti Staff Quarters by the Minister of NRE, YB Dato Sri Douglas Uggah Embas, was held on 9 May. The construction of the Meranti Staff Quarters, with an allocation of RM14.7 million from the Federal Government, started on 9 July 2009. The project included the construction of a security guard house, a centralised garbage collection area and other external infrastructure. Of the 60 new apartment units at the Meranti Quarters, two will be allocated for guests, two more for FRIM officers and 56 for support staff.



Menteri menandatangani plak Kwarters Kediaman Berpusat Meranti
The Minister signing on the plaque of the Meranti Quarters



Salah seorang kakitangan menerima "Kunci" daripada Dato Sri Douglas
A staff receiving the "Key" from Dato Sri Douglas

Projek Naik Taraf Pintu Masuk Utama

FRIM telah melaksanakan projek menaik taraf pintu masuk utama kampusnya yang bermula pada 24 September untuk menambah jumlah tempat meletak kereta bagi mengurangkan kesesakan jalan serta memberikan wajah baharu kepada kawasan tersebut. Projek pembangunan ini telah mendapat kelulusan Majlis Perbandaran Selayang pada 14 September 2012. Projek ini melibatkan pelebaran jalan daripada dua lorong kepada empat lorong dengan satu laluan khusus untuk membelok ke kiri. Selain itu, sebanyak 30 parkir akan disediakan untuk kereta dan dua untuk bas di kawasan seluas setengah hektar di sebelah kanan pintu masuk FRIM yang dahulunya hanya mampu menyediakan parkir kepada kurang daripada 15 buah kereta.

Projek ini juga melibatkan pembinaan jalan baharu merentasi kolam dari Jalan Bukit Baru dan Jalan Abdul Rahman Ali, kira-kira 50 m selepas memasuki pintu utama FRIM, dan pemasangan pembedung dengan kunci pintu air utama bagi memantau paras air di kolam tadahan untuk mengelak banjir.

Facelift Project at the Main Entrance

FRIM planned to upgrade the parking facilities at its main entrance, which will help to ease congestion and give the area a facelift, is well on the way with the earthworks being carried out since 24 September. The development project, which includes the beautification of the area, was approved by the Selayang Municipal Council on 14 September. Once completed, the road system will be significantly widened from the present two lanes into four lanes with a dedicated left turn. There will also be 30 parking lots for cars and two for buses at the half-hectare area to the right of the FRIM entrance where there used to be a small parking area with the capacity of accommodating less than 15 cars.

The project also includes the construction of a new road across a flood prone area, from Jalan Bukit Baru and Jalan Abdul Rahman Ali, some 50 meters from the entrance, and the installation of a culvert with lock gate to monitor the water levels of the stormwater detention pond to prevent floods.

Lawatan Rasmi

Official Visits

Sepanjang 2012, FRIM telah menerima sebanyak 25 lawatan rasmi yang disertai oleh sejumlah 329 orang delegasi dari dalam dan luar negara.

In 2012, FRIM received 25 official visits comprising a total of 329 local and international delegates.

BIL NO	PELAWAT VISITORS	TARIKH DATE
1	VTT Technical Research Centre of Finland dan Lembaga Kemajuan Perindustrian Malaysia (MIDA) VTT Technical Research Centre of Finland and the Malaysian Industrial Development Authority (MIDA)	30 Januari/January
2	45 orang siswazah tahun akhir Sekolah Perhutanan Tropika Antarabangsa bersama dua orang pensyarah dari Universiti Malaysia Sabah (UMS) 45 final year graduates and two lecturers from School of International Tropical Forestry, Universiti Malaysia Sabah (UMS)	4 Februari/February
3	Pelawat Mantan Ketua Pengarah FRIM, Tan Sri Dr Salleh Mohd Nor (dari Australia, diketuai oleh Dr Harban Singh) Visitors of the former FRIM Director General, Tan Sri Dr Salleh Mohd Nor (from Australia, headed by Dr Harban Singh)	21 Februari/February
4	Ketua Setiausaha Kementerian Pelancongan Malaysia Secretary General of the Ministry of Tourism Malaysia	9 Mac/March
5	Royal Institution of Surveyors Malaysia	17 Mac/March
6	Delegasi Korea/ Delegation from Korea	19 Mac/March
7	PT Mutu Agong Lestari dari Indonesia diwakili En. Tony Arifiarachman, En. James Apituley, En. Taiki Otomo dan Puan Dian Harini PT Mutu Agong Lestari from Indonesia represented by Mr Tony Arifiarachman, Mr James Apituley, Mr Taiki Otomo and Mrs Dian Harini	26-30 Mac/March
8	Dr Hugh Mansfield, Pengurus Teknikal TRADA Technology Limited Dr Hugh Mansfield, Technical Manager of TRADA Technology Limited	10 April
9	Pensyarah-pensyarah dan Pelajar-pelajar (MSc.) Perhutanan, Universiti of Toronto, Kanada Lecturers and students (MSc.) Forestry, Universiti of Toronto, Canada	16 April
10	Kerajaan Negeri Madhya Pradesh—Menteri Hutan Encik Santaj Singh; Pengarah Urusan Tambahan Madya Pradesh State Minor Forest Produce (Trade & Development) Co-operative Federation Ltd., Encik Ravi Srivastava, dan Ketua Pegawai Eksekutif Madhya Pradesh Minor Forest Produce—Processing and Research Centre, Encik RR Okhandiar Madhya Pradesh State Government—Forest Minister Mr Santaj Singh; Managing Director of Madya Pradesh State Minor Forest Produce (Trade & Development) Co-operative Federation Ltd., Mr Ravi Srivastava, and Chief Executive Officer of Madhya Pradesh Minor Forest Produce—Processing and Research Centre, Mr RR Okhandiar	18 April
11	Pegawai Kanan Jabatan Perkhidmatan Awam (JPA) & NRE Senior Officers from the Public Service Department & the NRE	18 April
12	Delegasi dari AKECU, Korea—Dr Ho Sang Kang (Secretary General, AKECOP (ASEAN-Korea Environmental Cooperation Project) dan Dr Goon Taek Le, Research Professor, Soil and Water Analysis Lab, National Instrumentation Center for Environmental Management, Seoul National University Delegation from AKECU, Korea—Dr Ho Sang Kang (Secretary General, AKECOP (ASEAN-Korea Environmental Cooperation Project) and Dr Goon Taek Le, Research Professor, Soil and Water Analysis Lab, National Instrumentation Center for Environmental Management, Seoul National University	26 April
13	Delegasi JIRCAS/Delegation from JIRCAS	3 Mei/May

BIL NO	PELAWAT VISITORS	TARIKH DATE
14	Delegasi dari India—Dr N Krishna Kumar (Pengarah) dan Dr A Karthikeyan (Saintis) dari Institute of Forest Genetics and Tree Breeding Delegation from India—Dr N Krishna Kumar (Director) and Dr A Karthikeyan (Scientist) from the Institute of Forest Genetics and Tree Breeding	7 Jun/June
15	Penasihat PIBG Sekolah Kebangsaan Kepong Advisor of Sekolah Kebangsaan Kepong Parents-Teacher Association	22 Jun/June
16	JKR Subang Subang Public Work Department	3 Julai/July
17	Delegasi Nigeria - National Institute for Policy and Strategic Studies (NIPSS), Republik Nigeria diketuai oleh Prof. Tijjani M. Bande, OFR, Ketua Pengarah NIPSS Delegation from Nigeria- National Institute for Policy and Strategic Studies (NIPSS), Republic of Nigeria headed by Prof. Tijjani M. Bande, OFR, Director General of NIPSS	25 Julai/July
18	Jabatan Kerja Raya ke Bangunan Glulam Public Work Department to the Glulam Building	26 Julai/July
19	Bank Pembangunan Islam (IDB) diketuai oleh En. Aminuddin Mat Ariff, Science & Technology and Technical Cooperation Division (STC), Capacity Development Department Islamic Development Bank (IDB), headed by Mr Aminuddin Mat Ariff, Science & Technology and Technical Cooperation Division (STC), Capacity Development Department	5 Ogos/August
20	Duta Peru, Mr Marco V. Balarezo Peru Ambassador, HE Mr Marco V. Balarezo	28 Ogos/August
21	National Biodiversity Centre Singapore	25 September
22	MARDI —Timbalan Pengarah Program Pengurusan Kualiti & Inovasi Korporat, Puan Wan Sariyah Wan Hassan MARDI—Deputy Director Corporate Quality & Innovation Management Program, Mdm Wan Sariyah Wan Hassan	3 Oktober/October
23	The Michigan State Alumni Malaysia (PAMSUM)	3 Oktober/October
24	Menteri Sumber Asli & Alam Sekitar (NRE) dan Menteri Alam Sekitar & Sumber Air (MEWR) Minister of NRE and Minister of the Singapore Environment & Water Resources	11 Oktober/October
25	Panel Penilai Malaysian Good Design Mark 2012 (MGDM). Taklimat mengenai fungsi dan aktiviti MGDM dan Majlis Rekabentuk Malaysia (MRM) Malaysian Good Design Mark 2012 (MGDM) Evaluation Panel. Briefing on the MGDM and the Malaysian Design Council functions and activities	7 Disember/December

PELANTIKAN/APPOINTMENTS

Pegawai Penyelidik Gred Q41 Research Officer Grade Q41	Tarikh Iantikan Appointment date
Mohd Yusouf b. Abdul Latif1 (Bahagian Keluaran Hutan/Forest Products Division)	Jun/June
Praveena a/p Balai Kerishnan (Pejabat Ketua Pengarah/Director General's Office)	1 Jun/June

KENAIKAN PANGKAT/PROMOTIONS

Nama/ Name	Jawatan/Gred Post/Grade	Tarikh/ Date
Nor Azman Hussein Mahmudin Saleh Hamdan Hussain, Dr Ismail Parlan, Dr Muhammad Farid Abdul Rashid Mastura Mohtar, Dr	Pegawai Penyelidik Q54 Research Officer Q54	1 Julai/July
Ho Yuen Foon Mohamad Zaki Mohd Isa Vimala a/p P. Subramaniam, Dr Hashim W Samsi Lee Chai Ting, Dr Rosdi Koter Wan Mohd Shukri Wan Ahmad Nor Hasnida Hassan, Dr Kevin Ng Kit Siong, Dr Mohd Kharun Anwar Uyup, Dr Fadhilah Zainuddin, Dr	Pegawai Penyelidik Q52 Research Officer Q52	
Mohd Parid Mamat Mohd Shahidan Mohd Arshad Zahari Othman Nik Zanariah Nik Mahmood Ahmad Nazaruddin Mohd Roseli Zamree Md Shah Mohamad Nasir Mat Arip	Pegawai Penyelidik Gred Q48 Research Officer Q48	
Maizurah Ishak Nada Badruddin Lili Sahira Husin Azian Mohti Mahanim Sarif @ Mohd Ali Rafidah Jalil Noor Rasyila Mohamed Noor Saiful Azmi Johari Rozita Ahmad Nurul Hilal Hj. Ahmad Tarmidzi Tumirah Khadiran Mailina Jamil	Pegawai Penyelidik Q44 Research Officer Q44	
Mohd Kamarudin Saleh	Pen. Peg. Penyelidik Q32 Asst. Research Officer Q32	
Roszalli Mohd Abd. Azhan Shah Idris	Pen. Peg. Penyelidik Q32 (KUP) Asst. Research Officer Q32 (PTH)	

Nama/ Name	Jawatan/Gred Post/Grade	Tarikh/ Date
Saimin Basir	Pembantu Penyelidik Q26 Research Assistant Q26	1 Oktober/October
Zainol Abu Saifulhazlin Abd Rahim Mohamad Aidil Noordin Mohd Nizam Achin	Pembantu Penyelidik Gred Q22 Research Assistant Q22	
Sabri Ahmad Samsol Bohari	Pembantu Penyelidik Q22 (KUP) Research Assistant Q22 (PTH)	1 Oktober/October 25 Ogos/August
Zakaria Yusoff	Renjer Hutan G22 Ranger G22	16 September
Faridah Ismail	Pemb. S/U Pejabat N22 (KUP) Office Secretary Assist. N22 (PTH)	1 September
Syahrullzaman Ismail	Tukang K2 R22 (KUP) K2 Carpenter R22 (PTH)	8 November
Ahmad Hasim	Pengawas Hutan G14 (KUP) Forester G14 (PTH)	1 September
Mohammad Adzam Ahmad	Tukang K3 Gred R14 K3 Carpenter R14	1 Oktober/October
Rosidi Sulaiman Kamal Bahrin Mahbob Abdul Ghani Mohamad Mohd Azmi Omar	Tukang K3 R14 (KUP) K3 Carpenter R14 (PTH)	1 Februari/February
Kunasegaran a/l Muthu	Pekerja Awam Khas R6 Special General Worker R6	1 Oktober/October
Samsuddin Hj. Malek	Pemandu Kenderaan R6 (KUP) Driver R6 (PTH)	1 November
Rukiah Mirin	Pekerja Awam R4 General Worker R4	1 Oktober/October
Azizah Ariffin Zulkifli Md. Said Azahar Abdullah Fesal Johan	Pekerja Awam Gred R4 (KUP) General Worker R4 (PTH)	15 Januari/January 15 Januari/January 1 Februari/February 1 Februari/February

**PEMANGKUAN JAWATAN PEGAWAI PENYELIDIK
RESEARCH OFFICER (ACTING APPOINTMENT)**

Nama/Name	Jawatan Pemangku/Gred Acting Post/Grade	Tarikh/Date
Dr Vimala P Subramaniam Dr Nor Hasnida Hassan Dr Norwati Adnan Dr Norlia Basherudin	Pegawai Penyelidik Q52 Research Officer Q52	1 Januari/January
Dr Zaihan Jalaludin		7 Februari/February
Dr Fadillah Zainuddin Dr Sharmiza Adnan Dr Shawn Cheng Dr Sik Huei Shing Dr Siti Salwana Hashim	Pegawai Penyelidik Q48 Research Officer Q48	1 Januari/January 17 Februari/February 23 Februari/February 22 Jun/June 15 Ogos/August
Mohd Asmawee Ismail	Pegawai Tadbir N48 Administrative Officer N48	1 November
Noorsuhanis Abdul Latif	Pegawai Tadbir N44 Administrative Officer N44	

PELANTIKAN SECARA PINJAMAN/APPOINTMENT BY SECONDMENT

Nama/Name	Jawatan dipinjamkan/Gred Secondment Posts/Grade	Tarikh/Date
Datuk Dr Che Abdul Rahim Hj Nik	TKSU (Alam Sekitar) NRE, Gred Utama 'A' VU5 NRE Deputy Sec. Gen. (Environment), Premier Grade A VU5	15 April 2011
Mohd Zamshari Abd. Rahman	Pengarah Bhg Komersialisasi & Inovasi, Gred Utama 'C' VU7 Director, Commercialisation & Innovation Div., Premier Grade 'C' VU7	1 April 2011– 31 Mac/March 2013
Dr Mohd Fauzi Puasa	Timb. Pengarah Penyelidikan Deputy Director of Research	1 September 2012 – 31 Ogos/August 2014
Dr Elizabeth Philip	Pegawai Penyelidik Q54 Research Officer Q54	9 Januari/January 2012– 31 Disember/December 2012
Nor Azman Hussein	Pegawai Kanan MTDC MTDC Senior Officer	1 Januari/January 2011– 31 Disember/December 2012
Dr Gary William Theseira	Timbalan Setiausaha Bahagian Q54 (terbuka) Deputy Under Secretary Q54 (Open)	16 April 2012–15 April 2013
Dr Norwati Adnan	Pengarah Seksyen Penilaian dan Penyelidikan Q52 (Terbuka) Director Evaluation and Research Section Q52 (Open)	1 Oktober/October 2012– 30 September 2013

Nama/Name	Jawatan dipinjamkan/Gred Secondment Posts/Grade	Tarikh/Date
Norain Mohd Arif	Pegawai Penyelidik Q48 Research Officer Q48	1 September 2011–31 Ogos/August 2013
Jumaaton Abu Bakar	Akauntan W44/Accountant W44	23 Ogos/August 2011– 31 Julai/July 2013
Mazli Abdul Wahab	Setiausaha Pemulihan Dalam Komuniti (PDK Kasih) Q22 Secretary Rehabilitation in Community (PDK Kasih) Q22	1 April 2012–31 Mac/March 2013

**ANUGERAH ANJAKAN GAJI
SALARY INCREMENT AWARD**

Kumpulan Pengurusan dan Profesional Management and Professional Group	Kumpulan Sokongan Support Group
Dr Ani Sulaiman	Saripah Barom
Wan Mohd Shukri Wan Ahmad	Zuriati Ahmadin
Zahari Othman	Nor Marzuina FK Naszir
	Madzlan Zainuddin
	Zaitihaiza Khamaruddin
	Muzalina Muhammad
	Yahya Marhani
	Mohd Norin Nizan Mohd Janah
	Mahat Mohd Judin
	Mohamad Bohari Ehwan
	Amran Haron
	Mohd Hanafiah Ahmad
	Wan Adanan Wan Ishak
	Irwan Mohd Taib
	Zairul Hisham Suid
	Latifamir Ibrahim
	Mat Salan Mat Rosli
	Shukor Mohd Arif
	Khamis Mat Ain
	Vasuthevan a/l Narayana
	Mohd Amirul Ezzuan Mohd Yatim
	Samsudin Abdul Hamid
	Mohamad Adnan Mohd Idris
	Abdul Muhaimin Mohd Razali

PELETAKAN JAWATAN/RESIGNATION

Nama/Name	Tarikh/Date
Abdul Muaz Sagimin	1 Mei/May

PERSARAAN/RETIREMENT

Persaraan Retirement	Tarikh Date
Wajib/Mandatory	
Azmi Mahyudin	17 Januari/January
Zaiton Saleh	4 Disember/December
Pilihan/ Optional	
Mariam Din	1 Januari/January
Azman Hassan	1 Februari/February
Mohd Azmi Hashim	1.Mac/March
Dr Pan Khang Aun	1Jun/June
Mohd Zaini Ujang	27 Ogos/August
Dr Ani Sulaiman	1 November

Latihan Training

Latihan Akademik

Seramai sembilan orang pegawai FRIM telah menamatkan pengajian dari universiti tempatan dan luar negara. Mereka termasuklah lima orang pegawai yang berjaya memperoleh ijazah Doktor Falsafah dan lima orang mendapat Ijazah Sarjana. Seorang penuntut di bawah Skim Bantuan Penyelidikan FRIM berjaya menamatkan pengajian PhD, manakala tujuh yang lain berjaya memperoleh MSc.

Academic Training

Nine officers successfully completed their academic training from local and overseas universities. The degrees were awarded to five PhD and four MSc holders. One student under the FRIM Research Assistantship Scheme managed to complete his PhD, while another seven obtained MSc degrees.

Bil. No.	Nama Name	Ijazah Degree	Universiti University
1	Sharmiza Adnan, Dr	PhD	University of Monash, Australia
2	Shawn Cheng, Dr	PhD	Universiti Putra Malaysia
3	Farah Fazwa Mohd Ariff, Dr	PhD	Universiti Kebangsaan Malaysia
4	Asiah Osman, Dr	PhD	University of Griffith, Australia
5	Mohd Lokmal Ngah, Dr	PhD	Universiti Sultan Zainal Abidin, Terengganu
6	Huda Farhana Mohd. Muslim	MSc	Universiti Teknologi Mara
7	Patahayah Mansor	MSc	Universiti Putra Malaysia
8	Yao Tze Leong	MSc	Universiti Malaya
9	Syahida Emiza Suhaimi	MSc	Universiti Malaya

Skim Bantuan Penyelidikan/Research Assistantship Scheme

Bil. No.	Nama Name	Ijazah Degree	Universiti University
1	Siti Humeirah Abdul Ghani	MSc	Universiti Putra Malaysia
2	Yetti Heryati	MSc	Universiti Putra Malaysia
3	Faridah Azam	MSc	Universiti Kebangsaan Malaysia
4	Mohd Dasrul Darus	MSc	Universiti Putra Malaysia
5	Noor Azrieda Abd Rashid	MSc	Universiti Teknologi Mara
6	Tan Hooi Poay	PhD	Universiti Malaya
7	Ihsan Safwan Kamaruzzaman	MSc	Universiti Putra Malaysia
8	Nur Zati Akma Mustafa	MSc	Universiti Kebangsaan Malaysia

Penerbitan Publications

Pada tahun 2012, FRIM menerbitkan sejumlah 35 judul buku bagi menyebarkan maklumat hasil penyelidikannya. Antaranya ialah empat keluaran *Journal of Tropical Forest Science*, empat keluaran *FRIM in Focus* dan dua keluaran *Conservation Malaysia*. *Journal of Tropical Forest Science* merupakan jurnal bertaraf antarabangsa dan satu-satunya jurnal di Malaysia yang mula-mula memperoleh faktor impak. *Journal of Tropical Forest Science* menunjukkan faktor impak 0.467. *FRIM in Focus* merupakan surat berita FRIM yang memperihalkan dalam bahasa mudah tentang penyelidikan utama yang dijalankan di FRIM. Kedua-dua *Journal of Tropical Forest Science* dan *FRIM in Focus* boleh dicapai secara dalam talian. *Conservation Malaysia* pula memperihalkan tentang isu pemuliharaan tumbuhan dan haiwan yang terkini di Malaysia.

Buku *Pocket Check List of Timber Trees* telah dicetak semula pada tahun 2012 disebabkan permintaan yang menggalakkan. Buku ini digunakan sebagai buku teks di Universiti Putra Malaysia, Serdang, Universiti Teknologi MARA, Pahang dan Unit Latihan Perhutanan, Kepong. FRIM memenangi Anugerah Buku Negara (kategori buku teknikal) bagi buku bertajuk *Wild Orchids of Peninsular Malaysia*. Buku ini diterbitkan pada tahun 2011 tetapi telah mendapat sambutan yang begitu memberangsangkan sehingga ia diterbitkan semula pada tahun 2012 dengan kerjasama daripada MPH.

Pada bulan Ogos 2012, Kedai Buku FRIM menyambut ulang tahun ke-10. Sambutan ulang tahun kali ini sangat bermakna kerana Kedai Buku telah siap diubah suai dan kini nampak luas dan menarik dengan kaunter dan perabot baharu. Antara aktiviti yang dijalankan untuk sambutan ulang tahun ke-10 ialah pemberian buku percuma, kuiz untuk pelanggan Kedai Buku, kuiz dalam laman sesawang dan kutipan derma WWF-Malaysia. WWF-Malaysia telah menyumbang beg kanvas untuk diberi kepada pelanggan Kedai Buku FRIM dengan pembelian minimum RM150 serta pelekat WWF kepada penderma.

In 2012, FRIM published a total of 35 titles to disseminate information on its research findings. Among them are four issues of the *Journal of Tropical Forest Science*, four issues of *FRIM in Focus* and two issues of *Conservation Malaysia*. *Journal of Tropical Forest Science* is an international refereed journal and one of the first journals in Malaysia which has an impact factor. The impact factor for *Journal of Tropical Forest Science* is 0.467. *FRIM in Focus* is a newsletter detailing the research works at FRIM in simple language. Both the *Journal of Tropical Forest Science* and *FRIM in Focus* are available on-line. *Conservation Malaysia* focuses on current conservation issues of flora and fauna in Malaysia.

Pocket Check List of Timber Trees was reprinted in 2012 due to the popular demand. This book is being used as a text book in Universiti Putra Malaysia, Serdang, Universiti Teknologi Mara, Pahang and Forestry Training Unit, Kepong. FRIM became the proud winner of the National Book Award (Best Technical Book category) for the book *Wild Orchids of Peninsular Malaysia*. This book was published in 2011 but due to overwhelming demand, it was republished in 2012 in collaboration with MPH.

In the month of August 2012, FRIM Bookstore celebrated its 10th anniversary. The celebration this year is most meaningful as the bookstore is renovated and is now more spacious and more attractive fitted with a new counter and furniture. Among the activities organised during the 10th year anniversary were giving of free books, quiz for customers, quiz through FRIM web page and collection of donation for WWF-Malaysia. During the month of August, WWF-Malaysia contributed canvas bags to customers who had purchased a minimum of RM150 worth of books and stickers to donors.



Jenis penerbitan Types of publications	Judul Title	Bil. No.
Journal of Tropical Forest Science	JTFS23(1–4)	4
Malayan Forest Records	Flora of Peninsular Malaysia Series 2: Seed Plants, Volume 3	1
FRIM in Focus	March, June, September, Disember	4
Research Pamphlet	Checklist of Fungi of Malaysia	1
FRIM Technical Information Handbook	Penghasilan Daun Teh Misai Kucing Berkualiti Tinggi	1
FRIM Reports	The Bamboo Garden at Kepong Botanical Garden Laporan Kaji Selidik Tanah Stesen Penyelidikan FRIM (SPF) Selandar, Melaka	2
FRIM Technical Information	Activated Carbon	1
Timber Technology Bulletin	Use of Timber in Engineering	1
Special Publications	As Good as Wood 99 Spesies Buah di FRIM Status of Mangroves in Peninsular Malaysia	3
Conservation Malaysia	Conservation Malaysia No. 15, 16	2
Proceedings	Proceedings of the Conference on the Best of Both Worlds: Effective Environmental Education for Biodiversity Education, 8–10 November 2010, Kuching, Sarawak Proceedings of the International Symposium on Reclamation, Rehabilitation and Restoration Towards a Greener Asia, 3–5 July 2012, Kuala Lumpur	2
Annual Report	Annual Report 2011	1
Other Publications	FRIM in the Media: 2011 Anugerah & Pengiktirafan: Jejak Kegemilangan 1985–2011: Tokoh dan Jejak Pewaris Generasi FRIM FRIM Innovation and Technology 2011 One and a Half Decades of Medicinal Plants Research at FRIM Perosak Pokok Bakau Yang Ditanam di Semenanjung Malaysia Spesies Dipterokarpa Terancam di Semenanjung Malaysia Chain-of-custody Certification Based on Program of Endorsement for Forest Certification (PEFC) Standard: Sawmill Beyond the Red Meranti: Fresh Perspectives on Malaysia's Pasoh Forest Reserve and Climate Change Wild Orchids of Peninsular Malaysia Pokok Arboretum di Hutan Simpan Pasoh/ <i>Arboretum Trees of Pasoh Forest Reserve</i>	11
Reprint	Pocket Check List of Timber Trees	1
Total		35

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POSTER / POSTERS

- 1 ABDUL HAMID, S, YANTI, A.K, MARZALINA, M., KHAIRUL, M., AB JALIL, M. Engineered Palm Wood Veneer (E-PaWV) for furniture component. Poster presented at the International Invention, Innovation and Technology Exhibition 2012 (ITEX), 17–19 May 2012, Kuala Lumpur.
- 2 ABDUL HAMID, S, YANTI, A.K, MARZALINA, M., KHAIRUL, M., AB JALIL, M. Engineered Palm Wood Veneer (E-PaWV) for furniture component. Poster presented at Research Advisory Committee (RAC) Meeting, 4 December 2012, Kepong.
- 3 ABDUL HAMID, S, YANTI, A.K, MARZALINA, M., KHAIRUL, M., AB JALIL, M. Engineered Palm Wood Veneer (E-PaWV) for furniture component. Poster presented at Sabah International Trade Expo 21–24 September 2012, Kota Kinabalu.
- 4 ABDUL HAMID, S, YANTI, A.K, MARZALINA, M., KHAIRUL, M., AB JALIL, M., MUHD ADZAM, A. & AZHAR M. Multi-Purpose Corrugated Hybrid Palm Wood Veneer C-HyPaWV. Poster presented at the FRIM Innovation Day, 29 December 2012, Kepong.

- 5 ABDUL HAMID, S., YANTI, A.K, MARZALINA, M., KHAIRUL, M., AB JALIL, M., MUHD ADZAM, A. & AZHAR M. Multi-Purpose Corrugated Hybrid Palm Wood Veneer C-HyPaWV. Poster presented at the Ministry of Natural Resources and Environment (NRE) Innovation Day, 8 November 2012, Putrajaya.
- 6 ABDUL HAMID, S., YANTI, A.K., MARZALINA M., KHAIRUL, M.& AB JALIL. M. Engineered Palm Wood Veneer (E-PaWV) for furniture component. Poster presented at the FRIM Innovation Day, 29 December 2012, Kepong.
- 7 ABDUL HAMID, S., OMAR ALI, S., KHAIRUL, A.A., HAMDAN, H., YANTI, A.K., ANA AZRENA, A.R. & KHAIRUL, M. Nibong palm for furniture products. Poster presented at the Malaysian International Furniture Fair (MIFF), 6–10 March 2012, Kuala Lumpur.
- 8 ADIANA, M.A. & NADIA HANIM, S. Study on *Eurycoma longifolia* and its different extracts by fourier transform infrared spectroscopy and two-dimensional correlation infrared spectroscopy. Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 9 AHMAD NAZARUDIN, M.R., TSAN, F.Y., ADZMI, Y., NORMANIZA, O. & ROSFARIZAL, K. Effects of paclobutrazol and potassium nitrate on plant tissue structure of *Xanthostemon chrysanthus*. Poster presented at the 23rd Malaysian Society of Plant Physiology Conference, 18–20 December 2012, Langkawi.
- 10 AHMAD NAZARUDIN, M.R., TSAN, F.Y., ADZMI, Y., NORMANIZA, O. & ROSFARIZAL, K. Flowering pattern of *Xanthostemon chrysanthus* in relation to rainfall. Poster presented at the Urban Forestry Conference “Forests and Parks: Communicating Messages for Sustainability”, 2–6 October 2012, Kuching.
- 11 AMINAH, H., AHMAD FAUZI, M.S. MOHD ADI FAIZ, A.F., HAMZAH, M. & FAUZIAH, M. Production of planting stocks of *Neolamarckia cadamba* (kelempayan) by leafy stem cuttings. Poster presented in Portugal.
- 12 AMINAH, H. Environmental friendly green herbal door gift. Poster presented at the Malaysia Technology Expo (MTE) 2012, 16–18 February 2012, Kuala Lumpur.
- 13 AMINAH. H. & FARAH FAZWA, M.A. Cultivation and growth performances of some selected medicinal plants. Poster presented at the Conference on Agrodiversity Conservation and Sustainable Utilization RAC 2012, 25–27 September 2012, Langkawi.
- 14 ANWAR, U.M.K., HAMDAN, H., PARIDAH, M.T., NORDAHLIA, A.S., SITI RAFIDAH, M., MOHD FAIZUL, M.S. & MAT YAACOB, C.W. Exterior grade plybamboo. Poster presented at the World Bamboo Day. 18–23 September 2012, Kuala Lumpur.
- 15 ASLINA, B., THESEIRA, G.W. Towards a comprehensive biodiversity database for the Malaysian Biodiversity Clearing House Mechanism. Poster presented at the Association for Tropical Biology and Conservation Asia-Pacific Chapter Annual Meeting, 24–27 March 2012, China.
- 16 AZHARIZAN, M.N., TARIQ MUBARAK, H. & MOHD RIZUWAN, M. Chain of Custody Certification. Poster presented at the Urban Forestry Conference 2012: Forests and Parks: Communicating Messages for Sustainability, 2–6 October 2012, Kuching.
- 17 AZRINA, A., NOR AZAH, M., SITI HUMAIRAH, A.G., MASTURA, M., MAILINA, J., MOHD FARIDZ, Z.P. & MUHD HAFIZI, Z. Chemical constituents and anti-microbial activities of *Leptospermum brandyandrum* collected from Maran Research Station, Pahang. Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 18 AZYYATI, A.K, NAIMAH, C.L & NOOR AZLIN, Y. FRIM play its roles in developing a caring nation through environmental education and ecotourism activities. Poster presented at the Research Advisory Committee Meeting, 4 November 2012, Kepong.
- 19 BAHARUDIN, K., SHAHLINNEY, L., NOOR AZRIEDA, A.R., RAHIM, S. & SALMIAH, U. A case study on sampling authenticated wood species based on BS EN 350 Standard in Kelantan. Poster presented at the 12th Symposium of the Malaysian Society of Applied Biology, 1–3 June 2012, Terengganu.
- 20 FADZUREENA, J., MAZURA, M. P., ZAINON, A.S., HANI IDAYU, B. & RASADAH, M.A. Inhibition of Xanthine Oxidase by some selected medicinal plants. Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 21 FARAH FAZWA M.A., ADI FAIZ A.F., MOHD ZAKI, A. & LOKMAL, N. Morphological assessment of two varieties of *Labisia pumila* at naturally populations in peninsular Malaysia. Poster presented at the Conference on Agrodiversity Conservation and Sustainable Utilization RAC 2012, 25–27 September 2012, Langkawi.
- 22 FARAH FAZWA, M.A., SAMSURI, T.H., MOHD. ASRI, L., NOR NAJWA, C.L., ROHAIDAH, N., ROSLI, I. & HALIM, M. Teknik pengekstrakan mudah alih untuk tujuan pembiakbakaan. Poster presented at the ‘Hari Inovasi FRIM, 27–28 November 2012, Institut Penyelidikan Perhutanan Malaysia, Kepong.

- 23 FAUZIAH, A., FADZUREENA, J., ZUNOLIZA, A., SITI KAMARIAH, M.H. & HANI IDAYU, B. Potential Xantine Oxidase inhibitor from *Tetracera maingayi*. Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 24 GETHA, K., MUHAMMAD SYAMIL, A., MASTURA M. & HATSU M. Anti-MRSA activity of the tetrahydrofuran derivative F4009bP1 from a red root rot-associated *Ganoderma* sp. Poster presented at the Pharmatech 2012, 20–21 November 2012, Kuala Lumpur.
- 25 HALIZA, I., NORMAH, B., ROZIDAH, K., NAZIRAH, A., NOR HASNIDA, H. & Siti SUHAILA, A.R. 'Aglonema lady valentine, penghasilan bahan tanaman hiasan secara seragam melalui kultur tisu'. Poster presented at the 'Hari Inovasi dan Rekacipta FRIM 2012', 28–29 November 2012, Kepong.
- 26 HALIZA, I., NORMAH, B., SHARIFAH, M., NOR HASNIDA, H., SITI SUHAILA, A.R. & NAZIRAH, A. Asymbiotic seed germination and acclimatization of tiger orchid (*Grammatophyllum speciosum* Blume). Poster presented at the Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 27 HAMDAN, H., NORDAHLIA, A.S., MOHD KHAIRUN ANWAR, U., ABD. LATIF, M. & ABD. RAZAK, O. Authenticated reference of bamboo. Poster presented at the World Bamboo Day, 18–23 September 2012, Kuala Lumpur.
- 28 HAMDAN, H., NORDAHLIA, A.S., MOHD. KHAIRUN ANWAR, U., ABD. LATIF, M. & ABD. RAZAK, O. Authenticable reference of bamboo species occurring in Malaysia. Poster presented at the 2012 IUFRO Conference, Division 5 Forest Products, 8–13 July 2012, Lisbon.
- 29 HAMIDAH, M., CHUA, L.S.L. & ASLINA, B. Integration of geoinformation technology for threatened dipterocarp conservation in Peninsular Malaysia. Poster presented at the Association for Tropical Biology and Conservation, Asia-Pacific Chapter Conference, 24–27 March 2012, China.
- 30 JANI, S., MARZUKI, H., RUSHDAN, I. & PUAD, E. 'Pembangunan produk berasaskan sisa buangan padi'. Poster presented at the MAHA 2012, 23 November–2 December 2012, Selangor.
- 31 JULIUS, A., CHUNG, R.C.K. & ASLINA, B. Kepong Herbarium (KEP), Forest Research Institute Malaysia. Poster presented at the Fifth Annual Meeting of Global Plants Initiative (GPI), 9–13 April 2012, Spain.
- 32 KHAIRUL KAMILAH, A.K., ZUNOLIZA, A., ABD. RASHID, L., MOHD KAMAL, N.H., ZULKHAIRI, A. & MOHD SHAHIDAN, M.A. Hypocholesterolemic effect of *Averrhoa carambola* polysaccharide in atherosclerotic induced-rabbits. Paper presented at the 12th Symposium of the Malaysian Society of Applied Biology, 1–3 June 2012, Terengganu.
- 33 KHAIRUL KAMILAH, A.K., ZULKHAIRI, A., NORHAIZAN, M.E., MOHD KAMAL, N.H., NIK MUSAADAH, M., SHAHIDAN, M.A. & RASADAH, M.A. Rice varieties reduced atheroma plaque formation in cholesterol-fed rabbits. Poster presented at the 4th National Conference on Laboratory Animal Science, 11–12 July 2012, Kuala Lumpur.
- 34 KHAIRUL, M. Sesenduk clone furniture. Poster presented at the Malaysian International Furniture Fair (MIFF) 2012, Putra World Trade Center (PWTC), 6–10 March 2012, Kuala Lumpur.
- 35 KHAIRUL, M. Sesenduk clone. Poster presented at the 'Seminar Pembangunan Industri Perabot Sarawak 2012'. 14–16 February 2012, Kuching.
- 36 KHONG, H.Y., JAMALUDIN, F., KUTOI, C.J. & SERUJI, N.M.U. Anti-inflammatory properties of four selected *Cryptocarya* species (Lauraceae). Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 37 LOKMAL, N & MOHD NOR, G. Genotype by environments interaction in specific gravity of *Acacia mangium*. Poster presented at the International Conference on Plant Growth, Nutrition and Environment Interaction, 18–21 February, Austria.
- 38 MAHANIM, S.M.A., RAFIDAH, J., PUAD, E., WAN ASMA, I. & SHAHARUDDIN, H. Potential application of bamboo activated carbon in supercapacitor industry. Poster presented at the World Bamboo Day, 18–23 September 2012, Kuala Lumpur.
- 39 MAHANIM, S.M.A., RAFIDAH, J., PUAD, E., WAN ASMA, I. & SHAHARUDDIN, H. Simultaneous process on the conversion of bamboo biomass to activated carbon. Poster presented at the International Conference on Biomass for Biofuels and Value-Added Products, 23–24 October 2012, Kuala Lumpur.
- 40 MARRYANNA, L., SITI AISAH, S., ABD RAHMAN, K. & MOHD, M.S. Hydrological monitoring at upper hills dipterocarp forest Peninsular Malaysia. Poster presented at the Seminar on Long-Term Ecological Research in East Asia Pacific Region 2012 (EAP-LTER2012), 4–5 July 2012, Kepong.

- 41 MARZALINA, M., MOHD. AFENDI, H. NADIAH SALMI, N., NORALIZA, A., NOR ASMAH, H. & NASHATUL ZAIMAH, N.A. Phenology study of coastaline species for planting material production. Poster presented at the 7th National Seed Symposium, 15–16 May 2012, Putrajaya.
- 42 MOHAMAD JANI, S., MARZUKHI, H., RUSHDAN, I. & PUAD, E. ‘Pembangunan produk berasaskan sisa buangan padi’. Poster presented at the Malaysia Agriculture, Horticulture and Agrotourism International Show 2012 (MAHA 2012), 23 November–2 December 2012, Selangor.
- 43 MOHAMAD OMAR, M. K. & MOHD JAMIL, A.W. Timber engineering laboratory—Testing services. Poster presented at the Malaysian International Furniture Fair (MIFF), 6–10 March 2012, Kuala Lumpur.
- 44 MOHD AZAHARI, F. & HAMDAN, O. Introduction to GIS. Paper presented at the Training on Quantum GIS (QGIS) Application in the Management of Natural Resources and Environment, 19–21 September 2012, Kepong.
- 45 MOHD AZAHARI, F. & KHALI AZIZ, H. Forest cover and carbon mapping in the greater Mekong subregion and Malaysia project: A study site of Malaysia. Poster presented at the Progress and Training Workshop of GMS+ Project, 5–8 June 2012, Vientiane.
- 46 MOHD FARHAN, A.R., MUHAMMAD SHAHRUL, M.N., ZAMREE, M.S., PIN, K.Y., NOOR RASYILA, M.N., NURHAZWANI, M.H., MOHD KAMAL, N.H., MASITAH, M.T., FIRMANSYAH, J.S., MOHD HAPIZOL, U.L., AMEER JASRI, J. & RISHWAN HAKIM, K. Preliminary study on antioxidant activity and total phenolic content of *Cynometra cauliflora* at different extraction temperatures. Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 47 MOHD FARID, A., AHMAD NAZARUDIN, M.R., AHMAD AZARUDDIN, M.N. & PATAHAYAH, M. Some destructive diseases of landscape trees in Klang valley. Poster presented at the Urban Forestry Conference. Forests and Parks: Communicating Messages for Sustainability, 2–6 October 2012, Kuching.
- 48 MOHD GHAZALI, H., MARRYANNA, L., SAIFUL ISKANDAR, K., AHMAD FIRDAUS, Z, ABD RAHMAN, K. & RASHIDAH, H. Re-introduction of *Nelumbo nucifera* at Tasik Chini, Pahang. Poster presented at the Seminar on Long-Term Ecological Research in East Asia Pacific Region 2012 (EAP-LTER2012), 4–5 July 2012, Kepong.
- 49 MOHD KAMAL, N.H., RASADAH, M.A., ZULKHAIRI, H.A., MOHD SHAHIDAN, M.A., ZAMREE, M.S., KHAIRUL KAMILAH, A.K. & IHSAN SAFWAN, K. Effect of apigenin, berberine and rutin on cholesterol metabolism. Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 50 MOHD KHAIRUN ANWAR, U., HAMDAN, H., PARIDAH, M.T., NORDAHLIA A.S., SITI RAFIDAH, M., MOHD FAIZUL, M.S. & MAT YAACOB, C.W. Mechanical properties of bamboo composite. Poster presented at Society of the Advancement of Material and Process Engineering (SAMPE), 21–22 February, Kuala Lumpur.
- 51 MOHD RIZUWAN, M., NAZIMATUL AZMA, N., MOHD AZAHARI, F. & KHALI AZIZ, H. Urban forestry mapping and correction technique using laser equipment (total station). Poster presented at the Urban Forestry Conference 2012 “Forests and Parks: Communicating Messages for Sustainability”, 2–6 October 2012, Kuching.
- 52 MOHD ZAKI, A., MOHD. LOKMAL, N., FARAH FAZWA, M.A. MOHD. ADI FAIZ, A.F., AZILA, I. & AB RASIP, A.G. Ex-situ conservation of *Nypa fruticans* for sap production 1st regional. Poster presented at the Conference on Agrodiversity Conservation and Sustainable Utilization RAC 2012, 25–27 September 2012, Langkawi.
- 53 MOHD NOOR, M., KHAIRUL, M. & ABDUL HAMID, S. Sesendok clone furniture. Poster presented at the Malaysian International Furniture Fair (MIFF), 6–10 March 2012, Kuala Lumpur.
- 54 MOHD. ARSHAD, S. & SITI ZALEHA, A. Furniture Testing Laboratory—Testing services. Poster presented at the Malaysian International Furniture Fair (MIFF), 6–10 March 2012, Kuala Lumpur.
- 55 MUHAMMAD HAFFIZ, J., NORHAYATI, I., NOR AZAH, M.A., GETHA, K., MOHD ILHAM, A., LILI SAHIRA, H., ROSHAN JAHN, M.S. & MUHAMMAD SYAMIL, A. Trypanocidal and cytotoxic activities of the essential oil of *Cymbopogon nardus* and their active constituents. Poster presented at the 28th Malaysian Natural Products Seminar, 28–29 March 2012, Kuching.
- 56 MUHAMMAD SYAMIL, A., GETHA, K., LILI SAHIRA, H. , MUHD HAFFIZ, J., NORHAYATI, I. & ROSHAN, J. Bioassay guided fractionation of antitypanosomal active extract from rare Actinobacteria. Poster presented at the 28th Malaysian Natural Products Seminar, 28–29 March 2012, Kuching.
- 57 NADIAH SALMI, N., NASHATUL ZAIMAH, N.A., NOR ASMAH, H., NORALIZA, A. & MARZALINA, M. Climate effects on flowering and fruiting pattern of *Dryobalanops oblongifolia* (keladan) in 20 years. Poster presented at the 7th National Seed Symposium, 15–16 May 2012, Putrajaya.

- 58 NAZIMATUL AZMA, N. & AHMAD AZARUDDIN, M.N. & SAMSOL, B. Tree survey at selected urban areas in Sepang, Selangor. Poster presented at the Urban Forestry Conference 2012 “Forests and Parks: Communicating Messages for Sustainability”, 2–6 October 2012, Kuching.
- 59 NAZIMATUL AZMA, N. & AHMAD AZARUDDIN, M.N. ‘Perjanjian persefahaman antara Perbadanan Putrajaya (PPj) dengan Institut Penyelidikan Perhutanan Malaysia (FRIM) dalam Bidang Pengurusan hutan bandar’. Poster presented at the “Pameran Floria Putrajaya 2012”, 30 June–8 July 2012, Putrajaya.
- 60 NAZIMATUL AZMA, N. & AHMAD AZARUDDIN, M.N. ‘Sistem inventori dan pengurusan pokok Perbadanan Putrajaya (SIPP)’. Poster presented at the ‘Pameran Floria Putrajaya 2012’, 30 June–8 July 2012, Putrajaya.
- 61 NAZIRAH, A., NOR HASNIDA, H., SITI SUHAILA, A.R., HALIZA, I. & ROZIDAH, K. Shoot multiplication and *in vitro* rooting of *Phaleria macrocarpa* (mahkota dewa). Poster presented at the Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 62 NG, K.K.S., LEE, S.L., HATAKEYAMA, M., KOBAYASHI, M. & SHIMIZU, K. Genome-wide polymorphism study in a non-model timber tree *Shorea leprosula* using next-generation sequencing. Poster presented at the Plant Population Biology Conference (POPPIO 2012), 17–19 May 2012, Zurich.
- 63 NIK ADLIN, N.M.S., WAN TARMEZE, W.A. & KHAIRUL, A. GHOST! Table with hidden speaker system but with improved speaker sound quality. Poster presented at the 23rd International Invention, Innovation and Technology Exhibition, ITEX 2012, 17–19 May 2012, Kuala Lumpur.
- 64 NIK ADLIN, N.M.S., WAN TARMEZE, W.A. & KHAIRUL, M. Modular furniture for garden and parks. Poster presented at the Urban Forestry Conference 2012 “Forests and Parks: Communicating Messages for Sustainability”, 2–6 October 2012, Kuching.
- 65 NIK ADLIN, N.M.S., WAN TARMEZE, W.A. & KHAIRUL, M. Modular outdoor furniture. Poster presented at the 23rd International Invention, Innovation and Technology Exhibition, ITEX 2012, 17–19 May 2012, Kuala Lumpur.
- 66 NIK ADLIN, N.M.S., WAN TARMEZE, W.A., KHAIRUL, M. & SHAMSUDDIN, I. ‘Produk-produk dari kayu bakau (*Rhizophora* spp)’. Poster presented at the ‘Majlis Sambutan Hari Perhutanan Sedunia ke-41 Peringkat Kebangsaan Tahun 2012’, 21 March 2012, Perak.
- 67 NIK ADLIN, N.M.S., WAN TARMEZE, W.A., KHAIRUL, M. & SHAMSUDDIN, I. ‘Produk-produk dari kayu bakau (*Rhizophora* spp)’. Poster presented at the ‘Majlis Sambutan Hari Perhutanan Sedunia ke-41 Peringkat FRIM’, 24 March 2012, Kepong.
- 68 NOGUCHI, S., KOSUGI, Y., TANI., M., TAKANASHI, S., ABD RAHMAN, K. & SITI AISAH, S. Relation between antecedent precipitation index and soil moisture in a tropical rain forest. Poster presented at the Seminar on Long-Term Ecological Research in East Asia Pacific Region 2012 (EAP-LTER2012), 4–5 July 2012, Kepong
- 69 NOOR AZLIN, Y., AHMAD NAZARUDIN, M.R., AZYYATI, A.K., NAIMAH, C.L. & AZAHARI, M.Y. Tropical plants as attractions: potentials for tourism and environmental education. Poster presented at the 23rd Malaysian Society of Plant Physiology Conference, 18–20 December 2012, Langkawi.
- 70 NOOR HADZUIN, N.H., NOR AZAH, M.A., SAIDATUL HUSNI, S., LUQMAN CHUAH, A., PIN, K.Y., YUS ANIZA, Y. & MOHAMMAD FARIDZ, Z.P. Optimisation of supercritical fluid extraction of betel leaves (*Piper betle* L.) using response surface methodology. Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 71 NOOR RASYILA, M.N., MOHD FARHAN, A.R., NURHAZWANI, M.H., PIN, K.Y., ZAMREE, M.S., HADA MASAYU, I., MOHD HAPIZUL, U.L., FIRMANSYAH, J.S., MOHS SHAHRUL, M.N. & MASITAH, M.T. In process quality control (IPQC) of compressed uncoated *Orthosiphon Stamineus* (misai kucing) tablets. Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 72 NOR ASMAH, H., NORALIZA, A., MOHD ADI FAIZ, A.F., NASHATUL ZAIMAH, N.A. & NADIAH SALMI, N. Effect of storage duration on tropical recalcitrant seeds. Poster presented at the 7th National Seed Symposium, 15–16 May 2012, Putrajaya.
- 73 NOR AZAH, M.A., MAILINA, J., SAHRIM, L., MUHD HAFIZI, Z., MOHD NASIR, M.A. & ABD MAJID, J. Classification of aroma profiles of selected agarwood samples (*Aquilaria*) by Hs-SPME-GC-MS and sensor technology. Poster presented at the 17th Malaysian Chemical Congress, 15–17 Oct 2012, Kuala Lumpur.
- 74 NOR AZAH, M.A., NURLAILA, I., MAILINA, J., ABDUL MAJID, J., MOHD FARIDZ, Z. & MOHD NASIR, T. Determination of the chemical constituents of selected agarwood oils by gas chromatograph-mass spectrometry and chemometric approach. Poster presented at the 36th International Symposium on Capillary Chromatography, 27 May–1 June 2012, Italy.

- 75 NOR AZAH, M.A., NURLALILA, I., MAILINA, J., MOHD NASIR, T. & MOHD HEZRI FAZALUL, R. Analysis of aroma compounds from gaharu oil by head-space solid phase microextraction & gas chromatography-mass spectrometry. Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 76 NOR AZAH, M.A., SAIDATUL HUSNI, S., MAILINA, J., AZRINA, A., ZARIDAH, M.Z., SITI HUMEIRAH, A.G., MASTURA, M. & MOHAMMAD FARIDZ, Z.P. Aromatic plant ingredients in skin and personal care formulations. Poster presented at the ICNaCS, 22–23 October 2012, Kuala Lumpur.
- 77 NOR AZLIN, M.F. & NOOR AZLIN, Y. The hornbills in urban and residential areas of Peninsular Malaysia. Poster presented at the Sarawak Hornbill Workshop 2012: Hornbills Conservation: Threats, Gaps & Future Direction, 30 October–1 November 2012, Bintulu.
- 78 NOR DATIAKMA, M.A., NURHANAN, M.Y., MASTURA, M., SITI SHARIFAH, M.M. & NORALIZA, A. Anti-staphylococcal and anti-proliferative activities of plant species. Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 79 NOR HASNIDA, H., NAZIRAH, A., FADHILAH, Z., SITI SUHAILA, A.R., HALIZA, I., ROHANI, A., ROZIDAH, K. & NOR RASHIDAH, M. Multi purpose laminar flow and trolley for handling bioreactors. Poster presented at the Malaysia Technology Expo (MTE) 2012, 16–18 February 2012, Kuala Lumpur.
- 80 NOR HASNIDA, H., NAZIRAH, A., SITI SUHAILA, A.R., HALIZA, I., NORMAH, B., ROZIDAH, K. & ROHANI, A. Shoot multiplication of *Aquilaria crassna*. Poster presented at the Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 81 NOR HAYATI, A., NURHANAN, M.Y. & SITI SYARIFAH, M.M. The anti-cancer activities of isolated compounds from *Prismatomeris malayana* Ridley against selected cancer cell lines. Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 82 NOR HAYATI, A., SAIFUL AZMI, J., MASTURA, M. & MAZURA, M.I. Anti-methicillin-resistant *Staphylococcus aureus* (MRSA) activity of compounds isolated from *Psidium guajava* Linn. leaves. Poster presented at the 17th Malaysian Chemical Congress (17MCC) 2012, 15–17 October 2012, Kuala Lumpur.
- 83 NORALIZA, A., NOR DATIAKMA, M.A., ANEE SURYANI, S., NORWATI, A. & MARZALINA, M. Protein profiling of *Aquilaria malaccensis* seeds—a preliminary study. Poster presented at the 7th National Seed Symposium, 15–16 May 2012, Putrajaya.
- 84 NORDAHLIA, A.S., MOHD KHAIRUN ANWAR, U. & HAMDAN, H. Fibre morphology, physical and mechanical properties of *Schizostachyum brachycladum* (buluh leman). Poster presented at the World Bamboo Day, 18–23 September 2012, Kuala Lumpur.
- 85 NORDAHLIA, A.S., MOHD. KHAIRUN ANWAR, U. & HAMDAN, H. Selected properties of Malaysian bamboo—*Schizostachum bracycladum* (buluh leman). Poster presented at the 2012 IUFRO Conference, Division 5 Forest Products, 8–13 July 2012, Portugal.
- 86 NORHAYATI, I., LING, S.K., GETHA, K., MOHD ILHAM, A., MUHD HAFFIZ, J., LILI SAHIRA, H., MUHAMMAD SYAMIL, A. & SITI SYARIFAH, M.M. Anti-trypanosomal activity of flavonoids isolated from *Chromolaena odorata* (L.) King and Robinson. Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 87 NORLIA, B., NOR HASNIDA, H., MOHD NOOR, M.I., MOHD ROSLI, H., NORWATI, A. & NORWATI, M. Transcriptome analysis on hairy root culture of tongkat ali (*Eurycoma longifolia*). Poster presented at the 37th Annual Conference of the Malaysian Society for biochemistry and molecular Biology, 18–19 July 2012, Kuala Lumpur.
- 88 NORMAH, B., NOR HASNIDA, H., NAZIRAH, A., SITI SUHAILA, A.R., SHARIFAH, M. & HALIZA, I. Ster Pouch: an innovative tool for pre-treatment of plant sample in the field. Poster presented at the 'Hari Inovasi dan Rekapipta FRIM 2012', 28–29 November 2012, Kepong.
- 89 NORSHAKILA, Y., INTAN NURULHANI, B., TAN, A.L., NURUL HUSNA, Z. & LIM, H.F. Knowledge and use of medicinal and aromatic plants (MAPS) by Orang Asli in Ulu Geroh, Gopeng, Perak. Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 90 NORWATI, A., NORLIA, B., MOHD ROSLI, H., NORWATI, M., SHARIFAH, T. & SURYANI, C.S. Insect resistance teak for forest plantation. Poster presented at the 23rd International Invention, Innovation and Technology Exhibition (ITEX '12), 17–19 May 2012, Kuala Lumpur.
- 91 NORWATI, A., NORLIA, B., MOHD ROSLI, H., NORWATI, M., SHARIFAH, T. & SURYANI, C.S. Method of teak (*Tectona grandis*) genetic transformation using gene gun bombardment. Poster presented at the Malaysia Technology Expo (MTE), 16–18 February 2012, Kuala Lumpur.

- 92 NORWATI, A., NORLIA, B., NORALIZA, A., NORWATI, M., MOHD. ROSLI, H. & SITI SALWANA, H. Allelopathic effects of transgenic teak on seed germinations of some legume species—Preliminary study. Poster presented at the 37th Annual Conference of the Malaysian Society for Biochemistry and Molecular Biology, 18–19 July 2012, Kuala Lumpur.
- 93 NURHANAN, M.Y., SITI SYARIFAH, M.M., MUHAMMAD HAFFIZ, J., HUQ, F. & YU, J.Q. Anti-proliferative and apoptotic effects of combined andrographolide and cisplatin against ovarian cancer cells. Poster presented at the Pharmatech 2012, 20–21 November 2012, Kuala Lumpur.
- 94 NURNADIAH, R., DZARAINI, K., ABD. RASID, L., MOHD RADZI, A. & AHMAD SHUKRI, A. synthesis of conjugated Galactomannan as a precursor molecule for production of Galactomannan nanoparticles. Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 95 NURUL HUSNA, M.H., SUHAIMI, M. & RUSHDAN, I. Corrugated paper from Malaysian bamboo—buluh semantan. Poster presented at the Invention, Innovation and Design (Competition and Exhibition) (IID PERAK 2012), 5–6 July 2012, Perak.
- 96 NUZIAH, H., ZUNOLIZA, A. & LING, S.K. Phytochemical fingerprint analysis of *Senna Alata* by high performance thin layer chromatography (HPTLC). Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 97 PUAD, E, HASHIM, W.S., JALALI, S. & ZAIHAN, J. Super palm plywood from oil palm trunk. Poster presented at the 'Karnival Sains dan Inovasi 2012—Zon Tengah, 20–21 October 2012, Negeri Sembilan.
- 98 PUAD, E., HASHIM, W.S., JALALI, S. & ZAIHAN, J. Engineered flooring from lesser known species (LKS). Poster presented at the 'Karnival Sains dan Inovasi 2012—Zon Tengah, 20–21 October 2012, Negeri Sembilan.
- 99 PUAD, E., HASHIM, W.S., JALALI, S. & ZAIHAN, J. Palmwood flooring: Engineered flooring from oil palm trunk. Poster presented at the 'Karnival Sains dan Inovasi 2012—Zon Tengah, 20–21 October 2012, Negeri Sembilan.
- 100 PUAD, E., HASHIM, W.S., JALALI, S. & ZAIHAN, J. Super palm plywood from oil palm trunk. Poster presented at the 'Karnival Sains dan Inovasi 2012—Zon Tengah, 20–21 October 2012, Negeri Sembilan.
- 101 PUAD, E., MAHANIM, S.M.A., RAFIDAH, J., WAN ASMA, I. & SHAHRUDDIN, H. Biomass pellets and briquette: Benefits and application. Poster presented at the International Conference on Biomass for Biofuels and Value-Added Products, 23–24 October 2012, Kuala Lumpur.
- 102 RAFIDAH, J., MAHANIM, S.M.A, WAN ASMA, I., PUAD, E., & SHAHRUDDIN, H. Oil palm trunk (OPT) as a potential feedstock for alternative fuel in future. Poster presented at the International Conference on Biomass for Biofuels and Value-Added Products, 23–24 October 2012, Kuala Lumpur
- 103 ROSAZLIN, A., CHE FAUZIAH, I., WAN RASIDAH, K. & ROSENANI, A.B. Composted recycled paper mill sludge as plant nutrients source. Poster presented at the 'Pameran Rekacipta, Penyelidikan dan Inovasi Malaysia 2012', 17–19 July 2012, Selangor.
- 104 ROSDI, K., HASHIM, M.N., ABD. RAZAK, O. & AHMAD ZUHAI, Y. Preliminary assessment on the growth of *Hevea brasiliensis* and *Gigantochloa albociliata* for latex and shoot production under agro forestry system. Poster presented at the 2012 IUFRO 3.08.00 Small-Scale Forestry Conference: Science for Solutions, 24–27 September 2012, USA.
- 105 ROSHAN JAHN, M.S., MUHAMMAD SYAMIL, A., MUHAMMAD HAFFIZ, J., AMYRA, M.S., GETHA, K., ILHAM, A. & VANESSA, Y. Antileishmanial activity of selected Malaysian plants and microbes. Poster presented at the 4th International Conference on Biotechnology for Wellness Industry, 20–21 June 2012, Kuala Lumpur.
- 106 ROSHAN JAHN, M.S., MUHAMMAD SYAMIL, A., MUHAMMAD HAFFIZ, J., AMYRA, M.S., GETHA, K., ILHAM, A. & VANESSA, Y. Evaluation on selected Malaysian plants and actinobacteria for their antileishmanial activity. Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 107 ROZITA, A., WAN RASIDAH, K., PUAD, E., MOHD. SAIDIN, K., AZIZAH, A., SAMSURI, M.S., NURHANEENA, D., MOHD. IZWAN, J. & SYAPAWI, L. Enhancing soil quality with biochar PMS. Poster presented at the 'Hari Inovasi dan Rekacipta FRIM 2012', 28–29 Nov. 2012. Kepong.
- 108 RUSHDAN, I. Pulp, paper and rayon from bamboo. Poster presented at the World Bamboo Congress, 18–23 September 2012, Kuala Lumpur.
- 109 RUSHDAN, I., MAHMUDIN, S., LATIFAH, J., SHARMIZA, A., AZIZI, A.J., MOHD SHUKRI, S., NURAZIZI A.R., FARAH YANA, D., NADIA, M.K. & ZAITUN, S. A method for producing rayon grade dissolving pulp from kenaf stalk. Poster presented at the Malaysia Technology Expo (MTE) 2012, 16–18 February 2012, Kuala Lumpur.

- 110 RUSHDAN, I., SHARMIZA, A., MAHMUDIN, S. & LATIFAH, J. Dissolving pulps from Malaysian kenaf variety V36. Poster presented at the International Symposium on Resource Efficiency in Pulp and paper Technology 2012 (REPTech2012), 20–22 November 2012, Indonesia.
- 111 SAIDATUL HUSNI, S., FAUZIAH, A., FADZUREENA, J., SITI KAMARIAH, M.H., HANI IDAYU, B., & NOR AZAH, M.A. Active ingredient for herbal product from *Tetracera maingayi*. Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 112 SAIDATUL HUSNI, S., NOR AZAH, M.A., SITI HUMEIRAH, A.G., MAILINA, J., VIMALA, S., SHARLINI, M. & MOHAMMAD FARIDZ, Z.P. Antioxidant nanoemulsion from *Aquilaria* sp. Poster presented at the ICNACS, 22–23 October 2012, Kuala Lumpur.
- 113 SALBIAH, M., TAN, A.L., TAN, H.P., & LING, S.K. Application of infrared spectral fingerprinting for identification of three *Senna* species. Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 114 SHARMILLAH, S. & NOOR AZLIN, Y. Planting timber tree species in schools. Poster presented at the 3rd International Plantation Industry Conference and Exhibition (IPiCEX) 2012, 5–7 November 2012, Kota Kinabalu.
- 115 SHARMIZA, A. & MAHMUDIN, S. Proficiency testing (PT) to benchmark paper testing laboratory performance. Poster presented at the International Symposium on Resource Efficiency in Pulp and paper Technology 2012 (REPTech2012), 20–22 November 2012, Indonesia.
- 116 SITI HUMEIRAH, A.G., NOR AZAH, M.A. & MAILINA, J. Chemical compositions of twig essential oils from three *Xylopi*a species and their potential as new antimicrobial agent. Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 117 SITI SUHAILA, A.R., NOR HASNIDA, H., NAZIRAH, A., HALIZA, I., SAIFUDULLAH, M.A.W. & FAWZUL, M.A.A. Scale up production of *Whitania somnifera* (ashwagandha) adventitious root cultures using bioreactor system. Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 118 SITI SYARIFAH, M.M., NURHANAN, M.Y., PUTERI SYAFINAZ, A., MUHAMAMD HAFFIZ, J. Chemical and bioactivity studies on *Cerbera* species against a panel of cancer cell lines. Poster presented at Pharmatech 2012, 20–21 November 2012, Kuala Lumpur.
- 119 SREETHERAN, M. & KONIJNENDIJK, C.C. A review on fear of crime in urban green environment settings. Poster presented at the IUFRO 2012 Conference: “Forest for People”, 21–25 May 2012, Austria.
- 120 SREETHERAN, M. & KONIJNENDIJK, C.C. Fear of crime in urban green environment. Poster presented at the 22nd IAPS Conference, 23–29 Jun 2012, Glasgow, Scotland.
- 121 SREETHERAN, M. & KONINNENDIJK, C.C. Fear of crime in urban green spaces: An infusion of narrative and systematic review. Poster presented at the Urban Forestry Conference 2012 “Forests and Parks: Communicating Messages for Sustainability”, 2–6 October 2012, Kuching.
- 122 TAKAO, G., HIRATA, Y., SAITO, H., FURUYA, N., KHALI AZIZ, H., HAMDAN, O. & MOHD AZAHARI, F. Error comparison between remotely sensed and ground truth data for biomass estimation in the tropical forest. Poster presented at the 23rd Annual Conference of the Japanese Forest Society, 26–28 March 2012, Japan.
- 123 TAN, Y. E. & RAHIM, S. FRIM—An international testing house. Poster presented at the Malaysian International Furniture Fair (MIFF), 6–10 March 2012, Kuala Lumpur.
- 124 TARIQ MUBARAK, H., AZHARIZAN, M.N., MOHD RIZUWAN, M. & MOHD NASIR, H. Importance of mangrove conservation in urban development near coastal areas. Poster presented at the Urban Forestry Conference 2012: Forests and Parks: Communicating Messages for Sustainability, 2–6 October 2012, Kuching.
- 125 TNAH, L.H., LEE, S.L., NG, C.H., NG, K.K.S., LEE, C.T., BIBIAN, D. & EYEN, K. DNA barcodes of major timber family (Dipterocarpaceae) in Southeast Asia using multigene tiered approach. Poster presented at the International Conference on Molecular Ecology, 4–7 February 2012, Austria.
- 126 VIMALA, S., SHALINI, M., KHAIRUNNISA, A.S., & JULIZA, M. Antioxidant evaluation: ORAC analysis of common spices used in Malaysia. Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 127 WAN ASMA, I., ZULKAFI, H., RAFIDAH, J, ZAINATUL BAHYAH, H., KHAIRATUN NAJWA, M., MUHAMAMD FAISAL, M.Y., PUAD, E., OTHMAN, S. & NURUL FAHIZA, A.Z. Waste oil palm trees (WPT) as resource. Poster presented at the International Conference on Biomass for Biofuels and Value-Added Products, 23–24 October 2012, Kuala Lumpur.

- 128 YONG, W.S.Y. & CHUA, L.S.L. 'Penyelidikan ke arah pengurusan pemuliharaan tumbuhan terancam'. Poster presented at the Sustainable Campus dan Environmental Daya 2012, Universiti Teknologi MARA (Perak), 9 December 2012, Perak.
- 129 YONG, W.S.Y., CHUA, L.S.L. & ASLINA, B. 'Spesies dipterokarp terancam di UiTM (Perak)'. Poster presented at the Sustainable Campus dan Environmental Daya 2012, Universiti Teknologi MARA (Perak), 9 December 2012, Perak.
- 130 ZAMREE, M.S., MOHD KAMAL, N.H., ZULKHAIRI, H.A., KHAIRUL KAMILAH, A.K., IHSAN SAFWAN, K., RASADAH, M.A., SHAHIDAN, M.A., & MOHD FARHAN, A.R. Hypocholesterolemic effects of different concentration of *Tinospora crisper* aqueous extract (patawali) on rabbits fed with high cholesterol diet. Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.
- 131 ZARIDAH, M.Z., NOR AZAH, M.A., MAILINA, J., ABDUL MAJID., J, MOHD.IRMAN SHAH, M., MOHD.FARIDZ, Z.P. & ROHANI, A. Larvicidal activity of *Clausena excavata* of Rutaceae family against *Aedes aegypti* and their major chemical constituents. Poster presented at the 5th ASEAN Congress of Tropical Medicine and Parasitology (5thACTMP), 15–17 May 2012, Philippines.
- 132 ZOBIR, H.M., ROZAITA, A., SITI, S.H. & TAUFIQ, Y.Y.H. Synthesis of pheromone (*Hexenoate*-zinc layered hydroxide) nanohybrid for insect control. Fundamental Science Congress (FSC) 2012: Managing Science, Industry and Society. 17–18 July 2012, Selangor.
- 133 NORSUHAINA, Z., ABD. RASHID, L., ZUNOLIZA, A., MOHD KAMAL, N.H., MOHD RADZI, A., NUR SITI FATIMAH, R. & AHMAD SHUKRI, A. Lipid peroxidation inhibition activity of *Avverhoa carambola* syrup. Poster presented at the 13th Medicinal and Aromatic Plants Seminar, 25–26 September 2012, Kuala Lumpur.

TESIS / THESES

- 1 AISAH, O. Structural and functional investigation of two parasite protein systems: alpha giardin from *Giardia lamblia* and pathogenesis-related protein from *Ancylostoma caninum*. PhD. Thesis, Griffith University, Australia.
- 2 FARAH FAZWA, M.A. Penilaian kandungan fenolik dan hubungan genetik bagi dua varieti kacip fatimah (*Labisia pumila* var. *pumila* dan *Labisia pumila* var. *alata*). PhD. Thesis, Universiti Kebangsaan Malaysia, Bangi, Selangor Darul Ehsan, Malaysia.
- 3 HUDA FARHANA, M.M. Host community's perception of socio-cultural impacts of ecotourism development. MSc. Thesis (Tourism Management), University of Technology MARA (UiTM), Shah Alam, Malaysia.
- 4 KHAIRUL KAMILAH, A.K. Chemical composition and hypocholesterolemic effects of white rice, brown rice and germinated brown rice (*Oryza Sativa* L.) in atherosclerosis-induced rabbits. MSc. Thesis, Universiti Putra Malaysia, Selangor, Malaysia.
- 5 MOHD LOKMAL, N. Genotype by environment interaction in wood properties and growth of *Acacia mangium*. PhD. Thesis, Universiti Sultan Zainal Abidin (UNIZA), Terengganu Darul Iman, Malaysia.
- 6 NOOR AZRIEDA, A.R. Cementboard from pioneer forest species: wood-cement compatibility study of six selected timber species and properties of cementboard. MSc. Thesis, University of Technology MARA (UiTM), Shah Alam, Malaysia.
- 7 SHARMIZA, A. Effect of microstructure, thermodynamic and operating conditions on performance of membrane distillation. PhD. Thesis, Monash University, Melbourne, Australia.
- 8 SITI AISAH, S. Influence of forest plantation establishment on the hydrological characteristics of small catchments in Selangor. PhD thesis, Universiti Teknologi Malaysia, Skudai, Johor, Malaysia.
- 9 SITI HUMEIRAH, A.G. Chemical compositions and biological activities of essential oils from *Goniothalamus* and *Xylopi* (Annonaceae) species. MSc. Thesis, Universiti Putra Malaysia, Selangor, Malaysia.

- 10 SYAHIDA EMIZA, S. A revision of *Erycibe* (Convolvulaceae) in Peninsular Malaysia. MSc. Thesis. Universiti Malaya, Kuala Lumpur, Malaysia.
- 11 TAN, H.P. Phytochemical and biological investigations of *Phyllagathis rotundifolia* and *Phyllagathis praetermissa*. PhD Thesis, Universiti Malaya, Kuala Lumpur, Malaysia.
- 12 YAO, T.L. A taxonomic revision of *Loxocarpus* (Gesneriaceae). MSc. Thesis. Universiti Malaya, Kuala Lumpur, Malaysia
- 13 ZAIHAN, J. The water vapour sorption behaviour of wood. PhD. Thesis, Edinburgh Napier University, Edinburgh, Scotland, United Kingdom.

Pegawai Officers

Berikut ialah senarai pegawai FRIM Gred 27 dan ke atas (hanya kelulusan tertinggi sahaja dimasukkan):
The followings are the list of FRIM officers Grade 27 and above (Only the highest education background are listed):

PEJABAT KETUA PENGARAH DIRECTOR DIRECTOR GENERAL'S OFFICE

Ketua Pengarah

Director General

- Dato' Dr Abd Latif Mohmod, (DIMP, JSM, KMN, AMN), PhD (UPM)

Setiausaha Pejabat

Office Secretary

- Amrah Toha, Dip. Sec. Sc. (UiTM)

Pegawai Penyelidik Kontrak

Contract Research Officer

- Praveena a/p Balai Kerishnan, BSc (UMS)

Timbalan Ketua Pengarah

(Penyelidikan dan Pembangunan)

Deputy Director General

(Research and Development)

- Dato' Dr Abdul Rashid Ab. Malik (DIMP), (Sehingga/Until September), PhD (London)
- Dr Mohd Nor Mohd Yusoff (KMN), (Dari/From September), PhD (Manchester)

Setiausaha Pejabat

Office Secretary

- Zariza Mohamed Yusuf, Dip. Sec. Sc. (UiTM)

Timbalan Ketua Pengarah (Operasi)

Deputy Director General (Operations)

- Dr Abdul Rahim Nik (KMN, AMN, JSM, PMW), (Sehingga/Until April), PhD (Wales)
- Wan Rahmah Wan A. Raof (Dari Mei /From May), Memangku jawatan VU6, Gred Utama 'B', M.HRD (UPM)

Unit Undang-Undang

Legal Unit

Ketua/Head

- Nor Azura Ahmad Murad, LLB (Hons) (UIA)

Penolong Pegawai Tadbir

Assistant Administrative Officer

- Nurl Shazlin Zulkiffeli, Dip. Public Admin (UiTM)

Audit Dalam/Internal Audit

Juruaudit/Auditor

- Ilyani Mazlan, B. Acc. (Hons) (UiTM)

Penolong Juruaudit/Assistant Auditor

- Mohd. Rozmi Mohamed Arif, Dip. Acc. (UiTM)

Unit Pengurusan Kualiti

Quality Management Unit

Ketua /Head

- Salamah Selamat, BSc (Hons) (UKM)

Pegawai Penyelidik/Research Officers

- Suhana Rafidah Md. Yusof, MSc Quality & Product. Mgmt (UKM)
- Suharti Samod, BSc (UPM)

Pegawai Teknologi Maklumat Kontrak

Contract Information Technology Officer

- Nor Haliyan Tan Shilan, MSc IT (UiTM)

Unit Pengurusan Korporat

Corporate Communication Unit

Ketua/Head

- Norhayati Nordin, MSc (Sussex)

Pegawai Penerangan

Information Officer

- Wahyu Abd. Wahab, B. Mass Comm. (UPM)

Pegawai Media/Media Officer

- Toh An Nee, B. Mass Comm. (USM)

APAFRI

Setiausaha Eksekutif

Executive Secretary

- Dr Sim Heok Choh, PhD (Idaho)

FMBioSis

Ketua Pegawai Eksekutif/ Chief Executive Officer

- Dr Fadhilah Zainudin, PhD (Birmingham)

Akauntan/Accountant

- Faizah Sahran, B. Acc. (UPM)

Pegawai Tadbir/Administrative Officer

- Mazdiana Mohd. Zain, B. Corp Admin (Hons.) (Comp. Sect)

**BAHAGIAN PERANCANGAN PENYELIDIKAN
DAN KORPORAT**
**RESEARCH PLANNING AND CORPORATE
DIVISION**

Pengarah/Director

- Dr Norini Haron (AMN), PhD (Aberystwyth, Wales)

Pegawai Penyelidik Kontrak

Contract Research Officers

- Ariff Fahmi Abu Bakar, BSc For. (Hons) (UMS)
- Nurul Husna Zaidi, MSc (UKM)

Pegawai Teknologi Maklumat Kontrak

Contract Information Technology Officers

- Rosniza Rawi, MSc (UiTM)

Cawangan Dasar dan Perancangan Penyelidikan
Policy and Research Planning Branch

Ketua/Head

- Dr Nur Supardi Md Noor (AMK), PhD (Reading)

Pegawai Penyelidik

Research Officer

- Nik Zanariah Nik Mahmood, MSc (UPM)

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Contract Research Officers

- Abdul Hafiz Mohamad Zakuan, MBA (UKM)

Pegawai Teknologi Maklumat Kontrak

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Pen. Pegawai Tadbir Kontrak

Contract Assistant Administration Officer

- Siti Ramizah Mohamed Pauzi, Dip. MT (UiTM)

BAHAGIAN PERHUTANAN DAN ALAM SEKITAR
FORESTRY AND ENVIRONMENT DIVISION

Pengarah

Director

- Dr Ismail Harun, PhD (UPM)

Setiausaha Pejabat

Administrative Secretary

- Nor Shahidah Hussin, Dip. Sec. Science
(Politeknik Tuanku Syed Sirajuddin, Perlis)

Program Hutan Asli

Natural Forest Programme

Ketua/Head

- Dr Ismail Harun, PhD (UPM)

Pegawai Penyelidik/Research Officers

- Dr Raja Barizan Raja Sulaiman, PhD (Stirling)
- Dr Ismail Parlan, PhD (UKM)
- Wan Mohd Shukri Wan Ahmad, MSc (UPM)
- Mohd Nasir Husin, MSc (UKM)
- Dr Serafina Christine Fletcher, PhD (UKM)
- Nur Hajar Zamah Shari, MSc (UPM)
- Salleh Mat, MSc (UPM)
- Tariq Mubarak Husin, BSc (UPM)
- Azharizan Mohd Norizan, MSc (UiTM)

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Contract Research Officers

- Farah Shahanim Mohamed Mohidin, MSc (UKM)
- Joann Christine Luruthusamy, MSc (UM)
- Mohd. Razman Salim, BSc (UPM)
- Musalmah Nasardin, BSc (UPM)
- Mohamad Faizul Kamarudin, BSc (UiTM)
- Nur Zati Akma Mustafa, MSc (UKM)

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- Sadali Sahat
- Harfendy Osman, Dip. Comp. Sc. (UPM)

Program Ekopelancongan dan Hutan Bandar
Ecotourism and Urban Forestry Programme

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- Ahmad Nazarudin Mohd. Roseli, MSc (UPM)
- Sreetheran Maruthaveeran, MSc (UPM)
- Nik Azyyati Abdul Kadir, BSc (UPM)
- Nik Adlin Nik Mohamed Sukri, BSc (UTM)

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- Nazimatul Azma Nazeri, BSc (UPM)
- Sharmillah Saleh, BSc (UMS)

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Assistant Research Officers

- Mohd. Afendi Husin, Dip. Agric. (UPM)
- Azahari Hj. Mohd. Yusoff, Dip. Landscape Design
(UiTM)
- Naimah Che Long, BSc (UPM)
- Wan Mohd Nafizul Hal Alim Wan Ahmad,
Dip. Electrical Eng. (UM)

Program Geoinformasi/Geoinformation Programme

Ketua/Head

- Dr Khali Aziz Hamzah, PhD (Reading)

Pegawai Penyelidik/Research Officers

- Tan Sek Aun, MSc (UPM)
- Hamdan Omar, MSc (UTM)

Pegawai Penyelidik Kontrak

Contract Research Officers

- Mohd Azahari Faidi, MSc (UTM)
- Mohd Rizuwan Mamat, B. Mech. Eng. (UiTM)

Penolong Pegawai Penyelidik

Assistant Research Officers

- Rodziah Hashim, Dip. Sc. (UiTM)
- Abdul Azhan Shah Idris, Dip. For. (UPM)

Program Perubahan Iklim dan Perhutanan Climate Change and Forestry Programme

Ketua/Head

- Dr Elizabeth Philip, PhD (UM),
(Dipinjamkan ke/Seconded to NRE)
- Dr Samsudin Musa, PhD (UKM)

Pegawai Penyelidik/Research Officer

- Azian Mohti, MSc (UPM)

Pegawai Penyelidik Kontrak/

Contract Research Officers

- Noraishah Safee, MSc (UKM)
- Chong Yen Mee, BSc (Hons.) (UMS)

Penolong Pegawai Penyelidik

Assistant Research Officers

- Nazaruddin Ramli, Dip. Agric. (UPM)
- Mohd Rizal Mohd Kassim, Dip. Plant. (UiTM)

Program Kualiti Air

Water Quality Programme

Ketua/Head

- Dr Abd Rahman Kassim, PhD (Oregon State)

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Research Officers

- Siti Aisah Shamsuddin, PhD (UTM)
- Mohd. Ghazali Hasan, M. Agric. Sc. (UPM)
- Saiful Iskandar Khalit, MSc (UPM)
- Marryanna Lion, MSc (UPM)

Penolong Pegawai Penyelidik

Assistant Research Officers

- Shahrulzaman Idris, Dip. For. (UiTM)
- Mohd. Md. Sahat

Pegawai Penyelidik Kontrak

Contract Research Officer

- Ahmad Firdaus Zainuddin, BSc. (UPM)
- Mohamad Danial Md Sabri, BSc (Hons.)(UiTM)

Taman Botani Kepong

Kepong Botanic Garden

Ketua/Head

- Adnan Mohammad, MSc (London)

Pegawai Penyelidik/Research Officers

- Muhammad Farid Abdul Rashid,
M. For. (Oregon State)
- Norsham Suhaina Yaakob, MSc (UKM)
- Noorsiha Ayop, BSc (UM)

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Assistant Research Officer

- Azrina Yahaya, B. Town & Reg. Plan (UiTM)
- Mohd. Shis Ibrahim, Dip. Comp. Sc. (UPM)
- Khairuddin Kamaruddin

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Contract Research Officer

- Nur Suriani Salleh, BSc (UiTM)

BAHAGIAN KELUARAN HUTAN

FOREST PRODUCTS DIVISION

Pengarah/Director

- Dr Rahim Sudin (AMN, DSM), PhD (Sheffield)

Program Biokomposit dan Perlindungan Kayu

Bio-Composites and Wood Protection Programme

Ketua/Head

- Dr Zaihan Jalaludin, PhD (Edinburgh)
(Dari/From April)

Pegawai Penyelidik/Research Officers

- Salamah Selamat, BSc (Hons) (UKM)
- Dr Salmiah Ujang, PhD (Portsmouth)
- Hashim W. Samsi, MSc (UPM)
- Dr Roszaini Kadir, PhD (Bangor)
- Dr Suffian Misran, PhD (Bangor)
- Dr Rafeadah Rusli, PhD (Manchester)
- Mohamad Nasir Mat Arip, MSc (UKM)
- Dr Mohd Khairun Anwar Uyup, PhD (UPM)
- Tumirah Khadiran, MSc (UKM)
- Shahlinney Lipeh, MSc (UKM)
- Mohd Yusouf Abd. Latif, MSc (UIAM)
(Dari Jun/From June)

Pegawai Penyelidik Kontrak

Contract Research Officers

- Khairul Azmi Jabar, MSc (USM)
- Mohd Yusouf Abd. Latif, MSc (UIAM)
- Siti Nor Ain Tamiran, BSc (UiTM)
- Noor Azrieda Abd. Rashid, BSc (Hons) (UiTM)

Penolong Pegawai Penyelidik

Assistant Research Officers

- Habibah Mohamad (PPN), Dip. Ind. Chem. (UiTM)
- Nor Azian Mohd Kasby, Dip. Civil Eng. (UTM)
- Baharuddin Kamaruddin, BSc (UPM)
- Rozaida Latip, Dip. Wood Tech. (UiTM)
- Siti Rafidah Mahmud, Dip. Wood Tech. (UiTM)

Program Pemrosesan Termaju dan Reka Bentuk **Advance Processing and Design Programme**

Ketua/Head

- Dr Tan Yu Eng, PhD (Brighton)

Pegawai Penyelidik/Research Officers

- Dr Mohamad Omar Mohamad Khaidzir, PhD (Sheffield)
- Mohd. Arshad Saru, B. Eng. (Sunderland)
- Abdul Hamid Saleh, MSc (UiTM)
- Ong Chee Beng, MSc (UPM)
- Dr Khairul Awang, PhD (USM)
- How Seok Sean, MSc (UPM)
- Siti Zaliha Ali, B. Eng. (Hons) (UIAM)

Pegawai Penyelidik Kontrak

Contract Research Officers

- Mohd. Jamil Abdul Wahab, B. Eng. (Hons) (UM)
- Izran Kamal, MSc (UPM)
- Yanti Abdul Kadir, BSc For. (UPM)

Penolong Pegawai Penyelidik

Assistant Research Officers

- Zawawi Kassim, Dip. Sc. (UiTM)
- Noor Nazreen Nasir, Dip. Elec. Eng. (UiTM) (Sehingga Mei /Until May)
- Roszalli Mohd.

Pembantu Teknik/Technical Assistant

- Ya'akob Zahari, Dip. Mech. Marine Eng. (Politeknik Ungku Omar)

Program Pulpa dan Kertas **Pulp and Paper Programme**

Ketua/Head

- Mahmudin Saleh, MSc (UiTM)

Pegawai Penyelidik

Research Officers

- Dr Rushdan Ibrahim, PhD (Manchester)
- Dr Sharmiza Adnan, PhD (Monash)
- Latifah Jasmani, MSc (UKM)

Penolong Pegawai Penyelidik

Assistant Research Officers

- Zaitun Said, Dip. Wood Tech. (UiTM)
- Azizi Abd. Jalil, Dip. Wood Tech. (UiTM)

Program Biotenaga/Bioenergy Programme

Ketua/Head

- Dr Wan Asma Ibrahim, PhD (UPM)

Pegawai Penyelidik/Research Officers

- Puad Elham, MSc (UPM)
- Shahrudin Hashim, BSc (USM)
- Rafidah Jalil, MSc (UKM)
- Mahanim Sarif @ Mohd. Ali, MSc (USM)

Program Teknologi Mesra Alam **Green Technology Programme**

Ketua/Head

- Dr Gan Kee Seng, PhD (Strathclyde)

Pegawai Penyelidik/Research Officer

- Dr Sik Huei Shing, PhD (UKM)

Pegawai Penyelidik Kontrak

Contract Research Officers

- Zairul Amin Rabidin, B. Eng. (Hons) (UM)
- Khairul Masseat, BSc (Hons) (UiTM)

Program Kualiti Kayu dan Hasil Bukan Kayu **Wood Quality and Non-Wood Products Programme**

Ketua/Head

- Dr Hamdan Husain, PhD (Wales)

Pegawai Penyelidik

Research Officers

- Dr Ani Sulaiman, PhD (Reading) (Sehingga/Until November)
- Mohd. Tamizi Mustafa PhD (USM)
- Nordahlia Abdullah Siam, MSc (UPM)

Penolong Pegawai Penyelidik

Assistant Research Officer

- Emlee Mohd. Taib (Berpindah ke Program Hutan Ladang)

Penolong Pegawai Penyelidik Kontrak

Contract Assistant Research Officer

- Mohd Izani Ishak, Dip. Mechanical Eng. (Politeknik Sultan Salahuddin Abdul Aziz Shah)

PROJEK FLAGSHIP MYScrim

MYScrim FLAGSHIP PROJECT

Pengarah/Director

- Dato' Dr Hjh Marzalina Mansor (DIMP), PhD (UKM)

Pegawai Penyelidik/Research Officer

- Dr Wan Tarmeze Wan Ariffin, PhD (Birmingham)

BAHAGIAN BIOTEKNOLOGI PERHUTANAN **FOREST BIOTECHNOLOGY DIVISION**

Pengarah/Director

- Dr Norwati Muhammad, PhD (Reading)

Program Bioteknologi

Biotechnology Programme

Ketua/Head

- Dr Norwati Muhammad, PhD (Reading)

Pegawai Penyelidik

Research Officers

- Dr Lee Soon Leong, PhD (UKM)
- Dr Lee Chai Ting, PhD (UPM)
- Dr Nor Hasnida Hassan, PhD (UKM)
- Dr Kevin Ng Kit Siong, PhD (UM)
- Dr Mohd Rosli Haron, PhD (UPM)
- Dr Norwati Adnan, PhD (UKM)
- Dr Norlia Basherudin, PhD (UPM)
- Nashatul Zaimah Noor Azman, MSc (London)
- Haliza Ismail, MSc (UPM)
- Dr Siti Salwana Hj. Hashim, PhD (UKM)
- Dr Ng Chin Hong, PhD (UKM)
- Dr Shawn Cheng, PhD (UPM) (Mulai/From September)
- Dr Tnah Lee Hong, PhD (UM)
- Nor Asmah Hassan, MSc (UKM)
- Nadiyah Salmi Nadzri, BSc (Hons) (UKM)
- Noraliza Alias, BSc (Hons) (UPM)

Pegawai Penyelidik Kontrak

Contract Research Officers

- Siti Suhaila A. Rahman, MSc (UPM)
- Nurul Farhanah Zakaria, BSc (UPM)
- Nazirah Abdullah, BSc (UPM)
- Nadzirah Amiruddin, MSc (UKM)
- Dinaiz Thinagaran, BSc (UM) (Dari/From September)

Program Hutan Ladang

Forest Plantation Programme

Ketua/Head

- Dr Hj Ahmad Zuhaidi Yahya (AMN), PhD (Irish U. Dublin)

Pegawai Penyelidik/Research Officers

- Dr Hashim Md. Noor (AMP), PhD (Wales)
- Dr Ang Lai Hoe, PhD (Aberdeen)
- Dr Wan Rasidah Wan Abdul Kadir, PhD (Ghent)
- Tuan Hj. Abd. Razak Othman, MSc (UKM)
- Rosdi Koter, MSc (UPM)
- Dr Lok Eng Hai, PhD (Murdoch Uni., Western Australia)
- Dr Ho Wai Mun, PhD (SNU, Seoul)
- V. Jeyanny Vijayanathan, MSc (UPM)
- Rozita Ahmad, BSc (Hons) (USM)
- Mohamad Fakhri Ishak, BSc For. (UPM)

Penolong Pegawai Penyelidik

Assistant Research Officers

- Suhaimi Wan Chik, Dip. Agric. (UPM)
- Amir Saaifuddin Kassim, BBA (Hons) (UiTM)

Penolong Pegawai Penyelidik Kontrak

Contract Assistant Research Officer

- Tang Lai Kuen, BSc (TARC)

Program Membaikbiak Tumbuhan

Plant Improvement Programme

Ketua/Head

- Dr Mohd Noor Mahat (AMN), (Dari Mac /From March), PhD (UPM)

Pegawai Penyelidik/Research Officers

- Dr Aminah Hamzah (KMN), PhD (Edinburgh)
- Dr Mohd Lokmal Ngah, PhD (UNISZA)
- Dr Mohd Zaki Abdullah, PhD (UKM)
- Ahmad Fauzi Mohd. Shariff, BSc (UPM)
- Dr Farah Fazwa Md Ariff, PhD (UKM)
- Mohd Adi Faiz Ahmad Fauzi, BSc (UUM)

Penolong Pegawai Penyelidik

Assistant Research Officers

- Azril Deenor Md Dan, Dip. Microbio. (UiTM)
- Muhammad Farhan Zolkifle, Dip. Kej. Elektronik (Politeknik Shah Alam)

Penolong Pegawai Taman/ Ladang

Assistant Garden/Plantation Officer

- Mohd Ramly Mohd. Saleh, Dip. Agric. (UPM)

BAHAGIAN BIODIVERSITI HUTAN

FOREST BIODIVERSITY DIVISION

Pengarah/Director

- Dr Saw Leng Guan, PhD (Reading)

Program Biodiversiti Flora

Flora Biodiversity Programme

Ketua/Head

- Dr Richard Chung Cheng Kong FLS, PhD (UM)

Pegawai Penyelidik/Research Officers

- Sam Yen Yen, M. Agric. Sc. (UPM)
- Chew Ming Yee, BSc (UPM)
- Nor Ezzawanis Abdullah Thani, MSc (UKM)
- Ummul Nazrah Abdul Rahman, MSc (UKM)
- Syahida Emiza Suhaimi, BSc (UPM)
- Avelinah Julius, MSc (UMS)
- Siti Munirah Mat Yunoh, MSc (UKM)

Pegawai Penyelidik Kontrak

Contract Research Officers

- Dr E. Soepadmo, PhD (Cambridge)
- Dr Ruth Kiew, PhD (Cantab.)
- Rafidah Abdul Rahman, MSc (UM)
- Nadiyah Idris, BSc (Hons.) (UKM)
- Yao Tze Leong, BSc For. (UPM)
- Lim Chung Lu, BSc (UPM)
- Joanne Tan Pei Chih, BSc (UPM)
- Ong Poh Teck, BSc (UPM)

Penolong Pegawai Penyelidik

Assistant Research Officers

- Kamarudin Saleh
- Kamarul Hisham Mustafa, Dip. Agric. Sc.

Program Biodiversiti Fauna

Fauna Biodiversity Programme

Ketua/Head

- Dr Laurence G Kirton, PhD (London)

Pegawai Penyelidik/Research Officers

- Dr Pan Khang Aun, PhD (Salford)
(Sehingga Mei/Until May)
- Shawn Cheng, MSc (Imperial College)
(Sehingga/Until September)
- Nada Badruddin, B. App. Sc. (Hons) (USM)

Pegawai Penyelidik Kontrak

Contract Research Officers

- Dr Grace Tabitha Lim, PhD Entomology
(Virginia Tech, USA) (Sehingga Mac/Until March)
- Phon Chooi Khim, MSc (USM)
- Veronica Khoo Swee Imm, BSc (Hons) (USM)
- Ong Su Ping, BSc (Hons) (USM)
- Mohammad Shahfiz Azman, BSc (Hons) (UNIMAS)
- Nor Azlin Mohd Fauzi, MSc (UKM)
(Sehingga Jun/Until June)
- Kaviarasu A/L Munian, BSc (Hons) (UPM)

Penolong Pegawai Penyelidik

Assistant Research Officer

- Azmi Mahyuddin (Sehingga Januari/Until January)

Program Kesihatan dan Pemuliharaan Hutan

Forest Health and Conservation Programme

Ketua/Head

- Dr Lee Su See (AMN), PhD (Aberdeen)

Pegawai Penyelidik/Research Officers

- Dr Lillian Chua Swee Lian, PhD (Bath)
- Dr Gary William Theseira, PhD (Mississippi)
- Dr Mohd. Farid Ahmad, PhD (USM)
- Patahayah Mansor, BSc (UPM)
- Hamidah Mamat, MSc (UTM)
- Lau Kah Hoo, MSc (UKM)
- Thi Bee Kin, MSc (UKM)
- Suhaida Mustafa, BSc (UPM)

Pegawai Penyelidik Kontrak

Contract Research Officers

- Chan Yoke Mui, MSc (UM)
- Wendy Yong Sze Yee, MSc (UPM)
- Aslina Baharum, MSc (UiTM)
- Nazura Zainuddin, MSc (Marine Biotech.) (UM)
(Sehingga Oktober /Until October)
- Chan Hong Twu, MSc (Mycol.) (UM)
(Sehingga Oktober /Until October)

BAHAGIAN HASILAN SEMULA JADI

NATURAL PRODUCTS DIVISION

Pengarah/Director

- Dr Rasadah Mat Ali (AMP), PhD (London)

Setiausaha Pejabat

Office Secretary

- Jesmini Mat Ali, Dip. Sec. Science (UiTM)

PROGRAM SUMBER BIOLOGI

BIOLOGY RESOURCE PROGRAMME

Pegawai Penyelidik

Research Officers

- Zamree Md. Shah, MSc (UPM)
- Hada Masayu Ismail @ Dahlan, B. Process & Food
Eng. (Hons.) (UPM)
- Tan Ai Lee, MSc (UKM)

Pegawai Penyelidik Kontrak

Contract Research Officer

- Ihsan Safwan Kamarazaman, MSc (UPM)
- Nurnida Mohd Kamal, MSc (UKM)

Penolong Pegawai Penyelidik

Assistant Research Officer

- Sharmizi Ismail, Dip. Plant. Industry Mgmt (UiTM)

Penolong Pegawai Penyelidik Kontrak

Contract Assistant Research Officer

- Mastura Mat Yasin, Dip. Civil Eng. (UiTM)

PROGRAM FITOKIMIA

PHYTOCHEMISTRY PROGRAMME

Pegawai Penyelidik

Research Officers

- Dr Ling Sui Kiong, PhD (Nagasaki)
- Fauziah Abdullah, MSc (UKM)
- Nor Hayati Abdullah, MSc (UM)
- Dr Zunoliza Abdullah, PhD (USM)
- Abdul Rashid Li, MSc (UiTM)
- Adiana Mohd Adib, MSc (UTM)
- Dr Tan Hooi Poay, PhD (UM)

Penolong Pegawai Penyelidik

Assistant Research Officers

- Mohd Radzi Ahmad, Dip. MLT (UKM)
- Nuziah Hashim, Dip. Ind. Chem. (UiTM)
- Salbiah Man, Dip. Ind. Chem. (UiTM)
- Abdull Rashih Ahmad

PROGRAM BIOAKTIVITI BIOACTIVITY PROGRAMME

Pegawai Penyelidik

Research Officers

- Dr Nik Musa'adah Mustapha, PhD (London)
- Dr Vimala Subramaniam, PhD (UM)
- Dr Mastura Mohtar, PhD (UKM)
- Zaridah Mohd. Zaki, MSc (UKM)
- Chee Beng Jin, MSc (UPM)
- Mazura Pizar, MSc (UKM)
- Saiful Azmi Johari, MSc (UPM)
- Dr Fadzureena Jamaluddin, PhD (UPM)
- Mary Khoo Gaik Hong, MSc (UPM)

Pegawai Penyelidik Kontrak

Contract Research Officers

- Khairul Kamilah Abd Kadir, MSc (UPM)
- Mohd Kamal Nik Hasan, MSc (UPM)
- Mohd Jemain Mohamad Ridhwan, MSc (UiTM)
- Shalini Markandan, B. BMed. Sc. (Hons.) (MSU)

Pegawai Sains Kontrak

Contract Science Officer

- Siti Nur Aisyah Mohd Hashim, BSc (Hons.) (UKM)

Penolong Pegawai Penyelidik

Assistant Research Officers

- Rohana Sahdan, Dip. Microbio. (UiTM)
- Mazurah Mohamed Isa, Dip. Microbio. (UiTM)

PROGRAM PEMBANGUNAN PRODUK HERBA HERBAL PRODUCTS DEVELOPMENT PROGRAMME

Pegawai Penyelidik

Research Officers

- Dr Nor Azah Mohamad Ali, PhD (UPM)
- Mailina Jamil, MSc (UKM)
- Saidatul Husni Saidin, MSc (UPM)
- Norulaiman Yusoff, MSc (UPM)
- Ong Boo Kean, MSc (UPM)

Pegawai Penyelidik Kontrak

Contract Research Officers

- Siti Humeirah Ab Ghani, MSc (UPM)
- Sahrim Lias, BSc (UiTM)

Pegawai Sains Kontrak

Contract Science Officer

- Muhd Hafizi Zainal, BSc (UKM)

Penolong Pegawai Penyelidik

Assistant Research Officers

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

Penolong Pegawai Penyelidik Kontrak

Contract Assistant Research Officers

- Azrina Aziz, BSc (UiTM)

PUSAT TEKNOLOGI HERBA HERBAL TECHNOLOGY CENTRE

Pegawai Penyelidik

Research Officers

- Zamree Md. Shah, MSc (UPM)
- Dr Pin Kar Yong, PhD (UPM)
- Noor Rasyila Mohamed Noor, MSc (UPM)

Pegawai Penyelidik Kontrak

Contract Research Officers

- Mohd Farhan Abdul Razak, B. Eng 9hons) (UniMAP)

Pegawai Sains Kontrak

Contract Science Officer

- Nurhazwani Mohd Hirmizi, BSc (Hons) (UiTM)

PUSAT PENEMUAN UBATAN DRUG DISCOVERY CENTRE

Pegawai Penyelidik

Research Officers

- Dr Getha Krishnasamy, PhD (UM)
- Dr Mohd Ilham Adenan, PhD (Okayama)
- Dr Nurhanan Murni Yunos, PhD (Univ. of Sydney)
- Dr Asiah Osman, PhD (Griffith Univ.)
- Nor Datiakma Mat Amin, MSc (IIUM)
- Norhayati Ismail, BSc (Hons) (UPM)
- Lili Sahira Husin, BSc (Hons) (UPM)
- Siti Syarifah Mohd Mutalip, BSc (Hons) (UPM)

Pegawai Penyelidik Kontrak

Contract Research Officers

- Hema Thopla Govender, BSc (Hons) (UNISEL)
- Roshan Jahn Mohd Salim, MSc (UIA)
- Nur Fairuz Mat Yasin, BA (Hons) (UPM)
- Muhammad Haffiz Jauri, MSc (UTM)
- Muhammad Syamil Azahar, MSc (UTM)
- Anee Suryani Sued, MSc (UKM)

BAHAGIAN PENTADBIRAN ADMINISTRATION DIVISION

Pengarah/Director

- Abdul Jabbar Hj Sabli, MBA (UKM)

Setiausaha Pejabat

Office Secretary

- Suzrina Shamsuddin, Dip. Sec. Sc. (UiTM)

Cawangan Pentadbiran

General Administration

Ketua/Head

- Zamri Mohd. Zangi, BSc (Hons) (UUM)

Penolong Pegawai Tadbir

Assistant Administrative Officers

- Md. Nasir Dayat (PPN, PJK)
- Nazly Jamaludin

Cawangan Perolehan

Procurement Branch

Ketua/Head

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

Penolong Akauntan/Assistant Accountant

- Norbaite Saharudin, Dip. Bus. Stud. (UiTM)

Cawangan Pembangunan dan Penyelenggaraan

Development and Maintenance Branch

Ketua/Head

Pegawai Tadbir/Administrative Officer

- Noorsuhanis Abdul Latif, B (Hons.) (UiTM)

Penolong Juruukur Bahan

Assistant Quantity Surveyor

- Jamal Abdul Razak, Dip. Qty. Survey (UiTM)

Penolong Pegawai Penyelidik

Assistant Research Officer

- Mohd Azhar Ishak @ Asahak, Dip. Mech. Eng. (Polytech)

Penolong Jurutera/Assistant Engineer

- Norhusaini Abdullah, Dip. Power Elect. Eng. (UTM)

BAHAGIAN KEWANGAN

FINANCE DIVISION

Pengarah/Director

- Tuan Hj Mohd Zamshari Hj Abd Rahman, MBA (UIAM)

Setiausaha Pejabat

Office Secretary

- Sarina Hussin, Dip in Sec. Sc. (UiTM)

Akauntan/Accountants

- Jumaaton Abu Bakar, B. Acc. (Hons) (UiTM)
- Saizatul Maheran Ramle, B. Acc.(Hons) (UiTM)

Penolong Akauntan/Assistant Accountants

- Zainorasri Yahya, B. Acc. (Hons) (UiTM)
- Emylia Ayoub, Dip.in Banking (UiTM)

BAHAGIAN SUMBER MANUSIA

HUMAN RESOURCE DIVISION

Pengarah/Director

- Imaludden Abdullah (KMN), B. Is. (UKM)

Cawangan Perjawatan dan Perkhidmatan

Establishment and Services Branch

Ketua/Head

- Mohd. Asmawee Ismail, B. HRM (Hons) (UUM)

Penolong Pegawai Tadbir

Assistant Administration Officer

- Nurazani Abdul Rasid, B. HRM (Hons) (UUM)

Cawangan Kompetensi dan Peperiksaan

Competency and Examination Branch

Ketua/Head

- Azuarni Abdul Adzis, B. A. (Hons.) (UPM)

Cawangan Pembangunan Modal Insan

Human Capital Development Branch

Ketua/Head

- Liza Ismail, M. (Human Res. Dev.) (UPM)

Penolong Pegawai Penyelidik

Assistant Research Officers

- Ruziah Ripin, B.Sc (Human Resource Development) (UPM)

Cawangan Perkhidmatan Psikologi

Branch of Psychological Services

Ketua/Head

- Mohd Akhir Abd Rahman

BAHAGIAN PERKHIDMATAN TEKNIKAL

TECHNICAL SERVICES DIVISION

Pengarah/Director

- Wan Zahiri Wan Yaacob, B. Comp. Sc. (Hons) (UTM)

Cawangan Penerbitan/Publications Branch

Ketua/Head

- Norhara Hussein, BSc (Hons) (USM)

Pegawai Penyelidik

Research Officers

- Ho Yuen Foon, MSc (UM)
- Sarifah Kunju Ahmad, MBiotech. (UM)

Pegawai Penyelidik Kontrak

Contract Research Officer

- Ida Suraini Abd. Shukor, MBA Gen. Mgmt. (UIA)

Cawangan Teknologi Maklumat

Information Technology Branch

Ketua/Head

- Zahari Othman, BSc (Hons) Info. Tech. (Hons.) (ITM)

Pegawai Penyelidik

Research Officers

- Norul Maslissa Ahmad, B. Info. Tech. (Hons.) (UUM)
- Maizura Ishak, BSc Comp. (Hons.) (UTM)
- Nurul Hilal A. Tarmidzi, BSc (Hons) Info Tech. (UNISEL)

Pegawai Teknologi Maklumat Kontrak

Contract Information Technology Officer

- Intan Dalina Rafidah Othman, BMultimedia (Hons) (UUM)

Penolong Pegawai Teknologi Maklumat

Assistant Information Technology Officers

- Siti Zaleha Abdul Goni, Dip. Interactive Multimedia (UniKL)
- Omar Ali Abdul Rahim, Dip. Comp. Sc. (Poly. Ungku Omar)
- Intan Farah Wahida Khabir, Dip. Comp. Sc. (UiTM)
- Nordaiman Shairi, Dip. Comp. Sc. (UPM)

Cawangan Perpustakaan/Library

Ketua/Head

- Mohamad Zaki Hj Mohd. Isa, MLib. Sc. (UIA)

Pegawai Penyelidik

Research Officer

- Mastura Buang, MLib. Sc. (UIA)

Cawangan Pameran

Exhibition Branch

Ketua/Head

- Wahyu Abd. Wahab, BComm (UPM)

Pereka Grafik/Graphic Artist

- Rosdi Mohamad, Dip. Comp. Sc. Multimedia (UTM)

Cawangan Galeri dan Antikuiti

Gallery and Antiquity Branch

Ketua/Head

- Noor Atizza Hj Mansor, MSc IT (UKM)

BAHAGIAN KOMERSIALISASI DAN INOVASI COMMERCIALIZATION AND INNOVATION DIVISION

Pengarah/Director

- Mohd. Zamshari Hj. Abd Rahman, MBA (UIAM)

Cawangan Pengurusan Harta Intelek dan Inovasi Intellectual Property Management and Innovation Branch

Ketua/Head

- Dr Woon Weng Chuen, PhD (Wales)

Penolong Pegawai Tadbir Kontrak

Contract Assistant Administrative Officer

- Syed Othman Syed Omar, B. Bus. Adm. (Hons) (UPM)

Cawangan Komersialisasi dan Inkubasi

Commercialization and Incubation Branch

Ketua/Head

- Dr Woon Weng Chuen, PhD (Wales)

Felo Kontrak/Contract Fellow

- Jaafar Yahya, MBA (England)

Pegawai Penyelidik Kontrak

Contract Research Officer

- Izanudin Zakaria, MBiotek. (UM)

Pusat Perkhidmatan Setempat (PPS)

Ketua/Head

- Tan Lay Lean, BSc Math. with Econ. (UMS)

Pegawai Penyelidik Kontrak

Contract Research Officer

Penolong Pegawai Tadbir

Assistant Administrative Officer

- Mohamad Akhir Abdul Rahman, STPM

Cawangan Perundingan

Consultancy Branch

Ketua/Head

- Izan Nor Farahni Ahmad, B. Acc. (Hons.)(UiTM)

Program Ekonomi dan Analisis Strategik

Economic and Strategic Analysis Programme

Ketua/Head

- Dr Ismariah Hj. Ahmad, PhD (Washington)

Pegawai Penyelidik

Research Officers

- Mohd. Parid Mamat, MSc (UPM)
- Huda Farhana Muslim, MSc (UiTM)
- Rohana Abd. Rahman, MSc (UPM)

Pegawai Penyelidik Kontrak

Contract Research Officers

- Dr Lim Hin Fui, PhD (UM)
- Norliyana Adnan, M. Eng. Env (UTM)

Pegawai Hal Ehwal Ekonomi Kontrak

Contract Economist

- Dr Noor Aini Zakaria, PhD (Paris)
- Noor Hazmira Merous, MSc (UPM)

Pegawai Penyelidik Sosial Kontrak

Contract Social Research Officers

- Norshakila A/P Yusof, B. Soc. Sc. (Hons) (UKM)
- Intan Nurulhani Baharuddin, B. Soc. Sc. (Hons) (UKM)

Penolong Pegawai Penyelidik Kontrak

Contract Assistant Research Officer

- Mohd Faridzul Mohamed Yusof, BSc (Hons) (UiTM)



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