

# The Darwin Initiative Papuan Plant Diversity Project

## Final Report



## 1. Darwin Project Information

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Project Title	UK Darwin Initiative Papuan Plant Diversity Project
UK Contractor	Royal Botanic Gardens, Kew
Collaborator	Universitas Negeri Papua
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Project Website	<a href="http://www.rbgekew.org.uk/herbarium/keys/fm/">http://www.rbgekew.org.uk/herbarium/keys/fm/</a>
Authors, date	Damien Hicks, John Dransfield, William Baker: 20 December 2004

## 2. Project Background/Rationale

The Herbarium at the Biodiversity Study Centre (PPKH), Universitas Papua Negeri (UniPa), Manokwari, is the only plant diversity reference collection in the Indonesian province of Papua, one of the least studied and most diverse areas of the humid tropics. At the start of the project its collections were in need of rehabilitation, this made more urgent by the island's under-researched biodiversity. Papua remains one of the botanically least known areas of the world and its plant diversity is very incompletely catalogued, with estimates of the number of vascular plant species ranging from 13 000 to 20 000. New Guinea is estimated to have the highest levels of island endemism in all of the Malesian islands (Johns, 1995), though Papua has the lowest collection density, with under 20 published collections per 100 km<sup>2</sup> (Conn, 1966).

Manokwari Herbarium (MAN) incorporates the remains of the rich collections of the former Dutch colonial forestry service. For a long time languishing and deteriorating in inappropriate storage, these collections were rescued by the University and form the core of MAN. Without the support of the Darwin Initiative, these 20 000 collections would have continued to deteriorate, falling prey to insect and fungal pests, until little of scientific value remained. Though the herbarium contains a uniquely important set of collections – up to 30% more of these highly significant Dutch collections from Papua than the two most important holders of plant specimens from Papua, the Leiden and Bogor herbaria - it was estimated that approximately 30% of the specimens had already been lost.

The project aimed to safeguard the Herbarium and to increase self-sufficiency by establishing a cadre of highly motivated botanists trained to develop and maintain the collections. Key outputs included annotated field guides to the families of Malesian seed plants and to the palms and rattans of New Guinea. In the context of Indonesia's increasing provincial autonomy from within and decreasing security from without, the project aimed to empower the people of Papua to take a lead in determining the future of the plant diversity of their home province.

The proposed project evolved from extended discussions between RBG Kew staff and R. Maturbongs, J. Wanggai (Head of the PPKH) and other staff during reciprocal visits to RBG Kew and Manokwari, and incorporated many of their ideas concerning the needs of the Herbarium. An official Memorandum of Understanding was established in 2000 between UniPa and RBG Kew as a written commitment between the two organisations to future collaborations and mutual support. This MOU is due for renewal in 2005, an opportunity for further positive contact between MAN and K and clarification of what each partner expects from the collaboration.

### 3. Project Summary

The primary objective of the project was to develop research capacity in plant diversity at the Biodiversity Study Centre through the rehabilitation of the Herbarium, the renovation and development of the herbarium collections and through the training of staff in curation and research.

International insecurity and Papuan political instability from the outset combined to deal us a remarkably difficult hand in managing this project. Research visas and permits for fieldwork were completely proscribed throughout, and continue to be so, because the immigration authority in Jakarta deems Papua to be one of the three 'sensitive' regions of this country. Ramifications were to be expected in this Islamic country following September 2001, though the Bali bomb in October 2002 and Jakarta Marriot Hotel and Australian Embassy bombs in August and September 2003 led the Foreign and Commonwealth Office to advise against all essential travel to Indonesia for a period of nearly one year. Shootings of the Papuan leader Theys Eluays in November 2001 and of several teachers in Tembagapura in August 2002 underline the ongoing political turbulence in Papua.

Travel to Papua during certain times of the last three years was therefore curtailed. Even at this moment it would require a difficult judgement call given the new terrorist threat warnings about Indonesia issued by the UK, Australian and New Zealand embassies last week (<http://news.bbc.co.uk/2/hi/asia-pacific/4097441.stm>). Aside from periods of FCO travel advisories, to have circumvented the system by travelling on a tourist visa could have had serious consequences for security and/or been highly inadvisable in regards to political relationships central to scientific collaboration in Indonesia. A case this month (<http://www.malra.org/posko/malra.php4?nr=35798>) of two academics who were discovered working on tourist visas in North Sumatra highlights some of the dangers. They are presently in jail for five months and the Indonesian Institute for Sciences is tightening procedures for research visas yet further.

The original Logical Framework is included as Appendix 1. Manokwari Herbarium now has a complete set of scientific equipment, curation facilities and a wealth of technically trained staff. Basic and fundamental renovation of the building structure has been completed, high quality curation work is continuing, a database of over 33000 records has been compiled, the library is adequately equipped, a pest control regime is in operation and the Interactive Key to Malesian Seed Plants - published by this project in September 2004 - is in frequent use in family sorts. We have succeeded in removing the obstacles to the development of this important facility and feel that it could



**Kew and Manokwari staff adding determinations to Verbenaceae specimens**

become the world authority on Papuan botany within a couple of years given continued institutional support of its human resources. PPKH technicians have taken responsibility for facets of herbarium management (see section 5. Project Impacts), and PPKH staff are already being sought for ecological surveys by developers in Papua (e.g. BP, Freeport) and government consultancy contracts. Work on publications such as new species descriptions (see Appendix 3), the checklist to the flora of Gunung Meja and 'Palms of New Guinea' (a collaboration between Indonesian Papua and researchers in PNG) signals Manokwari's progression to independent publication. Senior UniPa management have already granted expansion of the herbarium into an extra room for storage, and there is informal talk of continued expansion for collections and the use of a screenhouse for teaching purposes in the near future.



Field collection of specimens has been undertaken in the absence of Kew staff, who were unable to get research permits, and thus the herbarium incorporates important new material from Cyclops Mountains, Misool Island, Japen Island, Biak Island, Raja Ampat Islands, Merauke, Tami River and Etna Bay. One of the most important continuing activities now is the curation and safeguarding of these herbarium specimens. This features strongly in the 'Workplan, November 2004 onwards' (see Appendix 2), a document drafted in Manokwari and agreed by all project staff in both institutions.

**Manokwari technician Marthinus Iwanggin, collecting Icacinaceae specimen on Gunung Meja using pole-clippers sent from the Darwin Initiative Project**

The international profile of the Herbarium and staff has been raised by collaborative scientific publications (see 6: Outputs), general articles in botanical magazines, the newly-accredited PPKH journal 'Beccariana' and PPKH staff visits to Kew and to international botanical symposia. Jack Wanggai, Rudi Maturbongs and Charlie Heatubun attended the Flora Malesiana 5 Symposium in Sydney in 2001, where preparatory project discussions were held, Charlie gave an excellent and well-received paper and the profile of Manokwari was raised. Talks were held in 2002 with Bogor Herbarium management, Bapak Mohamed Prakosa, Menteri Kehutanan RI, FCO staff, and Megawati Soekarnoputri, then President of Indonesia, regarding this project. Later discussions were held with Dedi Darnaedi, Head of Kebun Raya Bogor, regarding visa procurement for this sensitive area.

Rudi Maturbongs, Nurhaidah Sinaga and Charlie Heatubun attended the Flora Malesiana 6 symposium held in Los Banos, Philippines. The symposium was a vital opportunity for discussions with the Malesian botanical community, who are clearly very interested in MAN. Rudi's discussions with Marco Roos of Leiden Herbarium led to him being invited to join the board of Flora Malesiana, a position from which he can direct more attention and influence towards MAN. The presence of Hard Pollo (Head of Herbarium Wallaceana, Manado University) allowed for the invitation of two Herbarium Wallaceana staff to the Herbarium Techniques Course later to be held in Manokwari. Charlie Heatubun gave an ethnobotanical presentation on Papuan palms and Damien Hicks demonstrated the Interactive Key to Malesian Seed Plants. The seven PPKH staff study visits to Kew are described in Section 4., below. A final presentation of the project was given by the coordinator at Kew on Tuesday 7<sup>th</sup> December.

The operational plan was modified in response to political assassinations in Papua, the Bali bomb, the Jakarta Marriot and Australian embassy bombs, visa restrictions and FCO travel advisories. This was done in correspondence with Sylvia Smith and through the Darwin reporting and half-yearly reporting procedure. The most obvious impacts have been a decreased presence of the UK team in Manokwari during times of FCO advisories, and an absence of fieldwork due to research visas not being granted by the Indonesian Institute of Sciences.

Previous reports have described how a lack of presence on the ground has turned to our advantage in creating an impressive level of independence on purchases of scientific equipment, training and curation in Manokwari. PPKH were able to contribute an illustrated report to the 2004 Darwin Initiative Annual Report. The last visit to the herbarium allowed us to confirm that this long-distance management was justified and carried out in a trustworthy manner and, furthermore, that small-scale collections carried out by PPKH are being curated and duplicates being prepared for shipment to other herbaria.

The activities and objectives of RBG Kew are intimately linked to the CBD. Articles of the convention best describing the Papuan Plant Diversity Project are:

Article 7: Identification and monitoring – taxonomic research has been catalysed through further education and the herbarium techniques course, continuing in spite of the inability of foreign research permits being granted for Papua. The HTC provided a model of how a local checklist could be produced independently by PPKH in a short period of time.

Article 8: *In-situ* conservation and Article 10: Sustainable use – The herbarium is in some ways fundamental to all of the articles of the CBD, in that progress on these is difficult to conceive without knowledge of the species present in Papua.

Article 9: *Ex-situ* conservation – The living collections department of PPKH is manned by a technician who divides his time between this and the herbarium.

Article 12: Research and training – Most notable here are the study visits to RBG Kew by several Manokwari staff, a Masters programme undertaken and passed by Rudi Maturbongs in 2003, the Herbarium Techniques Course and visits by several PPKH staff to Flora Malesiana Symposia in 2001 and 2005. Training of all staff was and continues to be carried out on an informal basis both in Manokwari and by email correspondence.

Article 15: Access to genetic resources and benefit sharing – Specimen exchange between institutions has begun with palm, fern and general collections sent to Kew for naming. Both parties have been working to break the deadlock on permits for fieldwork, and the Memorandum of Understanding is due to be extended next year. Collaborations have been built on these taxa, notably also on orchids (Agustina Arobaya) and pandans (Rita Sadsoeitoeboen), and continue to be built between experts of these two institutions and others such as NHN Leiden, Arnold Arboretum, Bogor, Lae and UPNG.

Article 16: Access to and Transfer of Technology – Manokwari Herbarium has been given a complete set of scientific herbarium equipment (e.g. dissecting microscope, herbarium racks and boxes, acid-free paper, taxonomic literature, archival glue, binoculars), with the literature and training that allows PPKH staff to study the taxonomy of Papua's flora.

Article 17: Exchange of information, and Article 18: technical and scientific co-operation – Joint research is outlined in the publication list; exchange of facilities, staff, equipment and know-how was achieved by frequent PPKH staff visits to Kew, and Kew staff visits to Bogor and Manokwari, throughout the project.

Success of the project is evident by reference to the objectives of the original proposal. With well-curated and expertly named herbarium collections to act as a basic reference, and with training in fieldwork and research, the staff of Manokwari Herbarium now have the means and ability to play an active role in the surveying of remaining natural vegetation in Papua, essential for the effective conservation of the region's biodiversity. Collaborative links with other herbarium botanists in Papua New Guinea and Indonesia have been established to open channels of communication for sharing ideas and physical resources, as evinced by work on the Palms of New Guinea, the Gunung Meja checklist and delegates invited for the Herbarium Techniques Course and BioCon.

In addition the project has tested the capacity for independent progress of Manokwari Herbarium and not found it wanting. There are evidently some committed individuals in Manokwari who have the potential to take Papuan botany to the next level using the herbarium as a foundation for identification, species accounts, checklists and field guides, loans and as a base for visiting botanists and ecologists. During difficult times for international collaboration, the project has worked to instil the sort of independence expounded by Pieter Baas in his keynote speech to Flora Malesiana 6 ('Four centuries of botanical inventory in Malesia: What can we learn from it?'), whereby western institutions strive to make themselves redundant from developing indigenous talent.

The project was concluded with local collaborators by a final discussion of future plans between Kew and Manokwari herbarium staff and the UniPa Rector, Prof. Frans Wanggai. Jack Wanggai gave a presentation detailing Manokwari's future plans and thanking the Darwin Initiative Papuan Plant Diversity Project for its work in Manokwari herbarium.

#### 4. Scientific, Training, and Technical Assessment

We are proud to relay that the house journal of PPKH, Beccariana, was accredited by the Indonesian Department for Education in June 2004. There are continuing plans for fieldwork and the essential curation that is such an important part of the process of herbarium taxonomy. There are several examples of strong collaborative work on palm research between Kew and Manokwari and additional partnerships developing in other taxonomic areas. Agustina Arobaya's orchid work is ongoing and Nurhaidah Sinaga's last fern collections revealed a new record for the island of New Guinea, *Aglaomorpha pilosa* (Hook. & Bauer) Copel., previously known only from Luzon, Negros, Mindanao and Seram. Advances may also be forthcoming from developing collaborations on Pandanaceae, Hydrocharitaceae, Fungi and Lichens.



Nurhaidah Sinaga mounting *Asplenium* fern specimen from field collection

The Interactive Key to Malesian Plant Families was conceived in response to the lack of botanical identification tools for the region. It was constructed from a foundation of core characters selected from van Balgooy's 'Malesian seed plants' (1997, 1998, 2001) and Watson and Dallwitz's 'The families of flowering plants' (2000). Characters were checked, matrix gaps scored and additional information added including generic information, updated family portraits and a unique set of over one thousand Malesian botanical images, which are invaluable to the identification process. Field-testing of the key was carried out in Kew, Leiden, Philippines, Bogor and Manokwari, before free distribution to all delegates of the Flora Malesiana conference. Positive feedback continues to be received via the Malesian Key Group email address; this work will continue long after the end of the Darwin Initiative project.

Damien has also used time in UK to publish a new species of *Pittosporum* from Papua and to work on all specimens of the genus *Ilex* collected from New Guinea at RBG Kew and loaned from herbaria in Berlin, Harvard, Brisbane and Leiden, which he has now identified, databased and curated. Taxonomic study has previously been done on this genus in parts of western Indonesia (Andrews 2002) but there was uncertainty as to the species present in New Guinea. Two papers have been accepted, on a new Papuan species and a on three high altitude Papuan species, and a further paper has been submitted which describes the six racemose species of New Guinea.

Four PPKH staff attended the Flora Malesiana 5 Symposium in Sydney, Australia, in 2001, and three visited Flora Malesiana 6 in Los Banos, Philippines, in September 2004.

Charlie Heatubun visited RBG Kew to work on the Field Guide to the Palms and Rattans of New Guinea for four months from July 2001.

Marthen Jitmau, PPKH technician and current undergraduate student at UniPa, attended one-month of curation training in Bogor Herbarium in mid 2002.

Jack Wanggai and Rudi Maturbongs visited RBG Kew for one month from September 2002, working on the Field Guide to the Palms and Rattans of New Guinea with Roy Banka (visiting from Lae, PNG) appraising RBG Kew's curation methods and holding regular discussions regarding Manokwari Herbarium. Jack and Rudi profitably used their time en route through Jakarta to search for more herbarium equipment and to discuss foreign visas with immigration officials, in particular the possibility of fieldwork in Papua.

Informal training sessions were held during coordinator visits to Manokwari, and a visit by John Dransfield in June 2002 allowed us to hold an open forum on future plans for the herbarium.

Rudi Maturbongs successfully completed his MSc course in Jakarta in late 2003.

Agustina Arobaya (current manager of Manokwari Herbarium) and Maria Justina Sadsoeitoeboen were carried out in February and March 2004. Maria specialises in the ethnobotany of Pandans and Bamboos; Agustina in the taxonomy of Papuan Orchids.

In addition to working on their chosen groups, they received thorough botanical training in several areas of the herbarium including the Spirit Collection, Loans and Processing, Pest Control, Digital imaging and Curation of specialist groups. Kew South-East Asian Section staff worked together with them on plant identification in

the herbarium, and introductory sessions were held in the Micropropagation Lab and Centre for Economic Botany. A visit to Kew by Denis Filer, the author of the BRAHMS herbarium database, allowed for a sound start to the installation of a professional database in Manokwari Herbarium. Agustina gave a presentation on her research on the Orchids of the Raja Ampat Archipelago in Papua, for which the specimens are being curated in Manokwari. An article recording this Darwin Initiative activity features in the April 2004 edition of Kew Scientist.

The Herbarium Techniques Course was run for two weeks in Manokwari in October 2004. There were fifteen delegates, comprising all Manokwari herbarium technicians and curators, two UniPa Forestry department staff, two staff from Herbarium Wallaceana in North Sulawesi, and three herbarium staff members from Lae, UPNG and Goroka in Papua New Guinea. The course was instructed by four botanists from Kew, greatly assisted in logistics and translation by PPKH staff. All delegates completing the course were given a certificate bearing the logos of UniPa, Darwin Initiative and Kew.

The primary objectives of the course were

- a. To review best practice for herbarium management, with particular relevance to Manokwari
- b. To demonstrate how a herbarium can be used to produce tangible products and its future safeguarded
- c. To reinforce the high value and potential of this unique West Papuan resource

The course consisted of a series of workshops and practical studies, with two days of field training in Gunung Meja and comprehensive processing of all collected material to mounted specimens incorporated in the herbarium. Presentations, computer sessions and workshops were combined with more informal practical work in the herbarium, and a large amount of course material was disseminated such as Herbarium Handbooks, Kew Information sheets, hand lenses, Interactive Keys, FSC glossaries and essential photocopied literature. The design of the course was such that PPKH would subsequently be empowered to produce a checklist and/or information of monitoring value for Gunung Meja, and also to work towards a curation manual for Herbarium Manokwariense. Please consult Appendix 5 for the timetable.



**Manokwari technician Marthen Jitmau receiving course certificate**

The course provided a chance to demonstrate how an organized approach could use all of the equipment, training and renovation provided by the Papuan Plant Diversity Project to produce effective and relevant outputs for such a regional herbarium. Further networking and sharing of ideas was catalysed by the attendance of staff from external herbaria and indeed one PNG delegate, Billy Bau, gave a presentation on his herbarium experience from Lae. He provided an excellent demonstration of the application of his herbarium database on the internet, <http://plantnet.rbg Syd.nsw.gov.au/PNGplants>, which could be repeated for Manokwari. The course was a chance to hold a family identification sort of collected material, an activity which has continued in PPKH. The Interactive Key to Malesian Seed Plants was found to be a user-friendly and valuable identification tool and the CD format highly relevant in such an area where internet access is frequently difficult. The practice and importance of expert curation was carried out using the materials



bought under the Darwin Initiative project, including basic procedures of drying, mounting and laying away. We touched on the wider picture of international conventions such as CBD and CITES and the importance of support within and between institutions for a herbarium. Forum sessions allowed a chance to discuss the considerable achievements of this important herbarium and how this scientific and human potential PPKH can be converted by careful planning of future directions.



**Damien Hicks lecturing on the CBD**

Duplicate specimens collected from Gunung Meja during the course are being shipped to Kew for naming and also to Bogor, Lae and UPNG. Further repetition of this model will result in the publication by PPKH of a checklist to the flora of Gunung Meja, a remarkable achievement and a milestone for Manokwari Herbarium. Though the Darwin Initiative project finishes in December 2004, we have facilitated the contact and mutual interest between the Kew Southeast Asian Team and PPKH which will be an engine for the future development and sustainability of Manokwari Herbarium. Informal discussion with the Kew contingent suggests that they would be pleased to return to Papua for BioCon 2005, and would then be in a position to monitor progress according to the Manokwari Workplan (Appendix 2).

## **5. Project Impacts**

PPKH now has a formidable capacity to perform vital herbarium taxonomy on its native flora. The physical evidence for the achievement of these project objectives is visible from images provided in this report and in that provided by PPKH for the Annual Report of 2004. The legacy of training such as PPKH study visits to Kew, Rudi's MSc course and the Herbarium Techniques Course are apparent in the atmosphere of capability which has been cultivated in PPKH. Please refer to the Manokwari workplan in Appendix 2.

In line with its increased research potential, the department changed its name from PSKH (the Biodiversity Studies Centre) to PPKH, the Biodiversity Research Centre, in 2004. UniPa hosted the annual Biological Conference (BioCon) in early October, a forum for researchers and students from New Guinea to give presentations on their work and discuss findings. This was another chance to raise the profile of Manokwari Herbarium and push forward collaborative work. The four Kew staff gave talks, acted as judges of the presentations and gave out CDs of the Interactive Key and Herbarium Handbooks as prizes.

PPKH instigated a basic pest control regime in 2001, has begun adding information to their specimens from determination lists, alphabetical ordering specimens for easy retrieval, is nearing completion of a specimen database, has printed a bilingual Curation Manual and Visitor Book, and now holds family sorts of unidentified herbarium material on a regular basis. They have begun to take independent management decisions such as the installation of herbarium racks instead of cupboards, deemed more appropriate for Manokwari. PPKH is soon to get access to the new internet server installed on the UniPa campus, providing what is now an essential resource for herbarium workers.

UniPa has shown support for the herbarium in backing the Papuan Plant Diversity Project and Herbarium Techniques Course. Senior management granted the use of an extra storage room for the herbarium and have informally stated that adjoining office space is earmarked for herbarium use in the near future, and that potentially strong herbarium staff of the future are being canvassed from current undergraduates. Maria Justina Sadsoeitoeboen has used her position as Papuan representative to the Indonesian Department of education to promote further discussion of the project's objectives and rationale with government officials in Jakarta and herbarium staff in Bogor. We hope once more that this will both increase national support for the development of the project and smooth the application process for foreign nationals who are seeking permits to work in and with Manokwari herbarium. A UniPa university forum was held in June 2002 to explain the purposes of the collaboration to all interested UniPa parties. PSKH staff assisted with translation of a DIPDP brief to Indonesian for this process.

It is clear that RBG Kew can continue to act in a key role of potential collaborations and the provision of taxonomic and curatorial advice. Manokwari staff are keen to build on relationships with NGO's involved with biodiversity in Papua, such as WWF, CI and TNC, to encourage information-sharing with their ongoing work.

UniPa teaching staff and undergraduates continue to work in the herbarium on an ad hoc basis. The list below outlines the current responsibilities of the core herbarium staff. We had strongly argued the need for compartmentalisation of essential herbarium work; two extra permanent UniPa herbarium positions are currently being made.

Agustina Arobaya	Herbarium Manager + Librarian
Martinus Iwanggin	Pest Control + AC
Maria Sagisolo	Accessions + Databasing
Ina Inggesi	Accessions + Databasing
Marthen Jitmau	Laying in
Filep Mambor (also living collections)	Mounting + Repair
Januarius Hoseo	Specimen drying

<b>Project Contribution to Articles under the Convention on Biological Diversity</b>		
<b>Article No./Title</b>	<b>Project %</b>	<b>Article Description</b>
<b>7. Identification and Monitoring</b>	15	Identify and monitor components of biological diversity, particularly those requiring urgent conservation; identify processes and activities that have adverse effects; maintain and organise relevant data.
<b>8. In-situ Conservation</b>	5	Establish systems of protected areas with guidelines for selection and management; regulate biological resources, promote protection of habitats; manage areas adjacent to protected areas; restore degraded ecosystems and recovery of threatened species; control risks associated with organisms modified by biotechnology; control spread of alien species; ensure compatibility between sustainable use of resources and their conservation; protect traditional lifestyles and knowledge on biological resources.
<b>9. Ex-situ Conservation</b>	5	Adopt ex-situ measures to conserve and research components of biological diversity, preferably in country of origin; facilitate recovery of threatened species; regulate and manage collection of biological resources.

<b>12. Research and Training</b>	20	Establish programmes for scientific and technical education in identification, conservation and sustainable use of biodiversity components; promote research contributing to the conservation and sustainable use of biological diversity, particularly in developing countries (in accordance with SBSTTA recommendations).
<b>13. Public Education and Awareness</b>	5	Promote understanding of the importance of measures to conserve biological diversity and propagate these measures through the media; cooperate with other states and organisations in developing awareness programmes.
<b>15. Access to Genetic Resources</b>	20	Whilst governments control access to their genetic resources they should also facilitate access of environmentally sound uses on mutually agreed terms; scientific research based on a country's genetic resources should ensure sharing in a fair and equitable way of results and benefits.
<b>16. Access to and Transfer of Technology</b>	10	Countries shall ensure access to technologies relevant to conservation and sustainable use of biodiversity under fair and most favourable terms to the source countries (subject to patents and intellectual property rights) and ensure the private sector facilitates such assess and joint development of technologies.
<b>17. Exchange of Information</b>	15	Countries shall facilitate information exchange and repatriation including technical scientific and socio-economic research, information on training and surveying programmes and local knowledge
<b>18. Technical and Scientific Cooperation</b>	5	Countries shall promote international technical and scientific cooperation in the field of conservation and sustainable use of biological diversity, where necessary, through the appropriate international and national institutions.
<b>Total %</b>	<b>100%</b>	<b>Check % = total 100</b>

## 6. Project Outputs

(see Appendices 3 and 4)

Political and security problems have been discussed in 3. Project Summary. Additionally we found that communication was very difficult in Manokwari, that all herbarium equipment had to be shipped in from Jakarta and abroad and that UniPa's infrastructure and human resources are in much need of development.

Nevertheless we have delivered the project's objectives with added value: We have gained institutional support and a culture of independence through long-distance management, greatly improved the herbarium library, jointly produced a curation manual and work plan for the following year, and laid the foundation for some potentially valuable scientific collaboration with botanical specialists around the world.

## 7. Project Expenditure

(see tabulation provided by Kew Finance Department)

## **8. Project Operation and Partnerships**

Around twenty UniPa staff and technicians have been directly involved in project activities. UniPa has the only herbarium in Papua and is the centre of forestry and biodiversity work in the region.

The project has at all times been run with final decision-making from PPKH. They are now operating as part of the international botanical community and are working on several collaborative projects researching Papua's plant diversity. It is hoped that unspent funds can be utilised for one more of these valuable study visits to Kew, this time by a herbarium technician. The first quarter of 2005 would be most appropriate for this as it would coincide with Kew Southeast Asia Team's botanical identification course and run alongside scheduled visits by other Papuan and Indonesian botanists for the Palm conference in March.

## **9. Monitoring and Evaluation, Lesson learning**

Staff in both Kew and Manokwari have learnt that flexibility has been of utmost importance in this project. We have been forced to regroup and re-evaluate at every turn (political assassinations in Papua, the Bali bomb, the Jakarta Marriot and Australian embassy bombs, visa problems and FCO advisories...) and drive the project forward regardless on shared objectives.

This long-distance management was ultimately highly effective, not least because of the independent capability of PPKH staff and their increased pride in the herbarium. It is difficult to imagine that further collaborative work in Papua will not face similar setbacks in political and security, but a pragmatic approach and mindfulness of the singular importance of Herbarium Manokwariense strongly justifies potential applications for similar development projects here. There can be few better examples of an imperative to share benefits and combat the taxonomic impediment than here in this biodiverse and isolated province, which may yet repeat the destructive development pattern of other Southeast Asian states.

If such an application were to be made and granted by the Darwin Initiative, the board might wish to see budgeting for at least one monitoring visit by the reviewer. This could save time and vexation in communicating the minutiae of the project between project staff and reviewers.

A site-specific lesson that may be learned is that the organisation and human resources of UniPa seem to conspire to force UniPa staff away from working in Manokwari. There are strong incentives to seek further education and financially-backed projects from elsewhere and this activity is seen as an end in itself, for individual advancement rather than a university capacity-building activity. Additionally, at this stage of a lack of well-educated UniPa staff, teachers are busy with their administrative responsibilities as well as taking on lectures left by staff pursuing further education. With staff thus constantly in flux one has to frequently examine afresh the power structure to ascertain who is responsible or most appropriate for the project's objectives. We have been extremely lucky to have the mature steersmanship of Pak Jack at the helm of PPKH for the duration of the project, as well as the support of the Rector Pak Frans who clearly prioritises work of an environmental nature.

## **10. Actions in response to annual report reviews**

Reviews were received in the final year of the project. These were analysed and acted on accordingly prior to the final visit to Manokwari.

## **11. Darwin Identity**

Regular efforts were made to discuss the source of funding for this project and the aims and origin of the Darwin Initiative both before and during the project, in particular at the Herbarium Techniques Course in October. The Darwin Initiative was acknowledged and logo featured on all material produced.

## **12. Leverage**

We worked with PPKH on the subject of support for the herbarium beyond the life of this Darwin project. Birdlife International staff were invited to Kew to discuss this, and a proposal to BP was put together in collaboration with the Southeast Asian section at Kew. We discussed other sources with Manokwari staff: the herbarium was unfortunately deemed by the board of the MacArthur Foundation to be outside their remit, and BP have been reticent about funding projects given the recent political instability in Papua. Institutional UniPa support is again the important factor here. This was apparent from the beginning of the project and ongoing effort has been put into arguing our case with senior UniPa management.

## **13. Sustainability and Legacy**

Implementation of the project is set to assist the host country to meet its CBD obligations by increasing its capacity for botanical research, through the improvement of its herbarium facilities. Training provided to herbarium staff, though significantly reduced, will also contribute to this capacity.

The enthusiasm and commitment of a few Papuan botanists in PPKH was the catalyst for the Papuan Plant Diversity Project, and the signs suggest that the project has both increased this local pride and encouraged peripheral UniPa staff to buy into the concept.

## **14. Value for money**

The project presents high value for money for several reasons. It has saved money on transportation because of decreased foreign travel to Papua and also because trips were run by personnel with experience of working in Indonesia. Equipment were reliably and independently purchased in Jakarta and shipped to Manokwari for much less than it would have costed to have Kew staff do this. Furthermore, books were donated from Kew and the publication of the Interactive Key to Malesian Seed Plants came out much under budget.

We were able to use some of this excess to fund more Kew study visits than originally budgeted, including a projected visit from one Manokwari technician early next year. These trips are powerful activities which address all objectives of the project.

This report has detailed outputs and impacts thus achieved within well under budget. It is difficult to put a financial value on the capacity-building of a unique resource in this highly biodiverse but under-researched region.



**Manokwari staff on fieldwork using hand lenses provided by the project**

## Appendix 1: Logical Framework

Project summary	Measurable indicators	Means of verification	Important assumptions
<p><b>Goal</b> To develop the Manokwari Herbarium to international standards so that it can fulfil its crucial role as the only plant diversity reference collection in Papua.</p>	<p>Papuan flora well-represented in the Herbarium, and Herbarium consulted as a key conservation reference collection; international profile of the Herbarium and staff raised.</p>	<p>Herbarium collections; annual reports; scientific publications</p>	<p>Staff commitment; continued international interest.</p>
<p><b>Purpose</b> To build capacity in plant diversity research at the Biodiversity Study Centre, Manokwari through the rehabilitation of the Herbarium, the renovation and development of the Herbarium collections and through the training of staff in curation and research.</p>	<p>Increase in use of Herbarium; expansion of Herbarium recurated to international standards; staff expertise called upon; staff conducting research independently.</p>	<p>Annual and interim reports; staff publication lists; expedition reports.</p>	<p>Universitas Cenderawasih maintains support after project conclusion; public awareness of Herbarium is raised.</p>
<p><b>Outputs</b> Herbarium curated and managed to international standards; Herbarium database; palm and rattan field guide; field guide to Papuan seed plant families; skills transferred; research collaborations established.</p>	<p>Specimens preserved; pests under control; database updated; field guides published.</p>	<p>Supervisory visits; annual and interim reports; management committee meetings; field guides available in public domain.</p>	<p>As above</p>
<p><b>Activities</b> Herbarium curation; Herbarium renovation; integrated pest management; fieldwork; staff training; writing field guides; databasing; identification of specimens; study visits to UK</p>	<p>Herbarium curated and renovated; backlog of un-mounted material incorporated; pest management implemented; training implemented; databasing implemented, specimens identified; study visits successfully completed.</p>	<p>Supervisory visits; annual and interim reports; management committee meetings.</p>	<p>As above</p>

## **Appendix 2: Workplan, November 2004 onwards**

**Ir. Jacobus Wanggai MP**  
**Ir. Rudy Maturbongs MSi**  
**Ir. Nurhaidah Iriany Sinaga MSi**  
**Ir. Agustina Arobaya MSc**  
**Dr John Dransfield**  
**Dr William Baker**  
**Mr Damien Hicks MSc**

Pest Control is the most important activity in this herbarium. The Pest Control regime, including Air-conditioning and specimen-freezing, is to be continued constantly for the life of the herbarium.

An extra Air-conditioning unit (bought already) and 'terali' window-railing is being installed in Dicot Herbarium. Folding tables (non-wooden!) to be fixed along window in both herbaria.

The Dissecting microscope is to be set up for use in the Dicot Herbarium.

Family identification of specimens in Storage Room has been started. As this is done these specimens will be put in the freezer for 3 days and then laid away.

Appending of determination slips from det lists, and alphabetical ordering of genus and species folders, is to continue to completion. Specimen lists in revisions also to be used for this curation work.

Photocopying to be completed for all Flora Malesiana volumes and papers relevant to New Guinea from Kew Bulletin, Blumea etc (UniPa staff in Bogor will provide photocopies where there are gaps in MAN). These books to be kept inside Dicot Herbarium and managed by Ina Inggesi.

Final budget and purchases of extra herbarium equipment to be made (e.g. computer, thick plastic bags, non-wooden folding tables, anti-virus programmes, repair of/new monitor, step-ladder, spirit bottles, (+ more specimen boxes like the - lighter – Bogor style - tromol?)). Other items (e.g. Kew study visit for 2 herbarium technicians) to be put in a budget for presentation to Darwin Initiative for 'Post-Project Funding'.

New computer (cost in budget) to be used for publications – Beccariana, checklist, proceedings ... so that 1 other computer is available for internet, 1 for databasing and 1 (needs repair of monitor) to be moved to the Dicot Herbarium for Interactive Key CD etc. Internet use for IPNI, Kew Record, Index Herbariorum, google image searches, email to other herbaria etc to be available to curators at some point during each day.

Genera/specimens to be wrapped in thick plastic bags (as in Bogor but not zip-lock) ... and transferred from tromol to lighter, easier-to-use boxes? First priority to moving the tromol which are on the floor of Dicot Herbarium up on to racks in their correct alphabetical place (e.g. Verbenaceae, Violaceae etc)



Possibility of fixing thick insulating curtains to eliminate radiant heating of herbarium through windows? (particularly marked in mornings from rear windows - RAM)

BW monocot family specimens to be moved to Monocot Herbarium and BW wood specimens to be moved to a new Ancillary Collections (Carpological, Spirit, Wood, Illustrations and Photographs) room. Ancillary Collections to be curated when the screenhouse is renovated or when more office space becomes available near herbarium.

Herbarium Manokwariense Curation Manual to be fixed to wall in Dicot and Monocot Herbaria, and copies given to all visitors.

Herbarium Manokwari to feature on UniPa website (<http://www.unipa.ac.id/>) in 2004.

Exchange of specimens and information with other herbaria is to be encouraged.

Teaching/research staff who are affiliated to Herbarium Manokwariense could have 5 hours per week herbarium curation (e.g. quality control of determinations and laying in, pest control, identification, backlog ...) written in to their UniPa contract?

Plans to present progress on herbarium work at BioCon 2005, to renew Memorandum of Understanding with Kew in 2006, and to present Manokwari herbarium-based paper at Flora Malesiana 7 in 2007.

Regular informal visits to local areas (e.g. remaining forest patches in Maruni, Nuni, Gunung Meja) to supplement work started during the Herbarium Techniques Course on drying, mounting, identification and laying-in.

Type specimen folders constructed (see K model) and used for types in Dicot and Monocot Herbaria.

**05 November 2004**

### Appendix 3: Publications

	Detail	Publishers	Available from	Cost £
Journal	A monograph of <i>Sommieria</i> (Arecaceae), C.Heatubun, 2002	Kew Bulletin 57(3): 599-611	charlie_deheatboen@yahoo.com	-
Journal	Two unusual <i>Calamus</i> species from New Guinea. Baker, W.J. 2002	Kew Bulletin 57: 719–724	W.Baker@kew.org	-
Journal	<i>Calamus maturbongsii</i> , an unusual new rattan species from New Guinea. Baker, W.J. & J. Dransfield, 2002	Kew Bulletin 57(3): 725-728	W.Baker@kew.org	-
Journal	<i>Calamus longipinna</i> (Arecaceae: Calamoideae) and its relatives in New Guinea. Baker, W.J. & J. Dransfield. 2002	Kew Bulletin 57: 853-866	W.Baker@kew.org	-
Journal	A new species of <i>Pittosporum</i> from Anggi Lakes, Papua, D.M. Hicks & T.M.A. Utteridge, 2002	Kew Bulletin 57(4): 937-941	D.Hicks@kew.org	-
Journal	Papuan Plant Diversity, Oct 2002	Kew Scientist 22: 2-3	J.Dransfield@kew.org	-
Journal	Progress Report on the DIPDP, 2002	Flora Malesiana Bulletin 13(1): 39	Veldkamp@nhn.leidenuniv.nl	-
Journal	A revision of the <i>Calamus aruensis</i> (Arecaceae) complex in New Guinea and the Pacific. WJ Baker, RP Bayton, J Dransfield, RA Maturbongs, 2003	Kew Bulletin 58(2): 351-370	W.Baker@kew.org	-
Journal	An account of the Papuan species of <i>Calamus</i> (Arecaceae) with paired fruit. Dransfield, J. & W.J. Baker, 2003.	Kew Bulletin Volume 58(2): 371-387	J.Dransfield@kew.org	-
Journal	A Monograph of the genus <i>Rhopaloblaste</i> (Arecaceae). Banka, R. & W.J. Baker., 2004	Kew Bulletin 59(1): 47-60	W.Baker@kew.org	-
Journal	A synopsis of the genus <i>Hydriastele</i> (Arecaceae). Baker, W.J. and A.H.B. Loo. 2004.	Kew Bulletin 59: 61–68	W.Baker@kew.org	-
Journal	A spectacular new species of <i>Licuala</i> (Arecaceae, Coryphoideae) from New Guinea. Banka, R. & A.S. Barfod. 2004.	Kew Bulletin 59: 73-75	rbanka@fri.pngfa.gov.pg	-
Journal	Elevational gradients, area and tropical island diversity: an example from the palms of New Guinea. Bachman, S., W.J. Baker, N. Brummitt, J. Dransfield & J. Moat. 2004.	Ecography 27: 299–310	s.bachman@kew.org	-

<b>Journal</b>	A new species of <i>Ilex</i> (Aquifoliaceae) from Kebar Valley, Papua, New Guinea. Hicks, D.M., 2004.	Kew Bulletin 59(4)	D.Hicks@kew.org	-
<b>Journal</b>	Update on the Darwin Initiative Papuan Plant Diversity Project, Hicks, D.M., Dransfield, J. & Baker, W.J. 2004.	Kew Scientist 25: 5	<a href="http://www.kew.org/kewscientist/">http://www.kew.org/kewscientist/</a>	-
<b>CD</b>	Interactive Key to Malesian Seed Plants. 2004.	RBG Kew and NHN Leiden	D.Hicks@kew.org	-
<b>Book</b>	Aquifoliaceae in R.J. Johns et al. 2005 A guide to the subalpine and alpine flora of Mount Jaya	RBG Kew Publications <i>in prep.</i>	T.Utteridge@kew.org	-
<b>Journal</b>	The racemose <i>Ilex</i> of New Guinea	Kew Bulletin <i>in prep.</i>	D.Hicks@kew.org	-
<b>Journal</b>	<i>Dransfieldia</i> (Arecaceae) - A New Palm Genus from Western New Guinea. Baker, W.J., S. Zona, C.D. Heatubun and R.A. Maturbongs. Submitted.	Systematic Botany	W.Baker@kew.org	-

## Appendix 4: Outputs

Training Outputs		
1a	Number of people to submit PhD thesis	
1b	Number of PhD qualifications obtained	
2	Number of Masters qualifications obtained	1
3	Number of other qualifications obtained	
4a	Number of undergraduate students receiving training	8
4b	Number of training weeks provided to undergraduate students	14
4c	Number of postgraduate students receiving training (not 1-3 above)	4
4d	Number of training weeks for postgraduate students	30
5	Number of people receiving other forms of <b>long-term</b> (>1yr) training not leading to formal qualification( i.e not categories 1-4 above)	
6a	Number of people receiving other forms of <b>short-term</b> education/training (i.e not categories 1-5 above)	15 (HTC)
6b	Number of training weeks not leading to formal qualification	30
7	Number of types of training materials produced for use by host country(s)	3 (CD Key, Herbarium Handbook, HTC handouts)

Research Outputs		
8	Number of weeks spent by UK project staff on project work in host country(s)	265
9	Number of species/habitat management plans (or action plans) produced for Governments, public authorities or other implementing agencies in the host country (s)	
10	Number of formal documents produced to assist work related to species identification, classification and recording.	12
11a	Number of papers published or accepted for publication in peer reviewed journals	16
11b	Number of papers published or accepted for publication elsewhere	
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country	1
12b	Number of computer-based databases enhanced (containing species/genetic information) and handed over to host country	1
13a	Number of species reference collections established and handed over to host country(s)	
13b	Number of species reference collections enhanced and handed over to host country(s)	1

<b>Dissemination Outputs</b>		
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work	2
14b	Number of conferences/seminars/ workshops <b>attended</b> at which findings from Darwin project work will be presented/ disseminated.	4
15a	Number of national press releases or publicity articles in host country(s)	
15b	Number of local press releases or publicity articles in host country(s)	
15c	Number of national press releases or publicity articles in UK	
15d	Number of local press releases or publicity articles in UK	3
16a	Number of issues of newsletters produced in the host country(s)	
16b	Estimated circulation of each newsletter in the host country(s)	
16c	Estimated circulation of each newsletter in the UK	8000
17a	Number of dissemination networks established	
17b	Number of dissemination networks enhanced or extended	
18a	Number of national TV programmes/features in host country(s)	
18b	Number of national TV programme/features in the UK	
18c	Number of local TV programme/features in host country	
18d	Number of local TV programme features in the UK	
19a	Number of national radio interviews/features in host country(s)	
19b	Number of national radio interviews/features in the UK	
19c	Number of local radio interviews/features in host country (s)	
19d	Number of local radio interviews/features in the UK	

<b>Physical Outputs</b>		
20	Estimated value (£s) of physical assets handed over to host country(s)	25 000
21	Number of permanent educational/training/research facilities or organisation established	1
22	Number of permanent field plots established	
23	Value of additional resources raised for project	

## Manokwari Herbarium Techniques Course – Week One: 11<sup>th</sup> October to 15<sup>th</sup> October 2004

	Monday 11 <sup>th</sup> Oct	Tuesday 12 <sup>th</sup> Oct	Wednesday 13 <sup>th</sup> Oct	Thursday 14 <sup>st</sup> Oct	Friday 15 <sup>th</sup> Oct
7.15 – 08:00	Introductions Pak Jack (+ DH if required)	Specimen collection demonstration (Gunung Meja) TU	Specimen collection practical (Gunung Meja) TU	The role of taxonomy RdK	Pests and Treatments in tropical herbaria JG
08:15 – 09:00	Aims and Contents. The principles of herbarium management DH	Specimen collection practical (Gunung Meja) All	Specimen collection practical (Gunung Meja) All	Herbarium Literature JG	International legal frameworks and local safeguards DH
Morning Break					
9:30 – 10:15	Basic plant morphology: glossaries DH	Specimen collection practical (Gunung Meja) All	Specimen collection practical (Gunung Meja) All	Databasing RdK	CBD, CITES, MOUs, handling of duplicates DH
10:15 – 11:00	Plant identification with available literature RdK	Specimen collection practical (Gunung Meja) All	Specimen collection practical (Gunung Meja) All	Databasing TU	Loans and Accessions PPKH: MAN Herbarium Manager?
Lunch					
13:00 – 13:45	Collecting-label demonstration TU	Pressing and Drying JG	Pressing, drying and checking labels JG	Specimen checking, processing, and labels JG	
13:45 – 14:30	Collecting-label practical (UniPa) TU	Pressing and Drying All	Pressing, drying and checking labels All	Specimen checking, processing, and labels All	

Manokwari Herbarium Techniques Course – Week Two: 18 <sup>th</sup> October to 22 <sup>nd</sup> October 2004					
	Monday 18 <sup>th</sup> Oct	Tuesday 19 <sup>th</sup> Oct	Wednesday 20 <sup>th</sup> Oct	Thursday 21 <sup>st</sup> Oct	Friday 22 <sup>nd</sup> Oct
7:15 – 8:00	Week 1 Review and Week 2 Intro DH	Revisions: sample run-through TU	Species descriptions and proformae. Botanical report-writing TU	Development, Purpose and Types of Herbaria: arrangement, ancillary collections JG	Strength by institutional co-operation: herbarium roles DH
8:15 – 9:00	Family Sort with Interactive Key: Malesian Key DH	Family Sort with Interactive Key: Other key software RdK	Floras and Checklists: examples and production RdK	Development, Purpose and Types of Herbaria: MAN is unique resource for West Papua DH	Future directions for MAN PPKH: RAM?
Morning Break					
9:30 – 10:15	Mounting: advantages and disadvantages of different mounting methods DH	Botanical names. Naming TU	Checklist Practical: towards a draft for Gunung Meja RdK	Laying away: how to handle specimens JG	Future directions RdK & TU
10:15 – 11:00	Mounting All	Naming All	Checklist Practical: towards a draft for Gunung Meja All	Laying away All	Checklist Review RdK
Lunch					Summary+Reception
13:00 – 13:45	Mounting All	Naming All	Checklist Practical: towards a draft for Gunung Meja All	Laying away All	
13:45 – 14:30	Mounting All	Naming All	Checklist Practical: towards a draft for Gunung Meja All	Laying away All	