



# Forestry Department

Food and Agriculture Organization of the United Nations

## Forest Genetic Resources Working Papers

*State of Forest and Tree Genetic Resources  
in the Pacific Islands  
&  
Sub-Regional Action Plan  
for their Conservation and Sustainable Use*

Based on the work of

*Suliana Siwatibau and Lex Thomson*

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Forest Resources Division, Rome  
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## **PREFACE**

This “*State of Forest and Tree Genetic Resources in the Pacific Islands & Sub-Regional Action Plan for their Conservation and Sustainable Use*” is based on presentations prepared for, and outcomes of, the *Pacific Sub-Regional Workshop on Forest and Tree Genetic Resources*. The workshop, convened for island countries and territories of the South Pacific, was held in Apia, Samoa, from April 12 to 16, 1999. The workshop was jointly organized by the South Pacific Regional Initiative on Forest Genetic Resources (SPRIG), the Australian Agency for International Development (AusAID), the Food and Agriculture Organization of the United Nations (FAO), the Pacific Islands Forest & Tree Support Programme of the Secretariat of the Pacific Community (SPC), the South Pacific Regional Environment Programme (SPREP) and the Forestry Division of Samoa.

During the workshop, Heads of Forestry, or their representatives, presented accounts of the state of forestry and forest genetic resources in their respective islands. They also prepared a draft sub-regional Action Plan for the conservation, management and sustainable use of forest and tree genetic resources in the South Pacific. The draft Action Plan was later tabled and discussed at the 9<sup>th</sup> Pacific Islands Heads of Forestry meeting held from 8-12 May 2000 in Nadi, Fiji. The Heads of Forestry endorsed the Action Plan for donor support and implementation.

Country papers from the following islands were available: American Samoa, Cook Islands, Federated States of Micronesia, French Polynesia, Guam, Hawai’i, Kiribati, Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Vanuatu and Wallis and Futuna. A common format had been recommended for the presentation of country papers. However, the availability of relevant information varied widely between islands and therefore standardized analyses could not be carried out systematically. Information contained in country papers has been complemented by information and data provided by participants at the workshop.

The present document aims to present an overview of the status of forests and forest tree genetic resources in the South Pacific and to outline practical actions that can be taken at the international, regional, national and local levels to address the loss of forest and tree genetic resources in the Pacific Islands. It summarizes the issues raised in country papers and recommendations made by participants at the workshop, including:

- the uses of trees and the importance of their role in the lives of Pacific peoples;
- the identification of major tree species and their current management and conservation status;
- the ranking of top priority trees species amenable to regional cooperation;
- the recommendations on species exploration, germplasm collection, evaluation, supply, transfer and exchange; and
- the identification of needs and priorities regarding institutional strengthening, training requirements, and opportunities for regional cooperation.

A brief review of the current regional and international institutions involved in activities related to forest and tree genetic resources conservation is also provided. In conclusion, the main findings and recommendations of the workshop are recalled.

# **State of Forest and Tree Genetic Resources in the Pacific Islands & Sub-Regional Action Plan for their Conservation and Sustainable Use**

## **EXECUTIVE SUMMARY**

Forests and trees play extremely important roles in the lives of Pacific island communities not only economically but also socially, culturally and in terms of the environment.

The South Pacific region covers a wide geographic area and presents a wide range of habitats for trees. The range of forest types resulting therefrom is therefore wide and complex. Forests in Melanesia are much richer in species numbers. New Caledonia has a unique flora of its own and has a collection of forest types associated with dryland areas. The larger landmasses of Papua New Guinea and Solomon Islands held approximately 13 different forest types, while the smaller islands of Fiji, New Caledonia and Vanuatu recognize about 8 forest types each. The islands of Micronesia, while covering a great expanse of ocean comprise tiny landmasses that support very few forest types. The higher islands of Palau, Guam and the Federated States of Micronesia recognize 6 forest types each while Nauru and Kiribati report 5 types each and the Marshall Islands report only 4 types. The islands of Polynesia that spread from Tonga in the southwest Pacific to Hawai'i in the northeast are much more variable as a group. The largest of them, Hawai'i, reports 24 forest types, and This is the most diverse island in the Pacific as Hawai'i has an interesting and unique flora. On the other hand the lower number of forest types is reported from Niue (only three).

In Melanesia, commercial timber production from indigenous forests is important in Papua New Guinea, Solomon Islands, Fiji and Vanuatu. In New Caledonia, much effort has gone into plantation of the introduced timber tree, *Pinus caribaea*, to meet domestic demand. Commercial timber production is much less important in the Polynesian islands where only Hawai'i and Samoa have significant native timber stands. French Polynesia, Niue and Tonga, recognizing the paucity of their own tree resources, have established plantations of introduced tree species for domestic use. Commercial timber production is largely absent in Micronesia. In all the countries and territories, the use of trees for wood and wood products for *i.a.* construction, carving and customary purposes, is very active. Forest trees used for wood and timber are in almost all cases native species that have a variety of other uses including sources of food, medicines, non-wood products and provide a range of environmental services. An analysis of the country reports showed that the majority of important tree species are used for wood products.

All the countries and territories of the region are aware of the threat to their forests and trees and have taken action to conserve them. They have an official body responsible for forest and trees. The management of forests at national level lies with these official institutions. However, local communities, who live close to the forests or deal daily with trees as part of agroforestry systems, are also important players in forest and tree conservation in the sub-region. Agroforestry is particularly important in the smaller countries such as Tonga and Kiribati. The countries recognized that one of the greatest threats to forest and tree conservation is human development activities and the pressure of population increases. Therefore raising awareness of local populations, of the need for conservation, was considered very important. However, other threats may also be significant, including raising numbers of wild animals and pests, invasive plant species, tree diseases, natural disasters, diminished or modified habitats and lack of national policy and legislation.

The existence of legal and policy framework, for the protection and conservation of forest and tree genetic resources and related issues, vary greatly from one country to another. In this regard the countries of the sub-region fall mainly into three groups. One group comprises those with no forestry act and no forestry policy. They may have minimum related legislation as in the case of Wallis & Futuna which has only the quarantine regulations or they may have a range of other regulations such as for environment protection that provide some cover for their trees and forests. Kiribati, Marshall Islands, Cook Islands and Nauru are examples. A second group is composed of those countries that do have forest legislation but are linked to larger countries, which cover their obligations to international treaties and obligations. The countries in this group are Guam, Federated States of Micronesia, French Polynesia and Niue. The third group has countries that have a forestry act and are usually independently members of various international treaties and agreements related to the protection of forests and trees and their genetic resources. This group includes all the Melanesian countries, Samoa and Hawai'i.

A Pacific Sub-Regional Workshop on Forest and Tree Genetic Resources, jointly organized and supported by SPRIG/AusAID, FAO Forestry Department and South Regional Office for the Pacific Islands, SPC Forestry Program, SPREP, IPGRI<sup>1</sup> and the Samoan Government's Forestry Division, was held in Apia, Samoa from April 12-16, 1999. The workshop put together a list of top priority tree species from the different country papers, upon which an Action Plan was prepared, outlining practical actions that can be taken at the international, regional, national and local levels to address the loss of forest and tree genetic resources in the Pacific Islands.

The Action Plan is organized into four themes as follows:

**1. Tree Species Priorities for Genetic Resource Operations and Activities, covering the broad geographic regions of Melanesia, Polynesia and Micronesia.**

Three indigenous tree species were identified as being among the top ten priorities in all parts of the Pacific: *Calophyllum inophyllum* (beach mahogany, Alexandrian laurel), *Cordia subcordata* (island walnut) and *Intsia bigger* (island teak). Several other highly valuable forest tree genera and species were identified in one or two sub-regions. The limited available resources for forest genetic resources research and development ought to be focussed on priority species.

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<sup>1</sup> SPRIG - South Pacific Regional Initiative on Forest Genetic Resources; SPC – Secretariat of the Pacific Community, SPREP – South Pacific Regional Environmental Program and IPGRI – International Plant Genetic Resources Institute

## **2. Conservation, Sustainable Use and Management of Forests and Trees.**

Throughout the Pacific Islands, and especially in Melanesia, there is a need to improve forest management to ensure a more sustainable use of forest and tree genetic resources. This is inclusive of improved land-use planning and multiple-use management of forested areas. Improved forest management is also a decisive factor for *in situ* conservation activities. Reforestation and tree planting programs using both indigenous and introduced tree species need to be further encouraged and developed in the Pacific Islands.

## **3. Germplasm Collection, Exchange and Access**

The uniqueness of Pacific Island environments and the importance of protecting priority species and ecosystems from threats such as pests, diseases, fires and invasive alien species needs to be fully recognized. Any exchange of Germplasm of tree species needs to be subject to screening and quarantine. Prior to introduction of new species, varieties, or germplasm from other locations, a science-based risk analysis ought to be performed. At present the region's major forest plantations are based mainly on introduced tree species and germplasm. Relatively little is known about the region's indigenous tree species and basic information may be lacking on important biological characteristics such as seed storage character and susceptibility to pests and diseases. Collaborative activities could include exchange of germplasm – this will entail more extensive use of regional and international databases on forest genetic resources; quarantine aspects; and international and legal considerations on germplasm exchange and access.

## **4. Institutional Strengthening, Training Needs and Regional Collaboration**

Most Pacific countries and territories have small Forestry and Environment Departments, with limited personnel and budget. There is a need to ensure that staff are well trained and informed in the subject areas of conservation, management and utilization of forest and tree genetic resources. The depth of skills and expertise in the region needs to be enhanced through the balanced application of both longer-term University training and through technical hands-on training.

The Action Plan sets ambitious but realistic and practicable technical goals. In order to reach them and produce tangible results, the Plan will require voluntary actions from national actors to ensure solid implementation. Current international, regional and bilateral organizations, mechanisms and instruments, will be invited to contribute to its success.

**PART I: STATE OF FOREST AND TREE GENETIC RESOURCES IN  
THE PACIFIC ISLANDS**

## **I.1. THE CURRENT STATUS**

### **I.1.1. The status of forests in the sub-region**

Forests in Pacific island countries and territories are diverse, reflecting the diversity of physical conditions under which they occur and of the impact of human activities on them. Workshop papers described a large range of forest types. However, criteria for classification were not always the same. Hence comparability across countries cannot be made reliably. Nevertheless, a presentation in this synthesis of the different forest types identified is useful in demonstrating the wide range of ecological conditions under which Pacific tree species thrive. Many of these are restricted to very small areas – a fact that has contributed to a high degree of endemism in the Pacific sub-region.

#### ***I.1.1.1. Major forest types in the Pacific Islands***

This synthesis discusses only the broad forest types largely as presented in the workshop papers. Classification is based mainly on a combination of criteria like location, structure and species composition. Forest types are defined by two major characteristics:

- Their structure – whether they are dense or light closed or open, tall or short, with one storey or several.
- Their characteristic tree species – whether dominated by one or several and which ones.

In the Pacific islands the two above features are in turn determined by a range of factors including:

- the size and type of island: high or low, volcanic or limestone or coral atoll;
- the distance from other land masses particularly from major continents;
- the geology and geological age of the islands;
- the conditions on each island, including altitude, soil types, rainfall (amount and distribution), temperatures, wind intensity and historical patterns of human occupation.

Apart from the entirely atoll nations of Kiribati, Marshall Islands, Tokelau and Tuvalu, and the raised limestone islands of Nauru and Niue, Pacific island nations usually comprise a range of different island types of different sizes within one nation. In terms of their substrata, the Indian- Australian continental plate underlies those islands to the west including all of Melanesia and the Polynesian islands of Tonga. Most of Micronesia and of Polynesia (including Hawai'i) were formed by marine volcanic eruptions from the oceanic Pacific Plate. Generally, islands nearer the Pacific rim along both the east and west, are larger and higher while those towards the center of the Pacific Basin become progressively lower and smaller as they gradually sink below the ocean surface.

Before human occupation, the plants and animals of these island groups migrated from the surrounding continental landmasses often diversifying as they adapted to new niches with little competition. Native species of the islands display affinities to those of the Malesian region, the Old World, the Australian region and the American continent. Some species are worldwide in distribution while others are found either only in the Pacific or endemic to single island groups. Human colonization has had varying impacts on the natural vegetation and transformed forest types particularly significantly in the smaller island groups. In order to grasp the situation more easily, this synthesis discusses forest types within the 3 major human cultural sub-regions of Melanesia, Micronesia and Polynesia.

#### ***1.1.1.2. Islands of Melanesia***

The Melanesian islands comprise the high continental island groups to the southwest of the Pacific. They include from west to east: Papua New Guinea, with a total land area of 462 243 sq.km; Solomon Islands, with 28 370 sq.km; New Caledonia, totaling 19 100 sq. km of land; Vanuatu, with some 12 190 sq.km and Fiji with total land area of 18 333 sq.km.

Their greater, topographically more diverse land masses and wider range of climatic conditions, coupled with their proximity to the rich Malesian center of speciation endow these island groups with a great species diversity and a wider range of forest types than most other Pacific island countries.

Major forest types recognized total 20 for the sub-region with 13 major types each for Papua New Guinea and the Solomon Islands and 8 each for New Caledonia, Vanuatu and Fiji. Forest types common to all countries are the mangrove and strand forests of coastal areas, rainforests, secondary forests as well as tree populated garden and abandoned garden areas. Rainforests, which also contain the merchantable timber stands, remain important in all countries despite serious deforestation which for Papua New Guinea is reported to have been at the rate of almost 0.5 percent annually over the last 20 or so years. Ecologically distinct forest types are identified for unique conditions:

- New Caledonia identifies chalky or limestone forests dominated by *Intsia* and *Araucaria*;
- Solomon Islands identifies swamp forests with trees like *Terminalia brasii* and *Casuarina papuana*;
- Papua New Guinea lists mountain forests with species of *Nothofagus*, *Lithocarpus* and *Araucaria*.

All Melanesian island groups have deciduous and evergreen dryland forests in leeward locations. Because of their larger landmasses, Papua New Guinea and Solomon Islands have significant stands of other forest types that are often present only in small patches in the smaller Melanesian countries. In Papua New Guinea, high altitude forests change gradually with increasing heights above sea level, resulting in subdivisions of the mountain forests. In the other Melanesian countries, the transition is condensed and the lowland rainforest changes abruptly to mountain type at high altitude summit and ridges. Appendix 5 summarizes the different forest types reported for the Melanesian island groups with some characteristic tree species where noted.

### ***1.1.1.3. Islands of Micronesia***

Stretching from just east of the Philippines in the northwest Pacific, through to the north of French Polynesia in the southeast Pacific, the small islands of Micronesia cover an extensive area of ocean. They include high volcanic and uplifted limestone islands to the west in Palau, Guam, Federated States of Micronesia and Nauru, to atolls formed on sinking volcanic peaks to the east in the Marshall Islands and Kiribati. None of these island states has a total land area close to or exceeding 1 000 sq.km. Federated States of Micronesia and Kiribati each has between 700 and 900 sq.km of land. Guam has just over 500 sq.km, the Marshall Islands has just under 200 sq.km. while Nauru has only 22 sq.km of land.

Aside from the common strand and mangrove forests, Micronesian forest types include dense rainforests, savannah, limestone in the high islands and climax atoll forests on the low islands. In many areas, the ubiquitous coconut has replaced the native forest as the dominant forest type. Forest types identified total 12 for this area of the Pacific sub-region and range from six each in the higher islands of Palau, Guam and Federated States of Micronesia to five each in Nauru and Kiribati and four in the Marshall Islands. These include the secondary forests and gardens dependent on human intervention. Appendix 6 summarizes the different forest types identified from Micronesia and some important species reported.

### ***1.1.1.4. Islands of Polynesia***

The Polynesian islands in this report include from west to east: Tonga, Wallis and Futuna, Samoa, American Samoa, Niue, Cook Islands, French Polynesia and Hawai'i to the northeast. Of these, Hawai'i has the largest land mass measuring some 16 600 sq.km. French Polynesia has 3 521 sq.km; Samoa has 2 935 sq.km. while Tonga has 747 sq.km of land. All the others have less than 300 sq.km of landmass each. With such small land areas forest types within each island group are small both in numbers and in extent. Hawai'i on the other hand with much larger landmass presents an interesting case of evolutionary plant and forest development. Hawai'i recognizes almost 100 different vegetation types and at least 24 forest types.

A total of 26 major forest types were identified for the Polynesian countries and, in individual countries, range from only three in Niue to 24 in Hawai'i. A mangrove and a strand or littoral forest clothe the border between land and sea for most of them. Human occupation along coastal areas has resulted in the disappearance of much of these forest types. Behind these, are found coastal forests of varying extents, structures and species associations depending on physical conditions such as topography, substrate and climate. The higher islands have some mountain forests while Hawai'i also has sub-alpine vegetation at even higher elevations. A distinct feature of the Hawai'ian forests is the dominance of the two tree species *Metrosideros polymorpha* and *Acacia koa*. Appendix 7 summarizes the forest types recognized by the different countries of Polynesia and some important tree species reported.

### **I.1.2. Utilization patterns for forest trees**

Tree resources play a significant role in both the formal and informal economy of Pacific island countries and territories. In the larger countries with merchantable forests such as Papua New Guinea, Solomon Islands, Fiji, Vanuatu, Hawai'i, Samoa, New Caledonia and to a lesser extent, Tonga, commercial timber production for local needs is important. Whether for the local market or also for export, timber and timber products in these countries are important contributors to national economic productivity. In the largest Pacific island nation of Papua New Guinea, the forestry sector contributed from 9 to 14 percent of the national GDP and employed from 5 500 to 7 000 people over the recent two decades. Despite a fall in timber prices in 1998/1999, forestry remains an important contributor to rural economic activities in that country. Solomon Islands, the second largest in terms of land area, earns about 50 percent of its national export earnings from log exports. The smaller timber producing countries supply local needs to varying degrees. New Caledonia harvests both indigenous and plantation forests to meet about 18 percent of its needs. Tonga, on the other hand, has almost exhausted its indigenous forests and supplies very little of its own timber needs. Samoa's forests were badly damaged by cyclones in 1990/91 so that its market is now largely restricted to the local one. Several small island timber-producing countries have expanded export opportunities for timber products through value-added production of special craftware, furniture and other wood products. Hawai'i, which produces lumber for the local market, reports a total contribution of \$US30 million annually by the Forestry sector to the Gross State Product in recent years. A significant amount of this is exported through tourist purchases of special wood products. In Vanuatu, where value added industries have been encouraged in recent years, the timber industry earned about \$US 1.5 million for the people and the government in 1997. It employed about 500 people that year.

Non-Timber Forest Products (NTFP) are becoming of increasing importance, being promoted in particular by NGOs with encouragement from governments. These include seed oil production (e.g. from *Canarium* spp. and *Aleurites moluccana*), traditional medicine (e.g. from *Morinda citrifolia* and *Calophyllum inophyllum*) and vegetable ivory (e.g. from *Metroxylon* spp.). The development of such products demonstrates the potential economic benefits from a sustained utilization of the genetic diversity of the forest trees.

Discussions on the conservation of forest tree genetic resources in the Pacific island nations cannot be isolated from serious consideration for the demands placed on those resources and the land on which they exist by ordinary Pacific islanders and their communities. The close dependence of local Pacific island communities on forests and trees was highly manifest in the national reports presented at the workshop. All workshop papers record the use of trees by local communities as sources of wood, food, fodder, fiber, dyes, medicine, oils, gums, resins, tannins and for a range of services such as shade, living fences, coastal stabilization, erosion control and water conservation. The countries were invited to present up to 50 important indigenous tree species and up to 20 important exotic species and their uses. Appendix 2 summarizes the percentages of the important trees identified under the major categories of use. The table (appendix 2) shows that many trees have multiple uses and that wood and services are the most frequent uses for both indigenous and exotic tree species. It is interesting that in some countries the major category of use for the most important tree species identified is for services. This includes, shade, living fence, agroforestry, coastal stabilization and protection, erosion control, soil and water conservation and sacred/spiritual value.

The countries were invited to identify from amongst the 50 important indigenous species they listed the ten most important. Ten tree species with the widest range of uses were identified from the list of 50 and were then put together in appendix 3. That table shows that 22 tree species were common to two or more countries. These 22 common species are listed in appendix 4 showing the countries which list each as amongst its top 10 and the major category of use stated. The four most frequently listed species, each by five countries are *Casuarina equisetifolia*, *Cocos nucifera*, *Intsia bijuga* and *Pometia pinnata*. The next most frequent are listed by four countries each. They are *Calophyllum inophyllum* and *Flueggea flexuosa*.

Many island communities consider certain trees and forest areas sacred and therefore give them special spiritual value. Some tree species, particularly those disseminated by sea, are found and used in several if not all Pacific island groups. These for example include several species of *Pandanus* used for food, medicine, building posts and for woven materials, *Casuarina equisetifolia* appreciated as fuelwood, *Barringtonia asiatica* for stupefying fish and *Cerbera manghas* as a source of medicine. While some of these widespread species remain common throughout their natural range, others have become scarce in some locations where concern has been raised regarding their dwindling numbers. These include the pan-Pacific durable timber tree, *Intsia bijuga*, that is reported to be threatened in Papua New Guinea, Tonga and Samoa, and the edible species of *Pandanus* that are claimed to be disappearing in Federated States of Micronesia and Kiribati.

Dependence on forests and trees for subsistence needs is greater for rural than for urbanised communities. Papua New Guinea reported that almost 85 percent of the country's 4.4 million population is rural, obtaining a large proportion of daily subsistence requirements from surrounding forest and marine resources. In countries that have become largely urbanised such as Guam, or where the native population is a minority such as Hawai'i, continued wide use of native trees and forests has declined. Therefore an added concern is the loss of traditional knowledge of native trees and forest products with increasing urbanization. As long as the knowledge and use of native trees persist, the chances for their voluntary conservation will remain significant. In some cases, they are already being conserved as components of village crop and home gardens as illustrated by the small tree *Flueggea flexuosa*, widely valued as a house post. The tree is a common feature of village and crop gardens in Vanuatu and Samoa, and an introduced species in the latter. Where they are not deliberately conserved or cultivated, useful trees are reported on the decrease. *Garcinia sessilis* for instance is an important custom tree that has become rare in Tonga. Supplementation of planting materials is being sought from Fiji where it occurs naturally. The tree *Cordia aspera*, commonly known as tou, may illustrate the disappearance of a tree species from the local vegetation once it is no longer used. As the source of glue for tapa making in ancient Fiji, Tonga and Samoa, it was a common tree around villages and abandoned gardens. Now that more convenient replacements are available, it has become rare if it has not disappeared altogether.

The workshop noted that trees show adaptation to specific local conditions within their distribution range. Even without marked variability throughout its distribution area, every local population of a species may conceal a distinct combination of genes that will disappear with its destruction. The tree *Metrosideros collina*, for example, occurs naturally from Vanuatu eastwards through to the Marquesas and Tuamotus. It is claimed to have become rare in Tonga. Any reintroduction from outside that country will not necessarily be assured of success, as conditions in Tonga are different from those in other areas of its range. A more widespread and more widely used species, *Intsia bijuga*, has been reported as threatened in four countries and continues to be widely harvested in many others. The loss of its population from any one country or even from an area of a country where it once occurred, can represent a serious erosion of its genetic variability and therefore its potential for greater adaptability and usefulness. The management of tree and forest conservation at local level throughout the range of any tree species is vital. For this reason and because almost all land in most Pacific island countries is owned by the indigenous people, the workshop placed great emphasis on local community participation in maintenance, conservation and restoration activities.

## **I.2. FORESTRY AND TREE-RELATED ACTIVITIES IN THE PACIFIC ISLANDS**

### **I.2.1. Management activities**

General concern was expressed at the rate of deforestation and forest degradation in the sub-region and the disappearance of individual tree species, particularly through excessive exploitation. Additionally, not enough is known about the biology, the ecology or the taxonomy of tree species to guide effective management and conservation efforts. While most countries have set aside conservation areas, national parks and forest reserves, these are not sufficient to conserve representative forest types and tree populations and protect rare or endangered species or genotypes. The lack of appropriate knowledge to guide effective measures and the insufficiency of current measures was obvious from discussions.

Demands on both land and tree resources vary greatly across the region resulting in different emphasis on common concerns. Hence this synthesis discusses current forest-related activities within each of the broad groups of Melanesia, Micronesia and Polynesia. To provide the framework for this discussion, each country was invited to present up to 20 most important tree species, the existing management regime for each species and indicate which species are reported threatened at population level.

#### ***I.2.1.1. Melanesia***

The Melanesian area presents one of the most interesting and most species-rich forests in the world:

- Papua New Guinea, with about 279 932 sq.km (71% of its land surface) covered with forest, is part of the Malesian center of speciation. It has some 20 000 species of vascular plants of which some 400 species are of commercial importance.
- Solomon Islands and Fiji also have very rich and related flora. The species-rich rainforest of Solomon Islands covers some 24 200 sq.km. (80% of its total land surface).

- New Caledonia flora to the south is of special evolutionary interest. Of its 3 300 recorded plant species, 77 percent are endemic. Small on the world scale with a land area of 19 100 sq.km, New Caledonia has five endemic families of plants. Some 600 species of woody plants are indigenous to New Caledonia and of these, a little less than 100 are of economic interest.
- Vanuatu at the center of the group is geologically younger and therefore not as floristically rich as its surrounding neighbors. Vanuatu's forests including scrublands and thickets cover about 75 percent of its land.

The loss of tree genetic resources is of particular interest in these countries especially because of the destructive activities associated with mining (New Caledonia), agricultural clearing (Papua New Guinea, Solomon Islands, Vanuatu) and commercial logging (Papua New Guinea, Solomon Islands, Vanuatu, Fiji). All the Melanesian countries have established forest plantations of both exotic and native timber tree species. However, the plantation forests account for less than 10 percent of total forest cover in all of them. The two larger countries where timber is a major foreign exchange earner have more extensive timber plantations. Papua New Guinea has almost 57 000 hectares of plantation forests, Fiji about 45 000 hectares of Mahogany and 50 000 hectares of *Pinus caribaea*, and Solomon Islands has just under 26 000 hectares of plantation forests. Vanuatu which has a much smaller timber export industry has about 3 000 hectares plantation forests while New Caledonia which grows only for its own needs has just under 10 000 hectares.

All have some forest conservation areas but there is no confidence that these are enough either to protect priority species or populations or to conserve representative forest types. This illustrates the fact that protection at landscape (or ecosystem) level does not necessarily provide adequate protection to a given tree species or population. The extents to which representative forest types and specific tree genetic resources are conserved or protected vary greatly between countries. In New Caledonia, all high altitude forests, 90 percent of the rainforests, mangroves, swamps and maquis are reported to be protected. Yet there is concern that the lack of protection of other unique forest types may threaten the survival of several endemic tree species and populations. Protecting individual species without conserving their natural environment is likely to be insufficient as evidenced by the threatened status of two protected tree species in Papua New Guinea: *Pterocarpus indicus* and *Diospyros* spp. These two species are officially protected but are not reported to be in any conservation area or reserved forest type. They continue to be harvested by people for local use and their populations are reported to be decreasing. Papua New Guinea reports 14 conservation areas conserving at least eight different forest types of varying extents from 12 hectares to 13 760 hectares. All but two of these areas are customary owned. In contrast, the Solomon Islands, where like Papua New Guinea, almost all the land is customary owned, the Government has established seven conservation areas mostly on government land. Only two of the conservation areas are managed by landowners. The areas vary from 39.5 to 18 000 hectares and protect about eight forest types within their range.

While formal conservation areas may serve to protect natural forest types and substantial components of tree genetic resources for a country, significant tree resources are also being conserved through the activities of local communities. The genetic banks of useful tree species that have been part of the local communities' village and crop gardens have been modified through many generations of selection - both by natural and human agents. These trees now continue to be conserved as part of the vegetation systems associated with subsistence agriculture, including secondary forests that regenerate after gardens and fields are abandoned. As gardening methods change and long-term cash cropping increase, certain tree species that were part of this kind of secondary forest may disappear.

The roles of both formal forest conservation areas and of human agroforestry activities in conserving up to 20 most important tree species in each country is presented in appendix 8. The 20 most important tree species from the four Melanesian countries total the 65 tree species in that table (appendix 8). Of that total, five species are considered important in two or more countries. Only one species, *Intsia bijuga*, is listed by all countries. Some 23 species are considered threatened at population level. Of these Vanuatu has four, Solomon Islands has four, Papua New Guinea has 12 and New Caledonia reported concern for five species. *Intsia bijuga* is reported to be threatened by logging activities in both Papua New Guinea and New Caledonia.

The large number of important tree species that are managed as part of village gardens or agricultural areas, evidences the important role of local communities in the conservation of tree resources.

#### ***1.2.1.2. Micronesia***

These small island countries have scattered landmasses ranging from 22 sq.km for Nauru to 702 sq.km of land for Federated States of Micronesia. They are linked by extensive areas of ocean which either facilitate or limit the dissemination of plant reproductive materials. It is observed that these islands share many common tree species. The Micronesian countries present at the workshop included Guam, Palau, Federated States of Micronesia, Nauru, Marshall Islands and Kiribati. Remaining native forest cover vary greatly between the islands depending on the population to land ratio, the kinds of activities human populations engage in and the physical conditions of the islands. The high islands of Palau and Federated States of Micronesia for example with less population density and without much urbanization, still have 75 percent and 78 percent of their land area under forests respectively. Guam, on the other hand, despite its larger landmass is more urbanised and has only 18 percent of its land under forests and woodlands. Guam has undertaken a programme of reforestation of its coastal areas with *Acacia* spp. Nauru, the atoll nations of Marshall Islands and Kiribati have only remnants of forests left.

Reflecting the pattern in the islands south of the equator, the flora of western Micronesia is relatively richer than the flora of the islands to the east. Palau for example has some 1 258 plant species and varieties, while Nauru, the site of abandoned phosphate mines, records only 61 species in its indigenous flora with two already extinct and five endangered. To the east of the group, the Marshall Islands report only 80 native plant species in all.

The larger and higher islands to the west have some conservation areas of major forest types. Federated States of Micronesia has an area of 10 000 acres of rainforest and 12 000 acres of mangrove forests. Guam on the other hand, while it has no formal conservation area, has one by default through military occupation, which thus restricts public entry. It has also begun a coastal conservation programme of reforestation. Palau has the Rock Islands conservation area that protects limestone coastal and littoral forest types. Nauru and the atoll nations of Marshall Islands and Kiribati reported no formal conservation areas and growing concern for the disappearance of native forest types. The widespread coconut tree and other exotics have replaced the native trees in most of these islands. Because of the limited land space and population pressure, it will not be possible to set aside large forest types in these latter countries. Conservation will have to focus on individual tree species such as Kiribati's attempt at conserving the genetic resource of the useful *Pandanus tectorius* and its numerous traditional varieties.

The lists of up to 20 most important tree species from five Micronesian countries totaled 60 species of which 13 are reported to be important from two or more countries. Those considered to be threatened at population level number four in Guam and 12 in Nauru. Appendix 9 summarizes pertinent details of the important tree species presented by the Micronesian countries

### **1.2.1.3. Polynesia**

Native forest cover in the Polynesian countries range from about 70 percent in French Polynesia and Niue, through about 60 percent in the Cook Islands, about 50 percent in Hawai'i and Wallis and Futuna to just under 40 percent in Samoa and a mere 5 percent in Tonga. Almost all of the Polynesian countries have established plantations of exotic timber species to supplement or replace indigenous timber supplies and therefore decrease exploitation of local species. Timber plantations however occupy only about 1 percent or less of total land area in each country. *Pinus caribaea*, *Swietenia macrophylla* and *Toona ciliata* are popular introduced species for plantations.

Most of the Polynesian nations have set aside forest conservation areas. Like other island groups in the Pacific, many of them display a high degree of endemism developed through many cycles of isolation, adaptation and diversification. The largest landmass in Polynesia, Hawai'i to the northeast reports to have a native flora of some 1 729 species and varieties. This has been added to through aboriginal introductions by native Hawaiians and later by subsequent human settlers. Hawai'i has conservation areas including state parks that protect representative types of at least 23 major forest types. Despite this, genetic resources of specific useful tree species are being significantly eroded through human activities. French Polynesia to the south of Hawai'i records some 675 native plant species of which 500 (or 75%) are endemic. An interesting feature of the flora of French Polynesia is that over 70 percent of the woody species are endemic.

Cook Islands has three national conservation areas with largely littoral vegetation. American Samoa has four conservation areas protecting representative areas of three types of vegetation. Samoa has a much more diverse flora than most of Polynesia, with nearly 500 species, 32 percent of which is reported to be endemic. Samoa has been active at conservation with six forest conservation areas protecting at least eight forest types. Government owns two of the conservation areas while the village landowners themselves manage the remaining four. Tonga is the only other Polynesian country to report the existence of forest conservation areas. Four were reported, protecting eight major forest types. Most of these forest areas are not easily accessible. Tonga lists 22 most important tree species. Of these 21 are declared to be threatened at population level. This is the highest level of threatened tree species in the whole Pacific sub-region. Wallis and Futuna also report extensive human impact on native forests and trees but no official regulations for the conservation of threatened forest types or trees. Further, the traditional system of taboo that would assist in their conservation is now little or no longer practiced.

All countries value trees both for timber and non-timber products as demonstrated by the lists produced of up to 20 of the most important trees for each. These important trees along with current management measures are summarized in the table of appendix 10. This shows a total of 70 tree species reported from six Polynesian countries. Of these, those threatened at population level number only one in the Cook Islands, four each in American Samoa and Samoa, five in Hawai'i and 12 in Tonga. Some 18 species are listed amongst the 20 most important species in two or more countries. Only one tree species, *Intsia bijuga*, is considered threatened at population level in more than one country.

The list include those species found in native and secondary forests as well as those found only in village gardens and agricultural areas. A large number are represented in conservation areas, national parks, forest reserves or other natural areas. A few however do not appear to be taken care of through any of these mechanisms. Notable amongst these is *Santalum insulare* of the Cook Islands. That species is threatened by over harvesting. It is neither represented in any forest conservation area nor appears to be cultivated in village gardens or formal tree plantations. Other species that are not represented in any forest conservation area but are not threatened appear to be common in areas around village settlements. These include for example, *Cordia subcordata*, *Syzygium malaccense* and *Thespesia populnea* in Hawai'i, *Calophyllum inophyllum* and *Pandanus edulis* in the Cook Islands, *Pandanus tectorius* and *Cananga odorata* in Tonga and *Flueggea flexuosa* in American Samoa. Amongst these only *Cananga odorata* in Tonga is considered threatened.

### **I.2.2. Threats to tree genetic resources**

Threats to tree genetic resources and to their conservation include issues of intensive harvesting and use, of destruction both by human and natural processes, of diminished habitats, of unfavorable changes in ecological conditions, disease epidemics and pests, existence of superior competitors and dependence on propagation by human agent. The degree to which any one of these issues is an important factor in any one country, varies depending on the range of human and natural factors that impact on the individual species populations. Vital for the control and minimization of these factors is the policy environment, relevant legislation, conducive land owning system, efficiency of different regimes for forest and tree management within each country and general awareness of those dealing with forest and trees.

### ***1.2.2.1. Human practices and population pressures***

#### ***1.2.2.1.1. Intensive harvest and use***

Several commercial timber species have become rare due to over exploitative logging while many culturally important species are threatened by heavy harvesting for traditional uses such as for carving, firewood and medicine. In the larger countries with substantial timber and commercial wood resources, some commercial tree species have been so heavily logged that they have now become threatened such as three species of *Agathis* and *Pterocarpus indicus* in Papua New Guinea or *Dacrydium nidulum* in Fiji or *Agathis macrophylla* in Solomon Islands, *Santalum austrocaledonicum* in Vanuatu and *Intsia bijuga* in Samoa. Commercialization of traditional products allow many communities to earn income from carving often resulting in over exploitation of good carving wood such as *Thespesia populnea*, *Cordia subcordata* and *Intsia bijuga*. Heavy harvest of bark for medicine in other communities prematurely kills large trees such as *Bischofia javanica* and *Spondias dulcis* in Tonga, therefore threatening the viability of those tree populations. In Kiribati, continuing high demand for *Pandanus* spp. trunks for construction, in Niue harvest of polewood for large feasts or functions, in American Samoa, harvest of *Bruguiera gymnorrhiza* for fuel, while in Cook Islands heavy harvesting of *Santalum insulare* for medicine are reported as threats.

While damage to forest trees as a whole is obvious in situations of logging by clear felling, the degree to which commercial selective logging destroys other forest tree species is not well known. Much depends on the practice of the logging operator and the efficiency of surveillance where strict logging regulations exist. In Papua New Guinea where surveillance has been difficult, a total of 16 out of 20 most important trees are reported to be threatened mostly by logging. In New Caledonia where strict regulations and good surveillance do exist and damage is minimized, the effect on regeneration is of concern and is unknown.

#### ***1.2.2.1.2. Agricultural and other activities***

In all Pacific countries, whether logging exists or not, serious deforestation results from clearing for agricultural and other human activities. Rapid population increases and greater demand per head for land due to cash cropping as well as changes in the practice of agriculture itself, all pose serious threats to the continuing existence of many forest types and tree species. Clearing of forests make them more vulnerable to damage by natural forces such as cyclones, and fires (both man made and spontaneous). Forest clearing for human settlements and other developments, including mining, are reported to threaten tree genetic resources in Hawai'i, American Samoa, Tonga, Palau, Kiribati, Nauru and New Caledonia.

Tree genetic resources of the smaller Micronesian countries are much more heavily threatened by the destructive effect of human activities. Nauru for example reports a total of 12 tree species as endangered due to destruction of habitat largely by mining activities. Marshall Islands and Kiribati report only remnant tree stands in isolated islands, as populations on densely settled islands are destroyed. Where spontaneous fires occur frequently, native forests have sometimes become severely restricted. This is so in leeward areas of many large islands such as in Papua New Guinea, Hawai'i, Fiji and New Caledonia. Guam reports fires in ravines as a threat to the survival of the tree fern *Cyathea lunulata*.

### *1.2.2.1.3. Diminished habitats*

Many Pacific plant species, especially endemic ones, occupy restricted habitats. The yet to be identified species of *Xanthostemon* in Choiseul and Isabel, Solomon Islands, is an example. When these habitats are destroyed, the species have little chance of survival. Concern was expressed that the destruction of maquis in New Caledonia threatens the survival of several endemic tree species of which little is yet known. These include endemic conifers, palms, ferns and Rubiaceae species. Others that may be more common but lack wide adaptability become threatened when their habitats are destroyed for other purposes. For example, Guam reported that the common coastal tree species *Heritiera longipetiolata* is threatened by the fact that its habitat is restricted.

### **1.2.2.2. Changes in ecological conditions**

#### *1.2.2.2.1. Pressure of ecological origin*

Climatic oscillations or changes are of particular concern to small and low lying island nations. However, their impacts on forests and individual tree species are difficult to predict. More immediately, they are a threat to forests and trees in coastal areas where erosion and tidal flooding changes ecological conditions and threatens existing tree species such as *Xylocarpus* in Tonga. Even without the effects of climate variations, the removal of a species, e.g. *Agathis* sp., in an interdependent ecosystem may result in a domino effect that threatens many other species.

#### *1.2.2.2.2. Disease epidemics and pests*

Some countries reported disease epidemics as having threatened specific tree species. In the Cook Islands, mites were reported to have destroyed the whole population of *Pandanus tectorius* on Atiu island. In Papua New Guinea, damage by a defoliator moth threatened the survival of *Toona sureni* on the New Guinea mainland and islands. Large stands of the prime timber tree of Hawai'i, *Acacia koa*, were reported to have been killed by the wilting terminal branch dieback disease. Other diseases that threaten this tree include fungal, insect and beetle attacks. Predation of fruits by bats, seedlings by deer, and seeds by insects, threaten three important tree species in Guam while pigs and bullocks destroy young seedlings and threaten regeneration of many forest trees in Vanuatu. Hawai'i reports animal damage such as ungulate grazing and seed consumption by rats as a threat.

#### *1.2.2.2.3. Invasive species*

Since the arrival of the first human settlers into the Pacific, native flora has had to compete with increasing numbers of aggressive plant species introduced by humans either inadvertently or deliberately. Native species are not always able to compete. Hawai'i for example reported that over 90 percent of dry forest areas have been destroyed mainly by invasive alien species and particularly by the aggressive grass *Pennisetum setaceum*. The small island states of Micronesia are losing much of their native coastal flora to dense stands of introduced species such as *Leucaena leucocephala* and *Mimosa invisa*. In French Polynesia, several invasive species have become well established including *Miconia calvescens*, *Lantana camara*, *Psidium guajava* and *Spathodea campanulata*. *Paraserianthes* spp., *Cordia alliodora* and *S. campanulata* are significant weeds in Samoa, Vanuatu and Fiji respectively.

#### *1.2.2.2.4. Dependence on propagation by human agents*

Some tree species, probably aboriginal introductions, have survived as integral components of traditional garden and village systems. When the traditional practices for their cultivation is weakened, their existence is threatened. *Garcia sessinalis* and *Schizostachyum glaucifolium* of Tonga and *Cordia aspera* of Fiji, Tonga and Samoa, are such species. The latter's existence in Samoa where it is now no longer used and cultivated is now questionable. It has also become very rare in both Tonga and Fiji for the same reasons.

#### **1.2.2.3. Land tenure, legal and institutional factors**

##### *1.2.2.3.1. Policy and legislation*

The lack of policy and appropriate legislation to protect forest and tree genetic resources in many countries pose a real threat to the survival of many tree species. Many of the smaller island countries where population pressure is relatively higher, do not have appropriate policies and depend only on remotely related legislation such as for plant quarantine regulation to protect native trees. Wallis and Futuna and Palau report lack of policy as limiting factors for effective conservation actions. Where policies do exist, their lack of implementation and surveillance are also important factors that could pose a threat to species survival. Marshall Islands expressed concern at the lack of enforcement of appropriate legislation.

##### *1.2.2.3.2. Forest and tree management/land tenure systems*

Good forest management both by official institutions and by local user communities is vital for conservation of tree resources. Often, knowledge is lacking on which tree species are under threat. Where threatened tree species are identified, there is insufficient knowledge on the taxonomy, biology and conservation requirements of such trees.

Many countries reported the existence of forest reserves. However, such reserves may not secure the long-term conservation of particular species or genotype. In addition, their status may not be actually respected. The Queen Elizabeth National Park in the Solomon Islands was reported to have been set up without proper consultation with the land owners who have continued to use it clearing much of the forests in the process. Where protected forest areas set aside are respected, they may not be enough to protect representative stands of the range of forests in the country as reported by New Caledonia. In the Grande Terre main island, insufficient protection is given to sclerophyll forests, mangroves and maquis. Where a representative area is set aside, the size may not be sufficient to ensure survival of the larger tree species. Even when the required area for conservation is available, land tenure systems may prevent commitment of all stakeholders to conserving the area. This is particularly so where the area identified has mixed ownership.

Management by user communities through traditional practices of harvest, cultivation and conservation had ensured the survival of many tree species in the past. This system is now weakening. Its disappearance poses a threat to the survival of useful tree species such as *Syzygium neurocalyx* and *Tarrena sambucina* in Tonga.

### *1.2.2.3.3. Awareness*

Lack of awareness is an important factor implied in several reports. An example is the felling of seed trees of *Acacia mangium* in Papua New Guinea's Western Province. Palau and New Caledonia state lack of general public awareness as a threat to tree resources conservation.

## **I.3. LEGAL, INSTITUTIONAL AND POLICY FRAMEWORK**

The legal, institutional and policy framework within which forest genetic resources are being or may be protected within the Pacific sub-region vary from almost nothing in some countries to a highly developed system in others. For purposes of discussion these may be categorized into three groups depending on the degree of legislated protection of forests and tree species.

### **I.3.1. Group I – Islands without Forestry Regulation Acts**

The smaller countries, where trees do not contribute significantly to the national formal economy, have generally not seen the need to legislate or pay specific attention to the conservation of their forest and tree resources. American Samoa, Cook Islands, Kiribati, Marshall Islands, Nauru, Palau, Wallis and Futuna have neither Forestry Act nor Forestry Policy. Every one of these however, has some legislation, which to varying extents may contribute to protection of their tree resources. The minimum protection is provided by Agricultural Quarantine Regulations. In Wallis and Futuna, this is the only relevant legislation, besides the overall framework of the Convention on Biological to which France is a signatory member.. Other islands are also covered through encompassing environmental legislation and international treaty obligations of those larger countries to which they are affiliated. Niue and Cook Islands are covered under the Convention on Biological Diversity through their association with New Zealand. The Marshall Islands, Palau and Federated States of Micronesia, under the Compact of Free Association agreed that the US continues to apply controls under the terms of the US National Environment Protection Act. American Samoa is subject to the same environmental legislation that applies in the US. Kiribati and Nauru potentially provide direct legislative protection for their forest genetic resources through their commitment to the terms of the Convention on Biological Diversity to which they are signatories. Some of these smaller countries have enacted other national legislation that may be applied to protect tree genetic resources. These include:

- Cook Islands Conservation Act of 1988/89 that covers broad conservation issues including forest areas.
- Kiribati's Land Planning Ordinance (1973), Prohibited Area Ordinance (1957) Plant importation Ordinance (1978) and proposed Environmental Bill (1996) each of which covers some area of tree resources conservation.
- Marshall Islands' Endangered Species Act (1995) that could protect endangered tree species, Tourism Act (1991), that allows the setting aside of areas for tourist attraction, National Environment Protection Act (1984), Coast Conservation Act (1988), Planning and Zoning Act (1987) and Earth-moving regulations.
- Nauru's Lands Act (1976) that gives protection to important tree species through stipulated compensation levels for destruction or removal, as well as both its National Environment Management Strategy and its National Environment Action Plan still in process for approval.

The institution responsible for forestry in these small islands is sometimes vested in a single or a few persons in the Department for Agriculture. This is so in Cook Islands and Kiribati. In others, it may be part of a department with a wider mandate such as the Department for Rural Economy and Fisheries in Wallis and Futuna or the Ministry for Island Development and Industries in Nauru. In American Samoa, forestry research work normally carried out by such formal government institutions is carried out by the American Samoa Community College.

### **I.3.2. Group II– Islands with limited Forestry Regulation**

In some other countries, although there may be very small or no timber production, the role of forests for other purposes is officially recognized in legislation. These forest roles include water catchment, erosion control, environmental quality enhancement, tourist attraction., fisheries hatchery by mangroves, as well as subsistence, cultural and other use. There are four countries/territories in this group. Each of them is dependent on a larger country for international relations and therefore usually covered by the obligations of the larger nation to international conventions and treaties. Guam is a part of the United States of America, Federated States of Micronesia and the Marshall Islands are bound by the Compact of Free association with the US, French Polynesia is covered by the international obligations of France, while Niue's foreign relations and obligations are determined by New Zealand. The particular national legislation of these countries that officially recognize the important role of forests include:

- Federated States of Micronesia's Forest Management Act of 1979 and its Watershed Forest Reserve and Mangrove Forest Protection Act of 1987.
- French Polynesia's Regulations for Urban Development of 1999 that protects forest zones for environmental quality including pollution control.
- Guam's Forestry Legislation of 1975 that vests responsibility for conserving soil resources in the Forestry unit under the Department of Agriculture.
- Niue's Village Council Ordinance of 1967 that gave responsibility for the protection of flora and fauna to the village councils.

Of this group, both Niue and French Polynesia have small forestry industries and both have exotic forest plantations. They therefore have more legislation that cover forestry management than the other countries in this group:

- French Polynesia has formally established a series of reserves and nature parks that protect some of its forest systems. Niue has a Draft Environment Management Bill that will see the establishment of protected areas and the protection of plant and wild life.
- French Polynesia has a Forestry Policy that covers both forest utilization and reforestation activities. Niue's Forestry Policy is in draft and in process for approval. Niue's Code of Logging Practice is also in draft.

In the four territories of this group, the institution responsible for agriculture is also in charge of forestry. Other institutions are also involved with specialized functions such as research, conservation or social forestry. These include the ministry for the Environment, the ministry in charge of research; CIRAD-Forêt, IRD (ex ORSTOM), the French University for the Pacific in French Polynesia and New Caledonia, the University of Guam and the Natural Resources Conservation Service in Guam. Both Federated States of Micronesia and Niue did not report other such specialized institutions within their countries.

### **I.3.3. Group III – Islands with specific Forestry Regulation Acts**

Those countries where forestry plays a more significant role in the formal economy have specific Forestry Act and forestry regulations that govern the management, including the protection, of forest resources. These countries include Papua New Guinea, Solomon Islands, Hawai'i, New Caledonia, Fiji, Vanuatu and Samoa. The independent countries of Papua New Guinea, Solomon Islands, Vanuatu and Fiji have all signed and ratified the Convention on Biological Diversity and CITES. They are also all party to the SPREP Convention and the Apia Convention. Papua New Guinea reported to be a signatory to the Convention on Climate Change and its Kyoto Protocol while the Solomon Islands reported that it is also party to the International Undertaking on Plant Genetic Resources, the RAMSAR Convention on Wetlands and the Convention on Climate Change. Samoa reported to be negotiating the International Undertaking on Genetic Resources for Food and Agriculture.

Papua New Guinea, with the largest and most species rich forests in the sub-region, enacted a Forestry Act (1991) and amended it in 1993 to provide for proper forestry management. At least 4 other major Acts also contribute to forest genetic resources conservation. These are the Environment Planning Act (1978), Conservation Areas Act, Fauna and Flora Control Act and Wildlife Management Area Act. Additional to its Forestry Act, Papua New Guinea has instituted supplementary regulations to cover specific areas of forest management including:

- the Forestry Guidelines of 1995 which form the primary input into the National Forestry Plan requiring its review every 3 years;
- Key Standards for Selection Logging of 1995;
- Code of Logging Practice in 1996;
- Procedures for Assessing post-logging wastes with a setup in 1996;
- the Tropical Forestry Action Plan.

Solomon Islands, similarly, has other Acts that complement its Forestry Act in the protection of forest genetic resources. The National Forestry and Timber Act of 1969 is supplemented by the Forest Resources and Timber Utilization (Amendment) Act of 1990, the National Parks Act of 1954, The Wildlife Protection and Management Act of 1998, the Environment Act of 1998, the Town and Country Planning Act of 1979 and the Wild Birds Protection Act.

The Solomon Islands National Forest and Timber Policy of 1984 was updated in the Forest Policy Statement of 1989 and again in the National Forest Policy of 1997. A National Forest Action Plan was developed in 1995 under the Tropical Forestry Action Plan. Solomon Islands instituted a Standard Logging Agreement in 1984 to regulate logging practices and adopted a Code of Logging Practice in 1990.

The management and responsibility for Hawai'i's forests and forest genetic resources are legally vested in the State Department of Agriculture under several acts that define its role. These include the Forestry Legislation and others that cover the establishment of national parks, reserves and protected areas as well as enforcement of regulations for conservation of natural resources. Hawai'i's forestry legislation covers research, utilization, conservation and international cooperation.

In New Caledonia, forestry regulations provide protection for 90 percent of the territory's rainforests and forest resources through application of selective logging terms and issuing of logging permits. However, these regulations do not apply to private land. Several pieces of legislation protect large ecosystems such as mangroves, swamps, maquis and areas threatened with bush fires.

New Caledonia has well-managed pine plantations that release the pressure from native trees. It is implementing a forestry policy whose major objective is to strengthen conservation measures in the next few years.

Vanuatu's Forestry legislation contained in its constitution was amended through the Forestry Act of 1998 to cover the management of both forests and individual species such as *Santalum austrocaledonicum*. Complimentary Acts include the National Parks Act of 1993 and the Draft Comprehensive Environmental Legislation of 1998.

Vanuatu adopted a National Forestry Policy in 1997 and followed it with a Code of Logging Practice. In 1998, it set up a Biodiversity Conservation Trust Fund which includes the conservation of forest genetic resources. Planning for conservation of forest resources is provided through several national activities including the general National Development Plan (1992-1996), the Vanuatu National Conservation Strategy (1993), the Draft National Land Use Planning Policy (1998) and the National Biodiversity Strategy and Action Plan for Vanuatu (1999).

Samoa's relevant acts, apart from the Forestry Act of 1967 and the Forest Regulations of 1969, are the Watershed Protection and Management Regulations (1992), National Parks and Reserves Act (1974) and the Lands and Environment Act (1989).

Samoa adopted a comprehensive National Environment Management Strategy (NEMS) in 1993. It has a National Forestry Policy whose five guiding principles are (a) optimal and sustainable use of forest resources, (b) forest protection, (c) basic human needs, (d) individual and collective responsibility and (e) economic development.

The institutions responsible for forestry in these countries are usually primarily the Department of Forestry either within a Department of Agriculture, as in Hawai'i, or in association with it in the same Ministry as in Fiji, Samoa and Vanuatu, or quite separately from it as in Papua New Guinea, Solomon Islands and Fiji.

The better-resourced countries such as Hawai'i, New Caledonia and Papua New Guinea have a series of other institutions that cover specific areas of forestry and forest genetic resources conservation. In Hawai'i, these include 7 arboreta, 15 citizen conservation organizations, 22 state government resource conservation departments and at least seven other organizations such as universities and museums. In New Caledonia, at least six civil organizations also deal with forestry matters. In Papua New Guinea, at least two national research institutes and two national universities also deal with forestry issues. In Solomon Islands, not only private sector groups such as KFPL, but also several NGOs like SWIFT (Solomon Western Islands Fair Trade), SOLTRUST, SIDT (Solomon Islands Development Trust) and landowner groups such as the Komarindi Catchment Conservation Area people are also active in forest conservation.

## **I.4. MAIN PRIORITIES AND CHALLENGES FOR A COMMON FRAMEWORK FOR FUTURE ACTION**

The main and common priorities and challenges for the countries of the sub-region were discussed in the workshop under four major themes as follows (see part II):

1. Tree species priorities for genetic resource operations and activities
2. Conservation, sustainable use and management of forests and trees
3. Germplasm collection, exchange and access
4. Institutional strengthening, training needs and regional collaboration

The Pacific Sub-Region Action Plan for the conservation, management and sustainable use of forest and tree genetic resources, has been prepared during the Apia Workshop (see Part II). The Action Plan outlined in that paper resulted from the preparation of country reports synthesized here and the discussions of the workshop at which the papers were presented.

This paper presents a briefer summary of the issues of concern raised by the participating countries.

### **I.4.1. Tree species priorities for genetic resource operations**

#### ***I.4.1.1. Countries' priority species and operations***

Countries were invited to present a list of up to 25 national priority tree species. They were to indicate for each the urgency of action required under three major categories of activities for genetic resource conservation. These were as follows:

- Exploration and germplasm collection – including biological information, gene-ecological studies and germplasm collection and research;
- Evaluation, improvement and germplasm supply – including field testing and evaluation, selection and breeding and germplasm supply;
- Conservation – including *ex situ* and *in situ* conservation.

This exercise resulted in a list of almost 200 tree species including a few exotics. They are presented in appendices 11 to 15. They are categorized in those tables according to the urgency of the needed action. The table of appendix 11 for example, which has a total of 23 species, contains those species that countries consider priority for urgent and immediate action in all three areas of exploration and germplasm collection, germplasm evaluation and supply and conservation. The table of appendix 12 with 13 species and appendix 13 with 33 species list those that require urgent and immediate action in two and one of these three areas of operations respectively. The 73 species in appendix 14 are those considered to require action in at least two of the three areas of operations within the next five years. The 66 species in the table of appendix 15 are the remainders. These include those that do not require action at all, require action in only one of the three areas of operations within the next five years or otherwise require action in all the three areas within the next ten years. These categories are referred to here as of priority orders A to E.

#### ***1.4.1.2. Common priority species***

Some 23 species were common to two or more countries. These were not always of the same priority order for all countries but sometimes were very close. Of these 23 common species, eight are listed as of priority order A by at least one country and appear in the table of appendix 11. These eight species are:

- *Agathis macrophylla* (Priority A for Solomon Islands, also listed by Vanuatu and Fiji)
- *Flueggea flexuosa* (Priority A for Samoa, also listed by Fiji, Solomon Islands Vanuatu and Wallis and Futuna)
- *Intsia bijuga* (Priority A for Tonga and Samoa, also listed by Solomon Islands Fiji, Vanuatu, Papua New Guinea and Guam)
- *Pometia pinnata* (Priority A for Samoa, also listed by Am. Samoa, Fiji, Papua New Guinea, Tonga, Vanuatu, Wallis and Futuna)
- *Pterocarpus indicus* (Priority A for Solomon Islands, also listed by Vanuatu, Papua New Guinea and Fiji.)
- *Santalum austrocaledonicum* (Priority A for Vanuatu, also listed by Cook Islands, New Caledonia)
- *Santalum yasi* (Priority A for both Tonga and Fiji)
- *Terminalia richii* (Priority A for Samoa, also listed by Am. Samoa)

Of the eight species given priority A rating, two are listed by the most number of countries, a total of seven for each: *Intsia bijuga* and *Pometia pinnata*. Only two species, *Intsia bijuga* and *Santalum yasi*, are given A priority status by more than one country - the former by Samoa and Tonga and the latter by Fiji and Tonga.

The identification of common species may facilitate action at regional level but does not diminish the importance of priority ratings for species at national levels. While some species occur in two or more countries, many are found only in one or even in very restricted areas within one country. The flora of New Caledonia and Hawai'i for example are of great botanical and evolutionary interest, and many of their species are endemic. Papua New Guinea and Solomon Islands on the other hand share many species with other Pacific nations but are much richer floristically so that they also have many more species they do not share with other countries close to them.

Only three common species fall into the priority B rating. These are as follows:

- *Artocarpus altilis* (Priority B for Kiribati, also listed by Fiji, Solomon Islands, Vanuatu);
- *Cordia subcordata* (Priority B for Solomon Islands, also listed by Cook Islands, Fiji, Hawai'i, Nauru, Vanuatu);
- *Endospermum medullosum* (Priority B for Solomon Islands, also listed by Vanuatu and Papua New Guinea).

The listing of the edible breadfruit tree with such high priority is not surprising. It also provides valuable timber in some parts of the Pacific. However, institutions concerned with agricultural crop cultivation have already included the breadfruit tree in their operations.

Another 11 species are categorised as priority rating C. Interestingly, six out of the 11 on this list are widespread coastal species. These 11 priority C common species are:

- *Agathis robusta* (Priority C for Papua New Guinea and Tonga);
- *Artocarpus mariannensis* (Priority C for Kiribati, also listed by Guam);
- *Calophyllum inophyllum* (Priority C for Wallis & Futuna, also listed by Kiribati, Nauru, Hawai'i);
- *Canarium harveyii* (Priority C for Vanuatu, also listed by Tonga);
- *Hernandia nymphaefolia* (Priority C for Solomon Islands, also listed by Nauru);
- *Morinda citrifolia* (Priority C for Kiribati, also listed by Nauru);
- *Pandanus tectorius* (Priority C for Tonga, also listed by Kiribati, Guam, Nauru);
- *Pinus caribaea* (Priority C for Fiji, also listed by New Caledonia and Tonga);
- *Santalum album* (Priority C for both Fiji and Tonga);
- *Terminalia catappa* (Priority C for Tonga, also listed by Kiribati, Guam, Nauru);
- *Thespesia populnea* (Priority C for Cook Islands and Tonga, also listed by Nauru and Hawai'i).

The remaining three of the 25 species common to two or more countries were of lower priority than C rating:

- *Syzygium malaccense*, listed by Fiji and Vanuatu;
- *Garuga floribunda*, listed by Samoa and Vanuatu;
- *Neonauclea fosteri*, listed by Samoa and Wallis & Futuna.

#### **I.4.2. Conservation, sustainable use and management of forests and trees**

Several priority actions were identified from the discussion on conservation, sustainable use and management of forests. Many of these are already on-going in some countries. Priority actions for conservation and management were reported as follows:

- Conservation of representative forest types is important for the *in situ* conservation of forest tree species. It is not enough to conserve only the few species or areas of interest. A tree species has to be conserved along with its local natural environment. Forest conservation also needs to address damage by introduced wild animals such as pigs, deer, and invasive and aggressive plant/weed species.
- Conservation should encourage the active involvement of local communities in all activities as far as possible- including monitoring. The traditional knowledge and practices of local communities should be respected and taken into account in the planning and implementation of conservation activities.
- Community and public education and awareness raising are important activities for conservation.
- In order to lessen the demand on native forest timber, some countries have increased exotic timber plantations particularly in pine and mahogany. Germplasm evaluation and supply of promising introduced species are therefore of high interest.

- Studies on the regeneration of logged native forests are necessary in order to assist operations for conservation in the long term.
- In some countries, the promotion of agroforestry will also provide a significant contribution to the conservation of certain tree species.
- In other countries, tree-planting activities in wood lots and around villages, as well as afforestation or restoration of degraded areas are considered urgent means of contributing to tree and genotype conservation.
- There is a great paucity of relevant data to guide the conservation of almost all important forest tree species. This paucity sometimes includes the lack of understanding for the conditions that lead to a certain tree's disappearance. Much relevant research as well as data storage and data analysis, are urgently needed.
- *Ex situ* conservation through seed storage was recognized as a short term means of conserving genetic resources of priority trees under certain conditions.

### **I.4.3. Germplasm collection, exchange and access**

For some species, such as the rare native species of *Agathis*, *Araucaria*, *Montrouziera* and *Santalum* of New Caledonia, more urgent action is needed to collect germplasm for *ex situ* conservation. Wallis & Futuna also consider it important to collect germplasm for the purposes of *ex situ* conservation. For others germplasm collection, nursery trials, vegetative propagation and tree improvement are all necessary as part of the general conservation of their genetic resources.

It was generally evident that while some indigenous tree species in a few countries such as Hawai'i, New Caledonia, French Polynesia, Papua New Guinea and Vanuatu, had been explored and their germplasm begun to be collected and evaluated, most of the priority species had not been addressed so far. Some smaller countries were particularly interested in accessing germplasm to augment their dwindled supplies. These included Guam, Wallis & Futuna and the Cook Islands.

The exchange of indigenous forest tree genetic materials has not been well developed in the Pacific sub-region. During pre- and early European times there was some exchange of cultivated crops and garden trees between Pacific peoples. Modern laws of quarantine have limited such exchanges. There now needs to be set up a system that not only facilitates the exchange but also records the details of the genetic materials for the purpose of ensuring their conservation in the long term. In this regard, it was suggested that all seed sources should be identified by specific geographic location and that each genetic transfer is fully documented. A regional system that allows comparison of data across countries should be developed. It was emphasized that such a system should include a process of risk analysis to avoid germplasm contamination and minimize threats, including the introduction of aggressive species.

The issue of access is a sensitive one for the sub-region. Through the SPRIG project the five participating countries have agreed to allow each other access to genetic material of some selected tree species. As more countries become interested in similar exchanges, some wider understanding and arrangement may need to be established across the region. The workshop discussed this issue at length and recognized that there are existing legal and technical frameworks they could tap into for advice. However, consistency across the sub-region, and with international agreements was found necessary to facilitate efficient exchange.

#### **I.4.4. Institutional strengthening, training and sub-regional cooperation**

The needs of the sub-region in the areas of institutional strengthening and training range widely depending on the resources available to each and the importance of forest trees in their economy. Hawai'i, New Caledonia, French Polynesia and to some extent, Papua New Guinea, are better served in terms of institutions and in terms of on-going operations. The small countries, like Nauru and Kiribati for example, have less demanding needs but do not have the resources to strengthen institutions that deal with tree genetic resource conservation. Some small countries, such as Vanuatu, are hampered by the lack of human resources to handle extra activities. Most countries emphasize the need to work together maximizing the use, through sharing, of the resources and knowledge available in the whole of the sub-region.

##### ***I.4.4.1. Institutional strengthening***

- Cooperation and sharing of experience in policy and regulations: institutions responsible for forestry and for tree resources need to work more closely with other national institutions to raise awareness of politicians and decision-makers.
- Making best use of existing facilities within and between countries for seed storage, data storage and processing, herbarium collections and plant propagation.

##### ***I.4.4.2. Training***

- Training in conservation of forest tree genetic resources is considered urgent. This is to include training in seed collection, nursery management, field trials, experimental design and analysis. A regional arrangement was suggested.
- Short term training through visits, professional training and study tours, particularly for the smaller countries, was considered urgent.

##### ***I.4.4.3. Sub-regional cooperation***

Cooperation across the sub-region was identified as potentially advantageous in the following areas:

- Germplasm exchange or transfer: it was agreed that a Code of Conduct for germplasm exchange needed to be developed.

- Exchange of experience in plantation techniques, in agroforestry, in reduced impact of logging, study of regeneration, silvicultural management and collaboration with local people and communities.
- Regular sharing of information and experience across the sub-region would benefit all members. A regional network to facilitate exchanges was suggested.

## **I.5. EXISTING REGIONAL AND INTERNATIONAL COLLABORATIVE PROGRAMMES AND PROJECTS SUPPORTING FOREST GENETIC RESOURCES RELATED WORK**

While focus on the conservation of forest tree genetic resources in the Pacific is yet limited, activities that contribute to it are more widespread although more carried out on a *ad hoc* basis than through a continued programme. Operations for conservation of specific forest tree genetic resources require scientific and technical expertise and institutional arrangements that have been largely the responsibility of governments and official regional and international institutions. *Ad hoc* activities that contribute to forest genetic resources conservation, such as the establishment of reserves and conservation areas, have resulted from initiatives both of government and Non-Government Organizations (NGOs).

Given the paucity of research facilities, of technical expertise and of data availability in the Pacific, most countries have begun the process of forest genetic resource conservation through establishing reserves and conservation areas. These are often not so much based on scientific criteria as on the willingness of the landowners or of the government to set aside an area of concern. International organizations that have supported such activities include the inter-governmental South Pacific Regional Environment Programme (SPREP) and several international NGOs. The latter include Conservation International (CI), the Foundation of the Peoples of the South Pacific International (FSPI), the International Union for the Conservation of Nature (IUCN), The Nature Conservancy (TNC) and World Wide Fund for Nature (WWF). Sometimes, these conservation areas have been selected as a result of national or sub-national forest surveys. The Australian government through its aid agency, AusAID, the Food and Agriculture Organization (FAO) and the New Zealand Maruia Society have supported or executed such surveys in several countries. There are also regional and international arrangements and organizations for the conservation of selected tree genetic resources such as for coconuts (IPGRI) and for special tree ecotypes such as for Mangroves (GLOMIS).

The organized conservation of specific forest tree genetic resources has largely been the responsibility of Forestry Departments or of offices responsible for forestry matters in a country. Aspects of conservation activities included in forestry management such as nursery production, provenance trials and plantation developments have been addressed as needed mainly at national levels. Further, while the choice of tree species for such activities had traditionally been for fast growing exotics, there is now growing interest and concern for disappearing indigenous ones. These have been much less investigated scientifically and therefore little is known of their requirements for conservation. Since the Pacific Islands Forests and Trees Support Programme (SPC/PIF&TSP) initiated by FAO and UNDP was incorporated into the activities of the Secretariat of the Pacific Community (SPC), forestry officials have been able to define more clearly their needs at regional level for forest resources conservation.

The AusAID-funded project South Pacific Regional Initiative on Forest Genetic Resources (SPRIG), is an attempt to address in a systematic way the problem of tree genetic resource conservation. It works closely with national Forest Services and supports both scientific and social investigation to promote a conservation system that is scientifically based but that actively involves local communities. This project first phase associated five countries: Fiji, Tonga, Samoa, Solomon Islands and Vanuatu.

## **I.6. CONCLUSIONS AND RECOMMENDATIONS**

The Apia workshop was a first attempt by the countries of the Pacific sub-region to pool their knowledge about, and needs for, tree genetic diversity conservation, identify priorities and determine a framework for regional action to address common concerns. The country papers emphasized the vital importance of trees and forests to the very survival of Pacific communities, cultures and peoples. In setting priorities for action, some 63 species were listed as requiring immediate and urgent attention for genetic resource exploration, evaluation and conservation activities. While exploration and collection of germplasm should commence the scientific operations for genetic conservation, the rapid disappearance of many tree species makes it imperative that immediate *in situ* conservation and some *ex situ* conservation of some rare and threatened ones be urgently established. Facilitation of exchange and transfer of genetic material was considered important to assist genetic resource conservation and supplementation.

A total of about 32 recommendations for action from the workshop are outlined in detail in the sub-regional action plan in Part 2 of this document.

In conclusion, it was noted that the convening of the Apia workshop has revealed much energy and interest in the conservation of forest tree genetic diversity among foresters of the Pacific islands. The workshop participants identified urgent and necessary activities both for each of the countries at national level and for cooperative efforts at regional level. While in many cases countries are able to carry out activities on their own, other types of activities will require external support in terms of technology transfer, improved facilities, technical expertise, and training opportunities. The workshop participants were hopeful that the necessary support will be available from donor agencies, for urgent activities to be undertaken.



**PART II: PACIFIC SUB-REGIONAL ACTION PLAN FOR  
CONSERVATION, MANAGEMENT AND SUSTAINABLE USE OF  
FOREST AND TREE GENETIC RESOURCES**

## **PREAMBLE**

Forests and trees and their associated genetic resources provide one of the essential foundations for culturally, economically and ecologically sustainable development in all Pacific Island countries and territories. The Pacific's forest genetic resources include many hundreds of indigenous tree and shrub species with great spiritual, cultural, commercial and subsistence economic values, and providing a wide range of environmental services, as illustrated in Part 1 of this document. Almost all of these benefits are either irreplaceable or extremely costly to replace with imported substitutes. Forest and tree genetic resources constitute the natural capital and inheritance for the maintenance and sustainable development of present and future generations of Pacific Islanders.

Governments of the region, regional and international organizations, donors and NGOs are involved in several important initiatives, including the SPRIG, SPC's Forests and Trees Programs and SPBCP, which aim to develop local capacity to conserve, manage, sustainably utilize and improve the region's forest genetic resources. However, forests and tree genetic resources are still being lost, often at high rates, in all Pacific Island countries and territories.

There is, thus, a need to address these matters through development and implementation of a Pacific Sub-Regional Action Plan<sup>2</sup>. The objective of this Action Plan is to indicate practical actions that can be taken at the international, regional, national and local levels to address the loss of forest and tree genetic resources in the Pacific Islands. It was developed by members of Pacific community at the Pacific Sub-Regional Workshop on Forest and Tree Genetic Resources held in Apia, Samoa from April 12-16, 1999, including preparation of country reports in the lead-up to the workshop and subsequent consultations and further elaboration. A list of participants is given in Appendix 21. This current document summarizes the results of these efforts. Factual information on the situation in the region and in individual countries is synthesized in Part I: *State of forest genetic resources in the Pacific Islands*.

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<sup>2</sup>The Action Plan covers the following Pacific countries and territories: American Samoa, Commonwealth of the Northern Marianas, Cook Islands, Federated States of Micronesia, Fiji, French Polynesia, Guam, Hawai'i, Kiribati, Marshall Islands, Nauru, New Caledonia, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, Vanuatu and Wallis and Futuna.

## **II.1. OVERVIEW OF THE THREATS TO FORESTS AND TREE DIVERSITY**

There are many reasons for the loss of forest and tree genetic diversity. In general, it is the result of increasingly widespread deforestation, forest degradation, forest fragmentation, agroforestation (the removal or failure to plant trees in agricultural and horticultural systems), and the failure to protect and plant trees throughout the Pacific Islands. Factors responsible include:

### *Human practices and population pressures*

- unsustainable and poorly planned logging and tree harvest;
- rapid urbanization and population increase;
- intensified, often monocultural, agricultural and livestock husbandry practices that eliminate trees from rural and urban agricultural areas.

### *Changes or variations in physical and biological environment*

- extreme climatic events (tropical cyclones, drought, tidal waves);
- invasive alien plants, animals and micro-organisms (which pose particularly high threats to the flora and fauna of island ecosystems).

### *Awareness –related factors*

- lack of awareness, at all levels, of the diversity of values, and need for conservation<sup>3</sup> and sustainable use, of forests and trees;
- loss of traditional knowledge of the cultural and ecological importance and use and management of forests and trees;
- failure of recent generations to protect regeneration and plant trees.
- indiscriminate burning and fire.

### *Institutional factors*

- inadequate scientific/traditional information available for informed conservation and sustainable management purposes;
- inadequate national and local capacity (human resources, infrastructure and finances) to develop, implement, monitor and continue programs.

### *Land tenure and legal factors*

- land tenure arrangements that often inhibit centralized conservation activities;
- inadequate legislation and/or enforcement to address the problem of the loss of forest and tree genetic resources.

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<sup>3</sup> Conservation of a resource is here understood as a set of measures that assure its continued existence and availability.

## **II. 2. OPPORTUNITIES AND GUIDELINES**

There are many opportunities and potential activities for addressing these threats to, and underlying and direct causes of, loss of tree and forest genetic resources. The more important of these are indicated below as the “Recommended Actions” of the Plan. Important factors that need to be considered in the implementation of these actions include:

- Planning, implementation and monitoring of actions ought to be, wherever possible and appropriate, be participatory, involving local communities and leadership in the initial phases, and be based on the best practices from both traditional and modern science and management strategies.
- There needs to be careful consideration of who the stakeholders are, whom will benefit or be disadvantaged and in what ways, and whom will be the focus of a given action.
- In each situation, there is a need to carefully identify the nature of the threats to forest and tree genetic diversity as these will differ between different geographical locations.
- The focus of conservation and related initiatives ought to be on “priority” tree species or genetic types of high socio-economic or cultural value, as identified at the regional, country, island and village/community levels.
- A multifaceted approach will be needed in implementing the Action Plan including both *in situ* and *ex situ* conservation strategies<sup>4</sup>, the promotion of sustainable use systems and the strengthening of regional, national and local capacity in relevant fields.
- The promotion of *in situ* conservation and sustainable use at the ecosystem or habitat level will in, most cases, be the most effective way to conserve a broad range of the Pacific’s forest genetic resources.
- Many countries and territories, local communities and regional organizations already have in place or support programs and activities included in the Action Plan. These need to be reviewed to determine which are in need of support and/or strengthening, and where gaps in coverage may exist.
- There is a need to use the SPRIG links and network of collaborating governments, NGOs, and regional and international agencies to strongly support the implementation of the Action Plan, through the provision or identification of funding and appropriate technical expertise.

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<sup>4</sup> These two strategies complement each other. *In situ* conservation means the continuing maintenance of a population within the community of which it is part, in the environment to which it is adapted. *Ex situ* conservation includes conservation as seed, pollen or tissue culture, and in live collections such as arboreta, clone banks, or specially established *ex situ* conservation stands.

## **II.3. OVERVIEW OF THE ACTION PLAN**

The Action Plan and recommendations is organized into four themes discussed during the Pacific Sub-Regional Workshop on Forest and Tree Genetic Resources as follows:

1. Tree Species Priorities for Genetic Resource Operations and Activities
2. Conservation, Sustainable Use and Management of Forests and Trees
3. Germplasm Collection, Exchange and Access
4. Institutional Strengthening, Training Needs and Regional Collaboration

A complete list of proposed actions developed at the workshop is given in appendix 16.

### **II.3.1. THEME 1. Tree Species Priorities for Genetic Resource Operations and Activities in the Pacific**

#### ***II.3.1.1. Introduction***

The discussion and identification of species/operational priorities was carried out during the workshop in three working groups, one each focusing on the broad geographic regions of Melanesia (Fiji, New Caledonia, Papua New Guinea, Solomon Islands and Vanuatu), Polynesia (American Samoa, Cook Islands, French Polynesia, Niue, Samoa, Tonga and Wallis and Futuna) and Micronesia (Guam, Federated States of Micronesia, Marshall Islands, Kiribati, Nauru, Palau, Tuvalu, plus Hawai'i<sup>5</sup>).

The Working Groups adopted slightly differing approaches to identifying about 20 common priority indigenous tree species, a limited number of top priority introduced species, and in identifying operational priorities for each selected species. In nearly all cases, a number of genera and species were considered to be of high priority in several countries and territories, and in many cases in more than one region (appendices 18, 19, 20). Some genera and species were identified as having high priority throughout the Pacific. In the cases of Hawai'i and New Caledonia, both of which have highly distinctive and rather unique endemic tree floras, a small number of top national priorities are included in the table of appendix 18.

Other national priority species can be found in country/territory reports to the workshop (see list of reports in appendix 22). In a few cases a species will have high priority in one country or region, but be of a lower priority in other parts of its distribution, e.g. *Garcinia sessilis* (heilala), a traditionally important cultural plant that is considered to be top priority in Tonga. Exchange of information between countries, including highlighting the importance of conservation of genetic resources throughout the native range of a given species of genus, and germplasm collection/exchange were considered to be among the most effective ways of conserving and working with such species.

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<sup>5</sup> Hawai'i was included in Micronesia group because of its geographic location in the northern Pacific and close political affiliations between USA and former/ trust territories.

Production forestry is a major sector in the economy of the Melanesian countries, and accordingly the identified priority species are mainly commercially important timber trees. Forests in the south-west Pacific, especially in Papua New Guinea and New Caledonia, contain exceptionally diverse tree floras and many high priority tree genetic resources. Accordingly the list of priority species presented in appendix 18 represents only a small proportion of the species in need of research and development and conservation in this zone.

In contrast, the northern and central Pacific includes many small atolls, has a less diverse tree flora, and the identified priorities mainly comprise widely-distributed, multipurpose coastal tree species. These species are major sources of timber, fuel, medicines, food, dyes, flowers and perfumes and many other products of subsistence and commercial value, as well they provide a wide range of ecological services to these low-lying, small-island countries (appendix 20).

*Cocos nucifera* (coconut) is widely regarded as the region's most important multipurpose tree. However, coconut was excluded from consideration because work on improving and conserving its genetic resources is already being undertaken by Agriculture Departments in the region, with networking being provided through IPGRI's COGENT<sup>6</sup>. *Artocarpus altilis* (breadfruit) and *Pandanus tectorius* (screwpine) are also multipurpose tree species of vast economic and cultural significance throughout Pacific Islands, but were only identified as priorities for action in Micronesia. This may be largely attributed to their close association with the agricultural sector, and the limited importance of commercial timber production outside Melanesia. For similar reasons other important Pacific food tree species, such as edible *Barringtonia* species (vutu, navele) and *Inocarpus fagifer* (Tahitian chestnut), were not included in the final priority lists.

### ***II.3.1.2. Species priorities***

#### Indigenous tree species

Three indigenous tree species were identified as being top ten priorities in all parts of the Pacific:

- *Calophyllum inophyllum* (beach mahogany, Alexandrian laurel);
- *Cordia subcordata* (island walnut);
- *Intsia bijuga* (island teak).

All three are widely distributed, coastal tree species which produce highly valued timbers, and are among the most highly valued woods for woodcarving and boat building. In the case of *Intsia bijuga*, it is also found in inland lowland forests as well as along rivers and streams.

In terms of regional priorities for action, the next most important species identified were:

- *Santalum* species (sandalwoods), which are top priorities in south-west Pacific (3 species), eastern Pacific (2 species) and Hawai'i (4 species) (appendices 18, 19, 20);
- *Calophyllum* spp. (especially *neo-ebudicum* and close relatives) all excellent timber species;

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<sup>6</sup> More information on COGENT can be obtained from IPGRI, Rome, Italy, <http://www.ipgri.cgiar.org/>

- *Pometia pinnata* (Pacific lychee), an excellent timber and firewood species, and medicinal and food plant, commonly found in secondary forests, in shifting agricultural areas and around villages;
- *Terminalia* species (including many fast-growing endemic inland species, and the coastal species, *T. catappa* or beach almond);
- *Thespesia populnea* (Thespians tree or milo), an important utility timber species and highly valued for woodcarving.

These were followed closely by:

- *Canarium* species (ngarli, nangai or galip nuts);
- *Diospyros* species (Pacific ebonies);
- *Morinda citrifolia* (Indian mulberry, nonu);
- *Serianthes* species (mamufai, vaivai);
- *Syzygium* species (asi toa, yasiyasi, fekika);
- mangroves (*Xylocarpus*, *Rhizophora* and *Bruguiera* spp.).

### Introduced tree species

The two highest priority introduced trees for the Pacific Islands are *Swietenia macrophylla* (big-leaf mahogany) and *Pinus caribaea* (Caribbean pine), both originating from tropical Central America. There are also several genera and species, some of which have important indigenous species in their native Pacific range, and which constitute priority species where they have been introduced elsewhere in the Pacific islands. These include *Acacia* spp. (especially *A. mangium*, *A. koa* and *A. spirorbis*), *Casuarina equisetifolia* (beach she oak or ironwood) and *Flueggea flexuosa* (namamau or poumuli).

#### **II.3.1.3 Operational priorities**

Activities and actions identified for priority attention varied between different species, with the exception of several top priority species where urgent action was considered necessary in all areas.

### Exploration and germplasm collection

All three working groups assigned top priority, i.e., urgent action needed, for exploration and germplasm collection activities in relation to the priority tree genera and species. This indicates that basic information is lacking, or else not widely available, for even the comparatively better known and widely utilised species.

In particular, biological information and gene-ecological studies were identified as being urgently needed for the following genera: *Artocarpus*, *Alphitonia*, *Calophyllum*, *Endospermum*, *Hibiscus*, *Intsia*, *Pandanus*, *Pisonia*, *Pometia*, *Pterocarpus*, *Santalum*, *Syzygium* and *Thespesia*.

The taxonomy of several complex genera such as *Barringtonia* (especially edible, semi-domesticated species), *Calophyllum*, *Diospyros*, *Pandanus*, *Santalum* (especially Hawai'ian taxa), *Serianthes* (especially *S. melanesica* and associates complex), *Syzygium/Cleistocalyx*, *Terminalia* and *Toona* (especially *T. ciliata*) is not well-understood in the Pacific Islands. There is a need to conduct more field studies, species/provenance trials and sometimes molecular studies to confirm taxonomy (which too frequently relies on dried herbarium materials). Furthermore, Pacific Island's foresters need to become more aware of the accepted nomenclature and species relationships in such poorly understood genera, and encouraged to use the same nomenclature, to facilitate exchange of information and germplasm.

Germplasm collections were identified as a top priority area for many important indigenous tree genera and species in Melanesia and Polynesia. Seed collections are needed for those genera/species for which provenance trials are planned and/or for studies of seed storage behavior. These include *Agathis*, *Alphitonia*, *Calophyllum*, *Canarium*, *Cordia*, *Endospermum*, *Intsia*, *Pometia*, *Pterocarpus*, *Santalum*, *Syzygium*, *Terminalia* and *Thespesia*.

#### Evaluation, improvement and germplasm supply

Evaluation, especially field testing of different provenances or seed source is considered important for several widespread, commercially important indigenous tree species for which little is known. Such species have already demonstrated promise for planting, and identification of the most promising seed sources is regarded as a vital step in their further domestication and use. They include *Agathis* (kauri) species, especially *A. macrophylla*, *Endospermum* species especially *E. medullosum* (whitewood, basswood), *Flueggea flexuosa*, *Gmelina* spp. (*G. molucanna* and *G. vitiense*), *Pandanus* species, *Planchonella samoensis* (mamalava), *Pometia pinnata*, *Pterocarpus indicus* (New Guinea rosewood), *Santalum* species, *Syzygium inophylloides* and *Thespesia populnea*.

Tree improvement was identified as a priority action for major plantation species, notably the two major introduced species, *Pinus caribaea* and *Swietenia macrophylla*. Development of seed stands is a priority activity for many planted species, especially multipurpose and food producing species such as *Artocarpus altilis*, *Canarium* species (*C. indicum* and *C. harveyi*), *Pandanus tectorius* and *Pometia pinnata*.

#### Conservation

Urgent action was recommended for the *in situ* conservation of the genetic resources of *Santalum* species in all three Pacific regions. *In situ* conservation was also considered a priority action for valuable commercial timber and multipurpose species, especially those growing in ecologically sensitive ecosystems, e.g. littoral and mangrove, such as *Intsia*, *Cordia*, *Thespesia*, *Xylocarpus*, *Bruguiera* and *Rhizophora*. *In situ* conservation activities were generally accorded a higher priority in Melanesian countries, although *in situ* conservation is also a priority on most of the Polynesian and Micronesian islands, where many of the high priority species are rare or in danger of local extinction. Priority timber genera/species in need of conservation and management in Melanesia included *Agathis*, *Diospyros*, *Endospermum* and *Dacrydium*.

*Ex situ* conservation was noted as a priority measure for various planted tree species in which desirable cultivars have been selected, such as *Barringtonia*, *Canarium*, *Pandanus*, *Pometia* and *Terminalia catappa*. *Ex situ* conservation, was also recommended, as a complementary conservation measure to *in situ* conservation, for certain high priority species, especially timber species, where maintenance in native habitats is uncertain e.g. *Calophyllum*, *Cordia subcordata*, *Endospermum*, *Intsia*, *Pometia* and *Santalum* species.

At a national level, species conservation strategies need to be urgently developed and implemented for many valuable or locally important tree species whose genetic resources are threatened. The workshop identified several priorities including:

- *Gyrinops ledermannii*<sup>7</sup> in Papua New Guinea;
- *Montrouziera cauliflora* (houp) in New Caledonia;
- *Meterosideros polymorpha*, *Nothocestrum* spp. and *Sophora chrysophylla* in Hawai'i;
- *Xanthostemon* sp. in Solomon Islands.

## **II.3.2. THEME 2. Conservation, Sustainable Use and Management of Forests and Trees**

### ***II.3.2.1. Preamble***

Throughout the Pacific Islands, and especially in Melanesia, there is a need to improve forest management to better ensure a sustainable use of forest and tree genetic resources. This is inclusive of improved land use planning and multiple use management of forested areas. Improved forest management is also a decisive factor in *in situ* conservation activities.

### ***II.3.2.2. Recommendations made during the Workshop***

#### A. Replanting programs

Reforestation and tree planting programs using both indigenous and introduced tree species need to be further encouraged and developed in the Pacific Islands. Establishment of plantations and agroforestry programs will reduce the pressure on the region's native forests. Priority indigenous species for inclusion in such plantation and agroforestry programs in the Pacific are identified in the country reports to this workshop.

#### B. Conservation

It is vital that regional and national programs, including SPRIG, be continued to foster the conservation of priority forest and tree genetic resources. Conservation of forest tree genetic resources will need to include both *in situ* and *ex situ* approaches.

It is strongly recommended that agencies involved in forestry and conservation within Pacific Island countries take action to conserve populations of priority trees species, as identified in this plan.

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<sup>7</sup> *Aquilaria* sp. at the Workshop.

### C. Participatory approach and stakeholder involvement

Further we encourage and support the involvement and commitment of all stakeholders, especially landholders, in forest conservation and management, towards the development of national programs on priority species. This includes the incorporation of traditional practices and leadership with modern science based approaches in conservation and use plans.

D. The uniqueness of Pacific Island environments and the need to protect priority species and ecosystems from threats such as pests, diseases, fires and invasive species need to be fully recognized. Any exchange of germplasm of priority species needs to be subject to screening and quarantine. Prior to introduction of new species, varieties, or germplasm from other locations a science-based risk analysis ought to be performed.

### E. Research.

The limited available resources for forest genetic resources research and development ought to be focussed on priority species in the following subject areas:

- assessment of the distribution and conservation status of forest genetic resources;
- identification of the main threats to the viability of forest genetic resources, including inappropriate land use practices, systems of harvesting, existing pests and invasive organisms;
- identification and description of existing local sustainable forest use practices and management regimes, to enable their wider adoption, and of indicator species that can help monitor progress made;
- assessment of requirements for species conservation plans for different countries and the region;
- germination and propagation techniques.

## **II.3.3. THEME 3. Germplasm Collection, Exchange and Access**

Tree germplasm consists of seed, pollen and vegetative materials able to be propagated, such as tissue-cultured plantlets and cuttings. Germplasm may be either indigenous/local or introduced to a country or region. At present the region's major forest plantations are based on introduced tree species and germplasm. Relatively little is known about the region's indigenous tree species and basic information may be lacking on important biological characteristics such as seed storage character and susceptibility to pests and diseases.

There is only limited exchange of tree germplasm between countries and territories, mainly for research and development, although historically Pacific peoples have moved useful tree germplasm widely within the region, and introduced many tree species from South-east Asia. Current international exchange involves both supply and receipt of germplasm between countries. Germplasm collections for exchange need to be well-documented and accompanied by a seed origin certificate, and where required an phytosanitary certificate. All exchange or access must be in accord with national and international regulations/or conventions. Furthermore germplasm needs to be moved in accordance with appropriate quarantine provisions and transport regimes and after a proper risk analysis. Germplasm may then be tested in small-scale trials where its adaptation, including risks of invasiveness, are carefully monitored.

### ***II.3.3.1. Germplasm exchange***

#### **A. Databases on tree species characteristics and seed availability**

Databases, such as the one being compiled by SPRIG, provide a ready source of information on Pacific Island tree species and seed availability. Pacific Island countries and territories need to be involved in the development and use of appropriate databases. Information on seed handling characteristics of indigenous tree species is vital and there is a need to document/database and better share existing unpublished information on seed characteristics of Pacific Island tree species amongst countries and territories. Suitable links with regional and international databases are desirable.

Pacific Island countries and territories need to be assisted to make more extensive use of regional and international databases on forest genetic resources, including contributing data on indigenous species. Regional and international institutions, notably SPC, FAO and IPGRI, are well placed to assist in this activity.

#### **B. Seed collection**

While basic seed collection skills are available in-country some important on-the-job training is required to make seed collection operations more successful.

There is a need for on-the-job training in seed collection from tall forest trees and seed handling especially for species with recalcitrant seed.

#### **C. *Ex situ* conservation (as seed)**

In general, small storage facilities (a domestic type refrigerator) will suffice for short-term seed storage in most small Pacific islands. In some cases facilities for seed storage may exist within agricultural organizations and these can also be used for storing tree seed. In some cases, small island countries with limited seed storage facilities may need to be assisted to store seed in appropriate storage facilities within the region. For priority tree species with recalcitrant seed there is a need to develop living genebanks from which seed may be readily obtained.

It is recommended that where alternative in-country storage is not available that countries be assisted to either obtain domestic refrigerators or else be assisted to utilize an appropriate regional facility to store tree seed on a temporary basis. It is also recommended that greater emphasis be given to developing *ex situ* seed stands for species with recalcitrant seed.

#### **D. Special needs of small island nations in the Pacific**

The workshop noted that the environments of small atoll island nations are unique and greater attention needs to be given to their special circumstances. For example, some of these countries are especially interested in *Pandanus* and mangrove species for multipurpose plantings.

A wide range of tree species, including *Pandanus* and other palms, mangroves and coastal tree species are required for planting and it is recommended that greater attention be given to capturing and evaluating their genetic diversity for small scale tree farming systems in the Pacific.

### E. Weedy tree species

Forest ecosystems of island countries are especially vulnerable to introduced tree species with environmental weed potential. Greater attention must be given to protecting Pacific Islands from invasive introduced weedy trees through developing skills in import risk analysis and management or eradication programs as necessary under established Emergency Response Planning coordinated by SPC-PPS.

Information on introduced weedy plant species of environmental concern has been compiled for Micronesia and American Samoa by the Pacific Islands at Risk Project of the USDA Forest Service. It is recommended that a database on introduced weedy trees, both known and potential, for the rest of the Pacific be prepared by SPC in close collaboration with the Forest Service, SPRIG, SPREP, the Department of Conservation and Landcare Research (New Zealand), the International Union for the Conservation of Nature's Invasive Species Specialist Group and others with expertise in this area, and sent to SPC-PPS Information Service for databases and distribution to the Plant Quarantine and forest management sections in each country and territory.

#### ***II.3.3.2. Quarantine***

Safe movement of germplasm and the prevention of pests and diseases from being spread are absolutely critical to Pacific island communities.

#### A. A database on pests and diseases of priority introduced and indigenous species in the Pacific is urgently needed.

It is recommended that more data be gathered on pests and diseases of tree species that are likely candidates for germplasm exchange and that these be included in FAO's Global Plant and Pest Information System (GPPIS)<sup>8</sup> through the SPC-PPS as the regional co-ordinating editor. This recommendation applies to indigenous species plus economically important introduced trees in the region e.g. *Swietenia*. SPC quarantine is encouraged to advance their research in this area as part of a regional initiative.

#### B. There appears to be limited co-ordination between forestry and quarantine Departments in-country.

It is recommended that greater efforts be made to coordinate within-country linkages between forestry and quarantine officials via established PPPO networks. It is recommended that SPC PPS/PPPO be encouraged to establish a regional workshop to discuss these issues at the earliest opportunity, as requested by the Heads of Forestry at their September, 1998, annual meeting.

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<sup>8</sup> GPPIS is a public domain database and forum designed for plant and crop pests and diseases. It is based on Internet at <http://www.fao.org/ag/agp/agpc/doc/info.htm> and also available on CD-ROM from FAO, Rome, Italy.

C. Pest Risk Analyses are lacking for nearly all tree species in the Pacific.

It is recommended that SPC/PPPO prepare Pest Risk Analysis for the safe movement of germplasm in the region from countries likely to be suppliers e.g. Australia and New Zealand as well as for movement between and within Pacific Island countries and territories. This process should start with the collection of information on pests and diseases associated with the priority species identified during the workshop (appendices 18, 19, 20).

It is recommended that SPC/PPPO develop pest profiles or data sheets for the region's most high risk forest pests. Initially work ought to focus on the 10 most dangerous pests.

***II.3.3.3. International and legal considerations on germplasm exchange and access***

The meeting recognizes that, in the final analysis, access to forest genetic resources remains an issue of national sovereignty.

Pacific Island countries and territories are encouraged to tap into existing frameworks for advice on legal and technical issues relating to exchange of forest genetic resources. However, there needs to be an increase in available resources to provide ready access to informed and sympathetic legal and technical opinion for forestry issues. Particular attention should be given to the following:

- Regional arrangements relating to forest genetic resources exchange need to be consistent among sovereign states and organizations.
- Regional arrangements relating to forest genetic resources exchange ought to be consistent with rules, regulations and guidelines operating in other sectors.

Recognizing the role that SPREP plays as a regional lead agency on conservation issues (particularly forest ecosystem conservation), the participants of the meeting also recognized that the mechanisms (including Code of Conduct), developed and implemented through SPRIG, have been effective and useful at the species level and this needs to be continued and expanded to cover more countries and species.

#### **II.3.4. THEME 4. Institutional Strengthening, Training Needs and Regional Collaboration**

Most Pacific countries and territories have small Forestry and Environment Departments, with limited personnel and budget. There is a need to ensure that staff are well-trained and informed in the subject area of conservation, management and utilization of forest and tree genetic resources. The depth of skills and expertise in the region needs to be enhanced through the balanced use of both longer-term University training and through technical hands-on training.

Regional collaboration needs to be maintained and strengthened, especially in the field of research and development and conservation of species which occur in several countries and territories.

More specifically the following needs and priorities have been identified:

##### Training

- Need for informal training through staff exchange programs and short-term attachments organized between countries within the region.
- Need to participate in short-courses in subjects related to forest genetic resources including:
  - technical issues (e.g. taxonomy, seed collection, safe movement of germplasm, propagation, identification/selection of seed sources, trial design, clonal forestry, tree domestication and improvement);
  - project implementation and management (e.g. participatory approaches to implementation of activities related to conservation and sustainable forest management);
  - social, economic and legal issues (e.g. traditional knowledge, intellectual property rights).
- Training through participation in study tours within the region which address common issues, such as conservation of forest genetic resources and codes of logging practice/sustainable forest management.
- Need for support in maintaining and enhancing professional skills through longer-term university level training (both graduate and postgraduate).
- Need to strengthen networks and links between researchers and research and development organizations working in different islands through short-term visits and workshops.
- Need for regional and international organizations and programs, including FAO, IPGRI, SPREP, SPC and SPRIG, to assist in developing technical guidelines on forest genetic resources and in widely disseminating technical forestry publications and literature at appropriate levels and in widely-used languages.

### Facilities

- Need to make best use of existing national seed storage facilities and to integrate forestry related facilities with those established in agriculture and other sectors.
- Exploration of opportunities for seed storage at regional level using already existing facilities.
- Support for making propagation facilities more widely available. Such facilities need to be based on appropriate technology, i.e. simple, cheap, robust and sustainable.
- Review of national herbarium facilities; what is required at national c.f. regional level (reference collections), how national facilities may be upgraded and made sustainable, use of electronic media to store data and images.

### Policy issues

- Need for Departments and personnel with responsibility for forestry and agroforestry to be proactive in linking with other land management and environment agencies.
- Need to raise awareness at political level of the importance of forestry issues in general and of forest genetic resource conservation and management issues in particular, and to promote the incorporation of forest genetic resources considerations into development plans and activities.

## **II.4. GENERAL CONCLUSION**

The activities and recommendations made by sixty participants at the Pacific Sub-Regional Workshop on Forest and Tree Genetic Resources, and reported in this Pacific Sub-Regional Action Plan for Conservation, Management and Sustainable Use of Forest and Tree Genetic Resources, represent a first attempt by Pacific Islands countries and territories to identify, prioritize and record issues of regional importance relating to forest genetic resources. For the first time, the Action Plan puts forward a consensus framework for action, with a view to promoting targeted, sound and equitable cooperative activities to the benefit of island countries, territories, local communities and individuals.

The plan is dynamic, requiring updating at regular intervals, for example in the light of the evolution of the status of tree species, changes in the ranking of priorities, and progress made towards the sustained management of forest tree genetic resources. In its current state, its ambition is to be used as a recognized basis for action. Based on these elements, more precise proposals, such as project proposals for example, could be formulated with the aim of presenting them for consideration and support by Governments, NGOs, private sector and donors and implementation by various partners.

**APPENDICES**

## Appendix 1: list of abbreviations and acronyms

AusAID	Australian Assistance for International Development
CGIAR	Consultative Group for International Agricultural Research
CI	Conservation International
CIFOR	Center for International Forestry Research (a CGIAR center)
CIRAD-Forêt	Forestry Division of the Centre international de recherche agricole pour le développement
CITES	Convention on International Trade in Endangered Species
COGENT	International Coconut Genetic Resources Network (IPGRI)
CSIRO	Commonwealth Scientific and Industrial Research Organization (Australia)
FAO	Food and Agriculture Organization of the United Nations
FGR	Forest Genetic Resources
FSM	Federated States of Micronesia
FSPI	Foundation of the Peoples of the South Pacific International
GLOMIS	Global Mangrove Database and Information System
HoF	Heads of Forestry
ICRAF	International Center for Research on Agroforestry
IPGRI	International Plant Genetic Resources Institute
IUCN	The World Conservation Union
KFPL	Kolobaqara Forestry Plantation Limited
NEMS	National Environment Management Strategy
NGO	Non-Governmental Organization
NTFP	Non-Timber Forest Products
ORSTOM	Office de recherche scientifique et technique d'outre mer
PGRFP	Pacific-German Regional Forestry Project (GTZ/SPC)
PIC	Pacific Island Country or Territory
PNG	Papua New Guinea
SIDT	Solomon Islands Development Trust
SOLTRUST	Solomon Islands Trust
SPACHEE	South Pacific Action Committee for Human Ecology and Environment
SPBCP	South Pacific Biodiversity Conservation Program (GEF/SPREP)
SPC	Secretariat of the Pacific Community (formerly South Pacific Commission)
SPREP	South Pacific Regional Environment Programme
SPRIG	South Pacific Regional Initiative on Forest Genetic Resources
SWIFT	Solomon Western Islands Fair Trade
TNC	The Nature Conservancy
UNDP	United Nations Development Programme
UNEP	United Nations Environment Program
US	United States of America
USAID	United States Agency for International Development
USDA	United States of America Department of Agriculture
USP	University of the South Pacific
WWF	World Wildlife Fund

## Appendix 2: statistical summary of up to 50 important indigenous and up to 20 exotic tree species and their uses in the sub-region

Country	Origin	Total species	Percentage species used for each major category				
			Wood	Food/ Fodder	NWFP	Services	Other
PNG	Indigenous	50	98	28	18	96	0
	Exotic	20	95	5	0	96	0
Solomon Is.	Indigenous	50	94	48	62	82	6
	Exotic	20	85	60	25	95	12
Vanuatu	Indigenous	50	100	44	12	72	0
	Exotic	14	86	57	14	79	0
<b>*Means for Melanesia</b>	<b>Indigenous</b>		<b>97</b>	<b>40</b>	<b>31</b>	<b>83</b>	<b>2</b>
	<b>Exotic</b>		<b>89</b>	<b>40</b>	<b>12</b>	<b>95</b>	<b>5</b>
FSM	Indigenous	19	68	11	21	32	5
	Exotic	0					
Guam	Indigenous	16	63	44	31	100	0
	Exotic	0					
Kiribati	Indigenous	50	64	22	50	66	16
	Exotic	7	42	57	0	86	57
<b>*Means for Micronesia</b>	<b>Indigenous only</b>		<b>65</b>	<b>24</b>	<b>40</b>	<b>65</b>	<b>11</b>
American Samoa	Indigenous	42	52	10	33	76	5
	Exotic	2	100	0	0	50	0
Cook Is.	Indigenous	14	100	27	53	47	0
	Exotic	1-for Wood					
French Polynesia	Indigenous	43	49	12	49	12	24
	Exotic	11	64	0	27	0	27
Samoa	Indigenous	35	100	6	6	29	0
	Exotic	10	100	0	0	40	0
Tonga	Indigenous	84	85	40	61	73	15
	Exotic	32	69	47	57	81	15
Wallis & Futuna	Indigenous	50	50	22	52	0	2
	Exotic	0					
<b>*Means for Polynesia</b>	<b>Indigenous</b>		<b>70</b>	<b>36</b>	<b>45</b>	<b>43</b>	<b>10</b>
	<b>**Exotic</b>		<b>74</b>	<b>1</b>	<b>40</b>	<b>57</b>	<b>15</b>

\*Weighted means

\*\* Means only for French Polynesia, Samoa and Tonga.

### Countries/Territories

AmSa = American Samoa

Cook = Cook Islands

FSM = Federated States of Micronesia

FrPol = French Polynesia

Kiri = Kiribati

PNG = Papua New Guinea

Sam = Samoa

Sol = Solomon Islands

Ton = Tonga

Van = Vanuatu

Wal&Fut = Wallis & Futuna

### Uses

Wood includes sawn timber, round post, carving canoe.

Food & Fodder includes fruit, nut, green vegetable, honey, animal fodder.

Non-wood forest products include medicinal plants, gums, resins, tannins, oils, cultural/custom use, plants, gums, resins, tannins, oils, cultural/custom use.

Services include shade, shelter, amenity, living fence, coastal stabilisation, soil and water conservation, sacred.

**Appendix 3: list of up to 10 important indigenous species given highest priority or those with the widest range of uses from each country – Melanesia, Micronesia and Polynesia**

Countries of Melanesia			Countries of Micronesia				Countries of Polynesia				
Papua New Guinea	Solomon islands	Vanuatu	Guam	Federated States of Micronesia	Kiribati	American Samoa	Cook Islands	French Polynesia	Samoa	Tonga	Wallis & Futuna
<i>Agathis</i> spp.	<i>Alstonia scholaris</i>	<i>Agathis macrophylla</i>	<i>Artocarpus marianensis</i>	<i>Barringtonia asiatica</i>	<i>Artocarpus marianensis</i>	<i>Cananga odorata</i>	<i>Casuarina equisetifolia</i>	<i>Aleurites moluccana</i>	<i>Calophyllum neo-ebudicum</i>	<i>Bischofia javanica</i>	<i>Artocarpus altilis</i>
<i>Alstonia scholaris</i>	<i>Barringtonia edulis</i>	<i>Canarium harveyi</i>	<i>Cycas circinalis</i>	<i>Hibiscus tiliaceus</i>	<i>Calophyllum inophyllum</i>	<i>Cocos nucifera</i>	<i>Cocos nucifera</i>	<i>Alphitonia zizyphoides</i>	<i>Flueggea flexuosa</i>	<i>Casuarina equisetifolia</i>	<i>Bischofia javanica</i>
<i>Calophyllum</i> spp.	<i>Calophyllum inophyllum</i>	<i>Canarium indicum</i>	<i>Elaeocarpus joga</i>	<i>Metroxylon amicarum</i>	<i>Cocos nucifera</i>	<i>Flueggea flexuosa</i>	<i>Cordia subcordata</i>	<i>Alstonia costata</i>	<i>Garuga floribunda</i>	<i>Cocos nucifera</i>	<i>Casuarina equisetifolia</i>
<i>Castanopsis acuminatissima</i>	<i>Canarium indicum</i>	<i>Endospermum medulosum</i>	<i>Heritiera longipetiolata</i>	<i>Rhizophora</i> spp.	<i>Cordia subcordata</i>	<i>Intsia bijuga</i>	<i>Calophyllum inophyllum</i>	<i>Argusia argentea</i>	<i>Inocarpus fagifer</i>	<i>Fagraea berteriana</i>	<i>Cocos nucifera</i>
<i>Dracontomelon dao</i>	<i>Endospermum medulosum</i>	<i>Flueggea flexuosa</i>	<i>Intsia bijuga</i>	<i>Sonneratia alba</i>	<i>Hernandia nymphaeifolia</i>	<i>Adenanthera pavonina</i>	<i>Morinda citrifolia</i>	<i>Artocarpus altilis</i>	<i>Manilkara hoshinoi</i>	<i>Garcinia sessilis</i>	<i>Flueggea flexuosa</i>
<i>Ganophyllum falcatum</i>	<i>Gmelina muluccana</i>	<i>Garuga floribunda</i>	<i>Merrilliodendron megacarpum</i>	<i>Terminalia carolinensis</i>	<i>Pandanus tectorius</i>	<i>Casuarina equisetifolia</i>	<i>Pandanus edulis</i>	<i>Astronidium glabrum</i>	<i>Palaquium stehlinii</i>	<i>Garuga floribunda</i>	<i>Neonauclea forsteri</i>
<i>Intsia bijuga</i>	<i>Intsia bijuga</i>	<i>Intsia bijuga</i>	<i>Pandanus tectorius</i>	<i>Xylocarpus granatum</i>	<i>Pemphis acidula</i>	<i>Dysoxylum samoensis</i>	<i>Santalum insulare</i>	<i>Barringtonia asiatica</i>	<i>Planchonella garberi</i>	<i>Inocarpus fagifer</i>	<i>Pometia pinnata</i>
<i>Intsia patembanica</i>	<i>Pometia pinnata</i>	<i>Pterocarpus indicus</i>	<i>Serianthes nelsonii</i>			<i>Hibiscus tiliaceus</i>	<i>Thespesia populnea</i>	<i>Calophyllum inophyllum</i>	<i>Pometia pinnata</i>	<i>Pometia pinnata</i>	<i>Syzygium clusiaefolium</i>
<i>Terminalia kaerbachii</i>	<i>Pterocarpus indicus</i>	<i>Santalum austrocaledonicum</i>	<i>Tabernaemontana rotensis</i>			<i>Pandanus tectorius</i>		<i>Casuarina equisetifolia</i>	<i>Syzygium inophylloides</i>	<i>Santalum yasi</i>	<i>Syzygium inophylloides</i>
<i>Vitex cofassus</i>	<i>Vitex cofassus</i>	<i>Terminalia catappa</i>	<i>Tristropsis obtusangula</i>			<i>Pometia pinnata</i>		<i>Maytenus crenatus</i>	<i>Terminalia catappa</i>		

### Appendix 4: important tree species listed by two or more countries and their major uses

Species	Wood	Food & Fodder	Non-wood forest product	Services	Other uses
<i>Agathis</i> spp. (PNG) <i>A. macrophylla</i> (Van)	PNG, Van.		PNG, Van	PNG, Van	
<i>Alstonia scholaris</i>	PNG, Sol		PNG, Sol	PNG, Sol	
<i>Artocarpus altilis</i>	FrPol Wal & Fut	FrPol Wal&Fut	Fr Pol Wal&Fut		FrPol
<i>Artocarpus marianensis</i>	Guam, Kiri	Guam, Kiri	Guam, Kiri	Guam, Kiri	
<i>Barringtonia asiatica</i>	FrPol		FSM, FrPol	FSM	FrPol
<i>Bischofia javanica</i>	Ton, Wal&Fut		Ton, Wal&Fut	Ton	Ton
<i>Calophyllum inophyllum</i> <i>Calophyllum</i> spp (PNG)	Cook, FrPol, PNG, Sol, Kiri	FrPol, Sol	Cook, FrPol, PNG, Kiri, Sol	FrPol, PNG, Kiri, Sol	Kiri
<i>Canarium indicum</i>	Sol, Van	Sol, Van	Sol, Van	Sol, Van	
<i>Casuarina equisetifolia</i>	AmSa, Cook, Ton, FrPol, Wal&Fut		Cook, FrPol,	AmSa, FrPol	FrPol
<i>Cocos nucifera</i>	AmSa, Cook, Kiri, Ton, Wal&Fut	AmSa, Cook, Kiri, Ton	Cook, Kiri, Ton	AmSa, Kiri, Ton	Ton
<i>Cordia subcordata</i>	Cook, Kiri	Cook, Kiri	Cook, Kiri	Kiri	
<i>Endospermum medullosum</i>	Sol, Van		Sol	Sol	
<i>Flueggea flexuosa</i>	AmSa, Sam, Van, Wal&Fut	Wal&Fut	Wal&Fut	AmSa, Sam, Van	
<i>Garuga floribunda</i>	Sam, Ton, Van		Ton	Sam, Ton, Van	
<i>Hibiscus tiliaceus</i>	AmSa, FSM		AmSa, FSM	AmSa	
<i>Inocarpus fagifer</i>	Ton	Ton, Sam,	Ton, Sam	Ton, Sam	
<i>Intsia bijuga</i>	AmSa, Guam, PNG, Sol, Van	PNG, Sol	AmSa, Guam, Sol, Van	Guam, PNG, Sol, Van	
<i>Pandanus tectorius</i>	Kiri	Guam, Kiri	AmSa, Guam, Kiri	AmSa, Guam, Kiri	
<i>Pometia pinnata</i>	AmSa, Sam, Sol, Ton, Wal&Fut	AmSa, Sol, Ton, Wal&Fut	Sol, Ton	Sol, Ton	
<i>Pterocarpus indicus</i>	Sol, Van	Sol, Van	Sol	Sol, Van	
<i>Syzygium inophylloides</i>	Sam, Wal&Fut				
<i>Vitex cofassus</i>	PNG, Sol	PNG, Sol	Sol	PNG, Sol	

This shows which countries list the major uses. The species are from the 10 selected by each country as shown in the table of the appendix 3.

#### Countries/Territories

AmSa = American Samoa

FrPol = French Polynesia

Sam = Samoa

Van = Vanuatu

Cook = Cook Islands

Kiri = Kiribati

Sol = Solomon Islands

Wal&Fut = Wallis & Futuna

FSM = Federated States of Micronesia

PNG = Papua New Guinea

Ton = Tonga

#### Uses

Wood includes sawn timber, round post, carving canoe,

Food & Fodder includes fruit, nut, green vegetable, honey, animal fodder.

Non-wood forest products include medicinal plants, gums, resins, tannins, oils, cultural/custom use, plants, gums, resins, tannins, oils, cultural/custom use.

Services include shade, shelter, amenity, living fence, coastal stabilisation, soil and water conservation, sacred.

### Appendix 5: major forest types in the Melanesian islands group

Forest type	Some characteristic or important tree species where reported				
	Papua New Guinea	Solomon Islands *	New Caledonia	Vanuatu **	Fiji ***
	13 forest types	13 forest types	8 forest types	8 forest types	8 forest types
<b>Mangrove</b>	<i>Bruguiera</i> spp. <i>Rhizophora</i> spp. <i>Avicennia</i> spp. <i>Xylocarpus</i> spp.	<i>Bruguiera</i> spp. <i>Rhizophora</i> spp. <i>Avicennia</i> spp. <i>Xylocarpus</i> spp.	Type identified but no species reported.	<i>Bruguiera</i> spp. <i>Rhizophora</i> spp. <i>Avicennia</i> spp. <i>Xylocarpus</i> spp.	<i>Bruguiera</i> spp. <i>Rhizophora</i> spp. <i>Xylocarpus</i> spp.
<b>Littoral/Strand or Beach forest</b>	The structure and species composition of strand or littoral forest types are similar throughout the Melanesian countries reflecting similar physical conditions and widespread dispersal by sea. Some typical tree species are <i>Barringtonia asiatica</i> , <i>Callophyllum inophyllum</i> , <i>Cerbera manghas</i> , <i>Intsia bijuga</i> , <i>Casuarina equisetifolia</i> , <i>Hernandia nymphaefolia</i> , <i>Terminalia cattapa</i> , <i>Cordia subcordata</i> and <i>Pandanus</i> spp.				
<b>Coastal</b>	Type not identified	Type not identified		Type not identified	<i>Terminalia catappa</i> , <i>Inocarpus fagifer</i> , <i>Cordia subcordata</i> , <i>Intsia bijuga</i>
<b>Chalky forests</b>	Type not identified	Type not identified	<i>Intsia bijuga</i> <i>Araucaria</i> spp.	Type not identified	Type not identified
<b>Lowland Rainforest</b>	<i>Pometia pinnata</i> , <i>Intsia bijuga</i> , <i>Octomeles</i> spp.	<i>Calophyllum</i> spp. <i>Camptosperma brevipetiolatum</i> <i>Dillenia salomonensis</i> , <i>Pometia pinnata</i> .	<u>On valleys, slopes and mid-altitude</u> No species identified	<i>Syzygium</i> spp., <i>Dysoxylum</i> spp., <i>Pterocarpus indicus</i> , <i>Endospermum</i> spp., <i>Calophyllum</i> spp., <i>Agathis macrophylla</i>	<i>Endospermum macrophyllum</i> Gmelina <i>vitiensis</i> , <i>Pometia pinnata</i> , <i>Syzygium</i> spp.
<b>Alluvial Valley forest</b>	<i>Pometia</i> spp., <i>Octomeles</i> spp.	<i>Albizia salomonensis</i> <i>Planchonella thyrsoidea</i>	Type not identified	Type not identified	Type not identified
<b>Fresh water Swamp mixed forest</b>	Type identified but no species reported	<i>Inocarpus fagifer</i> , <i>Eugenia tiermeyana</i> , <i>Casuarina papuana</i> , <i>Terminalia brasii</i>	Type identified but no species reported.	Type not identified	Not identified
<b>Swamp-Pandanus</b>	Type not identified	<i>Pandanus</i> spp.	Type not reported	Type not identified	Not identified
<b>Swamp – Palm</b>	Type not identified	Type identified but no species reported	Type not reported	Type not identified	Not identified
<b>Lowland moist seasonal or deciduous forest</b>	Type identified but no species reported	<i>Cananga odorata</i> <i>Kleinhovia hospitata</i> , <i>Semecarpus</i> spp.	Type not reported	<i>Kleinhovia hospitata</i> , <i>Dendrocnide</i> spp. <i>Castanospermum australis</i> , <i>Antiaris toxicana</i>	Not identified

Forest type	Some characteristic or important tree species where reported				
	Papua New Guinea	Solomon Islands *	New Caledonia	Vanuatu **	Fiji ***
<i>Lowland deciduous – dry</i>				<i>Acacia</i> spp. <i>Garuga floribunda</i>	Not identified
<i>Hill forest</i>	Type not reported	<i>Calophyllum kajewskii</i> , <i>Celtis</i> spp. <i>Palaquium</i> spp. <i>Endospermum medullosum</i>	<u>Sclerophyll forest</u> type identified but no species reported.	Type not identified	Type not identified
<i>Savannah</i>	<i>Santalum macgregorii</i>	Not reported	<u>Arborescent savannah</u> identified but no species reported	Type not identified	Type not identified
<i>Savannah - seasonal</i>	<i>Acacia</i> spp., <i>Melaleuca</i> spp., <i>Xanthostemon</i>	Not reported	<u>Maquis – shrublands</u> identified but no species reported	Type not identified	Not identified
<i>High dryland forest</i>	Not identified	Not identified	Not identified	Not identified	<i>Agathis</i> , <i>Decussocarpus</i> spp. <i>Dacrydium</i> spp.
<i>Lower mountain</i>	<i>Araucaria</i> spp. <i>Agathis</i> spp.			<u>Mountain forest not subdivided</u>	
<i>Upper mountain</i>	<i>Araucaria</i> spp.	<u>Mountain forest not subdivided</u>	High altitude cloud forest identified but no species reported	<i>Metrosideros collina</i> <i>Weinmannia</i> spp. <i>Syzygium</i> spp. <i>Geissois</i> spp.	Type not identified
<i>Mountain and high altitude ridge forest</i>	<i>Araucaria</i> spp. <i>Castanopsis</i> spp. <i>Nothofagus</i> spp. <i>Lithocarpus</i> spp.	<i>Dacrydium</i> spp., <i>Eugenia</i> spp.			
<i>Secondary forest</i>	<i>Eucalyptus</i> spp.	<i>Vitex cofassus</i> <i>Rhus taitensis</i> <i>Cananga odorata</i> , <i>Kleinhovia hospitata</i> , <i>Trichospermum</i> spp.	Not reported	<i>Commersonia batramia</i> , <i>Cordia dichotoma</i> , <i>Premna corymbosa</i>	<i>Commersonia batramia</i> , <i>Macaranga</i> spp., <i>Alphitonia zizyphoides</i>
<i>Abandoned fields and gardens</i>	<i>Eucalyptus</i> spp. <i>Pinus</i> spp. <i>Santalum</i> spp.	<i>Areca catechu</i> <i>Alphitonia</i> spp. <i>Acalypha grandis</i> , <i>Macaranga</i> spp. <i>Fruit trees</i> .	Not reported	<i>Macaranga</i> spp., <i>Alphitonia zizyphoides</i> , <i>Commersonia batramia</i> , <i>Hibiscus tiliaceus</i> , <i>Ficus</i> spp.	<i>Syzygium malaccense</i> , <i>Macaranga</i> spp. Fruit trees.

\*Classification of Solomon Islands forest types in the workshop paper is here supplemented with information from Hancock *et al.*, 1998.

\*\*The forest types for Vanuatu presented here are as described by Wheatley, 1992.

\*\*\*Forest types for Fiji are based mainly on descriptions in Smith, 1979

### Appendix 6: major forest types in the Micronesian islands group

Forest type	Some characteristic or important tree species where reported					
	Palau	Guam	Federated States of Micronesia	Nauru	Marshall Islands	Kiribati
	6 forest types	6 forest types	6 forest types	5 forest types	4 forest types	5 forest types
<b>Strand/Littoral</b>	Type not identified	Type identified but no species reported	<i>Calophyllum inophyllum</i> <i>Cordia subcordata</i> <i>Terminalia catappa</i>	<i>Terminalia catappa</i> <i>Calophyllum inophyllum</i> <i>Barringtonia asiatica</i> <i>Hernandia nymphaefolia</i> <i>Morinda citrifolia</i>	Single forest type on atolls is strand forest. See under atoll.	<i>Pemphis acidula</i> <i>Terminalia catappa</i>
<b>Mangrove</b>	Type identified but no species reported	Type not identified	<i>Rhizophora</i> spp. <i>Sonneratia alba</i> <i>Bruguiera gymnorhiza</i> <i>Xylocarpus granatum</i> , <i>Nipa fruiticans</i>	<i>Bruguiera gymnorhiza</i>	Type identified but no species reported	<i>Rhizophora mucronata</i> <i>Lumnitzera littoria</i> , <i>Sonneratia alba</i>
<b>Swamp</b>	Type identified but no species reported	Type not identified	Type not reported	Type not identified	Type identified but no species reported	Associated with mangrove
<b>Limestone</b>	Type identified but no species reported	Type identified but no species reported	Type not reported	Type not identified	Type absent	Type absent
<b>Inland – upland</b>	Type identified but no species reported	Type not identified	See rainforest	<i>Calophyllum inophyllum</i> <i>Premna serratifolia</i> <i>Terminalia catappa</i> , <i>Guettarda speciosa</i>	Type absent	Type absent
<b>Inland - lowland</b>	Type not recorded	Type not identified	Type not reported	Type not identified	Type absent	<i>Guettarda</i> spp. <i>Cordia subcordata</i> <i>Calophyllum inophyllum</i>
<b>Rainforest</b>	Type not reported	Type not identified	<i>Myristica insularum</i> <i>Elaeocarpus carolinensis</i> <i>Terminalia carolinensis</i> <i>Camptosperma brevipetiolata</i> <i>Ptychosperma</i> spp.	Type absent	Type absent	Type absent
<b>Ravine/riparian</b>	Type not reported	Type identified but no species reported	Type not reported	Type absent	Type absent	Type absent

Forest type	Some characteristic or important tree species where reported					
	Palau	Guam	Federated States of Micronesia	Nauru	Marshall Islands	Kiribati
<i>Atoll</i>	Type identified but no species reported	Type not reported	See under littoral	Type not identified	<i>Pisonia grandis</i> <i>Neisosperma oppositifolia</i> , <i>Cordia subcordata</i> , <i>Barringtonia asiatica</i> , <i>Suriana maritima</i> , <i>Pemphis acidula</i>	All of Kiribati is atoll with 2 natural forest types identified. See under strand/littoral and inland-lowland.
<i>Scrubland/savannah</i>	Type not reported	Type identified but no species reported	Type identified but no species reported	Type not identified	Type not present	Type absent
<i>Secondary forest</i>	Type not reported	Type identified but no species reported	<i>Inocarpus fagifer</i>	<i>Psidium guajava</i> <i>Hibiscus tiliaceus</i> <i>Ochrosia elliptica</i>	<i>Cocos nucifera</i> <i>Psidium guajava</i> <i>Leucaena leucocephala</i>	<i>Cocos nucifera</i> <i>Pandanus</i> spp.
<i>Garden</i>	Type not reported	Type identified but no species reported	<i>Pandanus</i> spp. <i>Mangifera indica</i>	<i>Pandanus</i> spp.	<i>Cocos nucifera</i> <i>Mangifera indica</i> <i>Psidium guajava</i> <i>Deloxia regia</i>	<i>Cocos nucifera</i> , <i>Artocarpus altilis</i> <i>Carica papaya</i> <i>Musa</i> spp. <i>Pandanus</i> spp.

## Appendix 7: major forest types in the Polynesian islands group

		Some characteristic important tree species reported							
Forest type	Hawai'i	Tonga	Wallis & Futuna	Samoa	American Samoa	Niue	Cook Islands	French Polynesia	
	24 types	9 types	6 types	10 types	8 types	3 types	7 types	11 types	
<b>Mangrove</b>	Not reported	<i>Bruguiera gymnorhiza</i> , <i>Rhizophora mangle</i> , <i>Excoecaria agallocha</i> , <i>Xylocarpus granatum</i>	<i>B. gymnorhiza</i> , <i>Rhizophora samoensis</i>	<i>X. moluccensis</i> , <i>B. gymnorhiza</i> , <i>Rhizophora</i> spp.	<i>Rhizophora</i> spp.	Not reported	Not reported	Not reported	
<b>Littoral/ Strand</b>	<i>Calophyllum inophyllum</i>	<i>Pandanus tectorius</i> , <i>Calophyllum inophyllum</i> , <i>Hibiscus tiliaceus</i> <i>Barringtonia asiatica</i> , <i>Casuarina equisetifolia</i> , <i>Acacia simplex</i> <i>Pisonia grandis</i> <i>Terminalia catappa</i> <i>T. littoralis</i> <i>Excoecaria agallocha</i> , <i>Thespesia populnea</i> .	<i>Acacia simplex</i> , <i>C. equisetifolia</i> , <i>Guettarda speciosa</i>	<i>Barringtonia asiatica</i>	<i>Casuarina equisetifolia</i>	Not reported	Not reported	<i>C. inophyllum</i> , <i>B. asiatica</i> , <i>Thespesia populnea</i> , <i>H. tiliaceus</i> , <i>C. equisetifolia</i> , <i>Hernandia nymphaeifolia</i>	
<b>Coastal</b>		<i>Diospyros elliptica</i> , <i>Cordia aspera</i> , <i>Planchonella grayana</i> , <i>Grewia crenata</i> , <i>Syzygium clusiaefolium</i> , <i>Santalum yasi</i> ,	<i>Barringtonia asiatica</i> , <i>Calophyllum inophyllum</i> , <i>Cordia subcordata</i> , <i>Ficus</i> spp., <i>Hernandia nymphaeifolia</i> , <i>Terminalia samoensis</i> , <i>Thespesia populnea</i> , <i>Inocarpus fagifer</i>	<i>Diospyros ellipticifolia</i> , <i>D. samoensis</i> , <i>Syzygium inophylloides</i> <i>Intsia bijuga</i> , <i>Terminalia catappa</i>	<i>Casuarina equisetifolia</i> <i>Barringtonia asiatica</i> , <i>Pisonia grandis</i> . <i>Cordia</i> spp.	Present but no species reported	<i>Casuarina equisetifolia</i> , <i>Thespesia populnea</i> , <i>Calophyllum inophyllum</i> ,	<i>Pandanus</i> spp <i>Pisonia</i> spp. <i>Hibiscus tiliaceus</i> <i>Calophyllum inophyllum</i> <i>Barringtonia asiatica</i> <i>Casuarina equisetifolia</i> <i>Hernandia nymphaeifolia</i>	
<b>Coastal-middle</b>		No subdivisions of coastal forest	No subdivisions of coastal forest	No subdivisions of coastal forest	No subdivisions of coastal forest	No subdivisions of coastal forest	Makatea forest type	No subdivision of coastal forests	
<b>Coastal-middle dry-wet</b>	<i>Pritchardia</i> spp.	No subdivisions of coastal forest	No subdivisions of coastal forest	No subdivisions of coastal forest	No subdivisions of coastal forest	No subdivisions of coastal forest	Identified but no species reported		
<b>Low-dry</b>	<i>Santalum ellipticum</i>	Lowland rainforest	No lowland forest apart from coastal type identified	Lowland forest	Lowland –plains	No further subdivision of forest based on altitude as Niue is flat. Inland forest	Valley forest	Lower and middle valley forest	

Some characteristic important tree species reported								
	Hawai'i	Tonga	Wallis & Futuna	Samoa	American Samoa	Niue	Cook Islands	French Polynesia
<b>Low-wet</b>	<i>Syzygium malaccense</i>	<i>Alphitonia zizyphoides</i> , <i>Calophyllum neo-samoense</i> , <i>Diospyros samoensis</i> , <i>Garcinia myrtifolia</i> , <i>Myristica hypargyrea</i> , <i>Dysoxylum forsteri</i> , <i>Elattostachys falcata</i> , <i>Heritiera littoralis</i> , <i>Melicope seemannii</i> , <i>Neisosperma oppositifolium</i> , etc.		<i>Pometia pinnata</i>	<i>Pometia pinnata</i> , <i>Syzygium inophyllum</i>	Divided into light and dense forest but no species identified.	<i>Barringtonia asiatica</i> , <i>Guettarda speciosa</i> , <i>Homalium acuminatum</i> , <i>Thespesia populnea</i> , <i>Calophyllum inophyllum</i> , <i>Pandanus edulis</i>	<i>H. tiliaceus</i> , <i>Neonauclaea forsteri</i> , <i>Rhus taitensis</i> , <i>Alphitonia zizyphoides</i> , <i>Aleurites moluccana</i> , <i>Inocarpus fagifer</i>
<b>Low-middle-dry</b>	<i>Erythrina sandwicensis</i>			<i>Dysoxylum</i> spp., <i>Calophyllum neo-ebudicum</i> , <i>Inocarpus fagifer</i> , <i>Cananga odorata</i> , <i>Albizia</i> spp., <i>Adenanthera pavonina</i> , <i>Hibiscus tiliaceus</i>	Lowland valley			
<b>Low-middle-wet</b>	<i>Cibotium</i> spp.				<i>Dysoxylum</i> spp., <i>Calophyllum neo-ebudicum</i>			
<b>Low-middle-dry mesic</b>	<i>Pouteria sandwicensis</i>							
<b>Low-middle-mesic-wet</b>	<i>Myrsine lessertiana</i> , <i>Psychotria hawaiiensis</i>							
<b>Low-middle-dry-wet</b>	<i>Nothocestrum</i> spp.				Lowland forests not separately identified from mid-altitude forests			
<b>Low-high-dry-wet</b>	<i>Metrosideros polymorpha</i>			No subdivisions of lowland forest identified				
<b>Middle open-wet</b>	<i>Ilex anomala</i>	No middle altitude forest types identified		Mid-mountain forest			Middle-altitude forests not separately	

Some characteristic important tree species reported								
	Hawai'i	Tonga	Wallis & Futuna	Samoa	American Samoa	Niue	Cook Islands	French Polynesia
<b>Middle dry</b>	<i>Santalum freycinetianum</i>		Degraded "Toafa" land <i>Pandanus tectorius</i> , <i>Decaspermum fruticosum</i> , <i>Scaevola sericea</i> , <i>Maoutia australis</i>	<i>Planchonella samoensis</i> , <i>Terminalia richii</i> , <i>Dysoxylum samoense</i> , <i>Canarium vitiense</i>			identified	
<b>Middle mesic</b>	<i>Sapindus saponaria</i>							Low to mid-altitude mesic forest
<b>Middle dry-mesic</b>	<i>Colubrina oppositifolia</i>							<i>Metrosideros collina</i> , <i>Commersonia bartramia</i> , <i>Xylosoma suaveolens</i>
<b>Middle dry-wet</b>	<i>Antidesma platyphyllum</i>		No further subdivision of forest types based on altitude identified					
<b>Middle-high dry</b>	<i>Myoporum sandwicense</i> <i>Santalum paniculatum</i> <i>Sophora chrysophylla</i>							Rainforest
<b>Middle-high mesic-wet</b>	<i>Acacia Koa</i>							<i>Ilex Strebilus</i> <i>Cyathea</i> spp.
<b>High mesic-dry</b>	<i>Santalum haleakalae</i>	No high altitude forest types identified		Upper and High altitude forest <i>Garuga floribunda</i> , <i>Planchonella samoensis</i> , <i>Myristica fatua</i> , <i>Dysoxylum</i> spp.	Upper valley <i>Planchonella</i> spp. <i>Dysoxylum</i> spp.		High altitude forest not separately identified	
<b>Ridge</b>	Ridge forest not separately identified	Not identified		<i>Inisia bijuga</i> , <i>Canarium vitiensis</i> , <i>Syzygium inophylloides</i> <i>Calophyllum neo-ebudicum</i>	<i>Syzygium</i> spp.		No ridge forest reported	Ridge forest not separately identified

Forest type	Some characteristic important tree species reported									
	Hawai'i	Tonga	Wallis & Futuna	Samoa	American Samoa	Niue	Cook Islands	French Polynesia		
<b>Secondary forest</b>	<i>Acacia koa</i> , <i>Erythrina sandwicensis</i> , <i>Metrosideros polymorpha</i> bamboo		<i>Acalypha grandis</i> , <i>Alphitonia zizyphoides</i> <i>Cerbera manghas</i> , <i>Commersonia bartramia</i> , <i>Macaranga</i> , <i>harveyana</i> , etc.	<i>Calophyllum neo-ebudicum</i> , <i>Canarium vittensis</i> , <i>Garuga floribunda</i> , <i>Inisia bijuga</i>	<i>Alphitonia zizyphoides</i>		No secondary forest reported	<i>Psidium guajava</i> , <i>Lantana camara</i> , <i>Miconia calvescens</i> , <i>Albizia</i> spp., false pistachio		
<b>Abandoned gardens</b>	<i>Calophyllum inophyllum</i> , <i>Erythrina sandwicensis</i> , <i>Myrsine lessertiana</i> , <i>Syzygium malaccense</i> , <i>Thespesia populnea</i> Fruit and other cultivated trees		<i>Aleurites moluccana</i> , <i>Artocarpus altilis</i> , <i>Carica papaya</i> , <i>Psidium guajava</i> , <i>Mangifera indica</i> , <i>Cocos nucifera</i> , <i>Musa</i> spp.	<i>Flueggea flexuosa</i> , <i>Garuga floribunda</i>	<i>Flueggea flexuosa</i>		Abandoned gardens not separately identified	<i>Cocos nucifera</i>		
<b>Mountain</b>	Mountain bog identified. No species reported	Present but species not reported	Not reported	<i>Planchonella samoensis</i> <i>Palaquium stehlinii</i> , <i>Canarium vittense</i> , <i>Dysoxylum huntii</i> , <i>Neonauclea forsterii</i> , <i>Calophyllum neo-ebudicum</i>	<i>Dysoxylum huntii</i> , <i>Syzygium samoense</i> , <i>Crossostylis biflora</i> , <i>Palaquium stehlinii</i>		No mountain forest reported	Humid valleys and high mountain <i>Metrosideros</i> spp., <i>Weinmannia</i> spp., <i>Astonia</i> spp.		
<b>Cloud</b>	Type identified but no species reported.	Present but species not reported	Not reported	Present but no species reported	Not reported		Not reported	Species not identified		
<b>Subalpine</b>	Type identified but no species reported.	Type not reported	Not reported	Not reported	Not reported		Not reported	Not reported		

### Appendix 8: total list of the most important species presented by countries of Melanesia

Species	Country	Protection status	Land use category
1. <i>Acacia auriculiformis</i>	PNG	CA	vil, agri
2. <i>Acacia labillardieri</i>	PNG	CA, Rf	nat, plan, vil, agri, oth
3. <i>Acacia mangium</i>	*PNG	CA	nat, plan, vil, agri, oth
4. <i>Agathis labillardieri</i>	*PNG	{--}	nat
5. <i>Agathis lanceolata</i>	*New Cal		
6. <i>Agathis macrophylla</i>	*Solo, Vanu	RF, O	
7. <i>Agathis moorei</i>	*NewCal		
8. <i>Agathis robusta</i>	*PNG	CA, RF	nat, plan, vil, agri, oth
9. <i>Agathis silbai</i>	Vanu	{--}	nat, sec, plan, vil
10. <i>Agathis spathulata</i>	*PNG	CA, RF,	nat, plan, vil, agri, oth
11. <i>Aguilaria spp.</i>	PNG	{--}	nat
12. <i>Alphitonia zizyphoides</i>	Vanu.	CA	nat, sec, plan, vil, agri
13. <i>Alstonia scholaris</i>	Solo.	{--}	nat, sec
14. <i>Anisopfera thurifera</i>	*PNG	CA, RF	plan, oth
15. <i>Antiaris toxicaria</i>	Vanu	CA	nat, sec, vil, agri
16. <i>Araucaria columnaris</i>	New Cal		
17. <i>Araucaria cunninghamii</i>	PNG	CA, NP, RF	nat, sec, plan, vil, agri, oth
18. <i>Araucaria hunsteinii</i>	PNG	CA, NP, RF	nat, sec, plan, vil, agri, oth
19. <i>Barringtonia edulis</i>	Vanu	CA	nat, sec, plan, vil, agri
20. <i>Barringtonia novae- hiberniae</i>	Vanu.	{--}	nat, sec, vil, agri
21. <i>Burckella obovata</i>	Solo.	{--}	nat, sec
22. <i>Calophyllum kajewski</i>	Solo.	{--}	nat, sec
23. <i>Calophyllum spp.</i>	PNG, New Cal.	CA, NP, RF	nat, plan, vil, oth
24. <i>Calophyllum vitiense</i>	Solo.	{--}	nat, sec
25. <i>Canarium harveyi</i>	Vanu.	{--}	nat, sec, plan, vil
26. <i>Canarium indicum</i>	Vanu	CA	nat, sec, vil, agri
27. <i>Castanospermum australe</i>	PNG, Vanu.	CA, NP, RF	nat, sec, plan, vil, agri, oth
28. <i>Cinnamomum solomonense</i>	Solo	{--}	nat, sec, vil
29. <i>Cordia spp.</i>	PNG	CA, RF	nat, plan, oth
30. <i>Cordia subcordata</i>	*Solo. *Vanu.	O, {--}	nat, sec
31. <i>Dacrydium guillauminii</i>	New Cal.		
32. <i>Dillenia salomonensis</i>	Solo.	{--}	nat, sec
33. <i>Diospyros hebecarpa</i>	Solo	{--}	nat, sec
34. <i>Diospyros spp.</i>	*PNG	O	nat
35. <i>Dysoxylum amooroides</i>	Vanu	CA	Nat, sec, vil, agri
36. <i>Elaeocarpus angustifolius</i>	Vanu	CA	nat, sec, vil, agri
37. <i>Endospermum medullosum</i>	Solo. *Vanu.	{--} CA	nat, sec, plan, vil, agri
38. <i>Eucalyptus degulpta</i>	*PNG	CA, NP	Sec, plan, vil
39. <i>Eucalyptus pellite</i>	*PNG	{--}	nat
40. <i>Eucalyptus robusta</i>	PNG	{--}	sec, plan, vil
41. <i>Flueggea flexuosa</i>	Vanu. Solo.	{--}, {--}	nat, sec, plan, vil, ari
42. <i>Garuga floribunda</i>	Vanu.	CA	nat, sec, plan, vil, agri
43. <i>Gmelina moluccana</i>	*Solo.	CA, RF	nat, sec
44. <i>Homalium foetidum</i>	*PNG	{--}	nat
45. <i>Intsia bijuga</i>	New Cal, PNG, Solo., Vanu	{--}, {--}, {--}, CA	nat, sec, plan, vil, agri.

Species	Country	Protection status	Land use category
46. <i>Kermadecia</i> spp.	New Cal.		
47. <i>Montrouziiera</i> spp.	New Cal.		
48. <i>Neocallitropsis pancheri</i>	New Cal.		
49. <i>Ochroma lagopus</i>	PNG	{--}	sec, plan, vil, agri, oth
50. <i>Octomeles sumatrana</i>	Solo.	{--}	nat, sec, vil
51. <i>Palaquium firmum</i>	Solo.	{--}	nat, sec
52. <i>Paraserianthes falcataria</i>	Solo.	{--}	nat, sec
53. <i>Parasitaxus ustus</i>	New Cal.		
54. <i>Pleigynium timorensis</i>	*Vanu.	CA	nat, sec, vil, agri
55. <i>Pometia pinnata</i>	Solo.	{--}	nat, sec, agri
56. <i>Pterocarpus indicus</i>	*PNG, Solo, Vanu.	O, {--}, CA	nat, sec, vil, agri
57. <i>Santalum austrocaledonicum</i>	*Vanu	CA	nat, plan, agri
58. <i>Santalum macgregorii</i>	*PNG	CA, RF	nat, plan, vil, agri
59. <i>Santalum</i> spp.	New Cal.		
60. <i>Syzygium malaccense</i>	Vanu	CA	nat, sec, vil, agri
61. <i>Terminalia brassii</i>	PNG	CA, RF	nat, sec, vil, agri
62. <i>Terminalia catappa</i>	Vanu.	CA	nat, sec, plan, vil, agri
63. <i>Toona sureni</i>	PNG		
64. <i>Vitex cofasus</i>	Solo.	CA, NP, RF	nat, sec, vil
65. <i>Xanthostemon</i> spp.	*Solo.	O	nat, sec

This table shows the country reporting, the protection status and the current land use categories for each species.

\* denotes that the species is threatened at population level in this country.

Countries

New Cal = New Caledonia

Solo = Solomon Islands

PNG = Papua New Guinea

Vanu = Vanuatu

Protection

CA = Conservation Forest

RF = Reserve Forest

{--} No protection areas

NP = National Park

O = Other

Land use category

nat = native forest

plan = plantation

agri = agricultural areas.

sec = secondary forest

vil = village gardens

### Appendix 9: total list of the most important tree species presented by countries of Micronesia

Species	Country	Protection status	Land use category
1. <i>Aidia cochichinensis</i>	*Nauru	{--}	
2. <i>Areca catechu</i>	FSM	O	agri
3. <i>Artocarpus altilis</i>	Kiri	{--}	plan; vil; agri
4. <i>Artocarpus marianensis</i>	Guam; Kiri	{--}	nat;sec;plan;vil;agri
5. <i>Barringtonia asiatica</i>	Mars; *Nauru	{--}	nat
6. <i>Bruguiera gymnorhiza</i>	*Nauru	{--}	nat
7. <i>Callicarpa candicans</i>	Guam	{--}	nat;sec; vil
8. <i>Calophyllum inophyllum</i>	FSM; Kiri; *Nauru; Mars	{O}	nat
9. <i>Calotropis gigantea</i>	Kiri	{--}	nat
10. <i>Camptosperma brevipetiolata</i>	FSM	CA; RF	nat
11. <i>Carica papaya</i>	FSM	O	vil
12. <i>Cassia alata</i>	FSM	O	other
13. <i>Casuarina equisetifolia</i>	Kiri	{--}	nat
14. <i>Ceiba pentandra</i>	FSM	O	other
15. <i>Cerbera dilatata</i>	Guam	{--}	nat;sec
16. <i>Cerbera manghas</i>	*Nauru	{--}	nat
17. <i>Cocos nucifera</i>	FSM;Kiri;Nauru	O	Other; vil
18. <i>Cordia subcordata</i>	FSM;Kiri;*Nauru; Mars	O {--}	nat
19. <i>Cyathea lunulata</i>	*Guam	{--}	nat
20. <i>Cycas circinalis</i>	Guam	{--}	nat;sec;vil
21. <i>Delonix regia</i>	Kiri	{--}	vil
22. <i>Dodonea viscosa</i>	Nauru	{--}	nat
23. <i>Elaeocarpus joga</i>	Guam	{--}	nat;sec;vil
24. <i>Erythrina variegata</i>	*Nauru	{--}	nat
25. <i>Eugenia painimbis</i>	Guam	{--}	nat;sec
26. <i>Eugenia thompsonii</i>	Guam	{--}	nat;sec
27. <i>Fagraea berteriana</i>	FSM	O	nat
28. <i>Ficus tinctoria</i>	Kiri	{--}	vil
29. <i>Guettarda speciosa</i>	Kiri; Mars; Nauru	{--}	
30. <i>Heritiera longipetiolata</i>	*Guam	{--}	nat
31. <i>Hernandia nymphaeifolia</i>	*Nauru	{--}	nat
32. <i>Hernandia ovigera</i>	Kiri	{--}	nat
33. <i>Inocarpus fagifer</i>	FSM	O	sec
34. <i>Intsia bijuga</i>	Guam	{--}	nat;sec;vil
35. <i>Leucaena insularum vr.guamensis</i>	Guam	{--}	nat
36. <i>Lumnitzera littorea</i>	FSM;Kiri	CA {--}	nat
37. <i>Mangifera indica</i>	FSM	O	vil
38. <i>Merrilliodendron megacarpum</i>	Guam	{--}	
39. <i>Metroxylon americanum</i>	FSM	O	nat
40. <i>Morinda citrifolia</i>	Kiri	{--}	nat
41. <i>Neisosperma oppositifolia ?</i>	*Nauru; Mars	{--}	nat
42. <i>Nipa fruticans</i>	FSM	O	nat
43. <i>Pandanus tectorius</i>	Guam;Kiri;Mars	{--}	nat; sec; vil
44. <i>Parinari laurina</i>	FSM	CA	nat
45. <i>Pemphis acidula</i>	Kiri; Mars	{--}	nat

Species	Country	Protection status	Land use category
46. <i>Pisonia grandis</i>	Kiri; *Nauru; Mars	{--}	nat; vil
47. <i>Premna obtusifolia</i>	Mars	{--}	nat
48. <i>Pterocarpus indicus</i>	FSM	O	other
49. <i>Rhizophora mucronata</i>	Kiri	{--}	nat
50. <i>Scaevola taccada</i>	Mars	{--}	nat
51. <i>Serianthes nelsonii</i>	*Guam	{--}	nat
52. <i>Sonneratia alba</i>	Kiri	{--}	nat
53. <i>Suriana maritima</i>	Mars	{--}	nat
54. <i>Tabernaemontana rotensis</i>	*Guam	{--}	nat
55. <i>Terminalia carolinensis</i>	FSM	O	nat
56. <i>Terminalia catappa</i>	FSM; Kiri	O {--}	nat
57. <i>Terminalia samoensis</i>	Kiri; *Nauru	{--}	nat
58. <i>Thespesia populnea</i>	*Nauru	{--}	nat
59. <i>Tournefortia argentea</i> <i>syn. For Argusea argentea</i>	Mars; *Nauru	{--}	nat
60. <i>Tristiropsis obtusangula</i>	Guam		

This table shows the country reporting, the protection status and the current land use categories for each species.

\* denotes that the species is threatened at population level in this country.

Countries

FSM = Federated States of Micronesia

Kiri = Kiribati

Mars = Marshall Islands

Protection

CA = Conservation Forest

NP = National Park

RF = Reserve Forest

O = Other

{--} No protection areas

Land use category

nat = native forest

sec = secondary forest

plan = plantation

vil = village gardens

agri = agricultural areas.

### Appendix 10: total list of the most important tree species presented by countries of Polynesia

Species	Country	Protection status	Land use category
1. <i>Acacia koa</i>	*Ha	CA, NP, RF, SP	nat, sec, plant, agri
2. <i>Agalia saltatorum</i>	*To	CA	vil, agr
3. <i>Aleurites moluccana</i>	Wa&Fu		sec, vil
4. <i>Alphitonia zizyphoides</i>	AmSa, To	CA, NP, FR, O	nat, sec, vil, agri
5. <i>Antidesma platyphyllum</i>	Ha	FR	nat.
6. <i>Artocarpus altilis</i>	To, Wa&Fu	CA, ---	sec, vil, agri
7. <i>Atuna racemosa</i>	*To	CA	sec, vil, agri
8. <i>Bischofia javanica</i>	*To, Wa&Fu	CA, ---	sec, vil, agri
9. <i>Bruguiera gymnorhiza</i>	*AmSa		nat
10. <i>Calophyllum inophyllum</i>	Co, Ha, Wa&Fu	---, ---, ---,	vil
11. <i>Calophyllum neo-ebudicum</i>	AmSa, To, Sa	CA, NP, Rf, O	nat, sec, plant, agri
12. <i>Cananga odorata</i>	*To		vil
13. <i>Canarium vitiense</i>	AmSa, Sa	CA, NP, RF, O	nat, sec, plan
14. <i>Casuarina equisetifolia</i>	AmSa, Wa&Fu	O,---	lit,vil
15. <i>Cibotium</i> spp.	Ha	CA, NP, FR, SP	nat
16. <i>Cocos nucifera</i>	Wa&Fu		nat, sec, plan, vil, agri
17. <i>Colubrina oppositifolia</i>	*Ha	NP, FR	nat
18. <i>Cordia aspera</i>	*To		
19. <i>Cordia subcordata</i>	Ha, *To	---,---	vil
20. <i>Dysoxylum samoense</i>	Sa	CA, NP, RF	nat, sec
21. <i>Erythrina sandwicensis</i>	Ha	FR	nat, sec
22. <i>Erythrina variegata</i>	Wa&Fu		Nat
23. <i>Fagraea beteroana</i>	*To	CA, NP, RF	nat, sec, vil, agri
24. <i>Flueggea flexuosa</i>	AmSa, Sa, Wa&Fu	---,CA, NP, RF	nat, sec, vil, agri
25. <i>Garcinia sessilis</i>	*To	CA	vil, agri
26. <i>Garuga floribunda</i>	*Sa	CA, Np, RF	nat, sec, vil, agri
27. <i>Glochidion ramiflorum</i>	Wa&Fu		nat, sec
28. <i>Guettarda speciosa</i>	Co	CA, NP, RF	
29. <i>Hibiscus tiliaceus</i>	Wa&Fu		Sec
30. <i>Ilex anomala</i>	Ha	FR, SP	nat
31. <i>Inocarpus fagifer</i>	To	CA, NP, FR	nat, sec, vil, agri
32. <i>Intsia bijuga</i>	AmSa, *Sa, *To	CA, RF	nat, sec, vil
33. <i>Manilkara hoshinoi</i>	*Sa	RF	nat
34. <i>Metrosideros polymorpha</i>	Ha	CA, NP, FR, SP	nat, sec
35. <i>Morinda citrifolia</i>	To	CA, NP, RF	nat, sec, plan, vil, agri
36. <i>Myoporum sandwicensis</i>	*Ha	NP, FR, SP	Nat
37. <i>Myrsine lessertiana</i>	Ha	FR	nat, vil
38. <i>Neonauclea forsteri</i>	Sa, Wa&Fu	CA, NP, RF ---	nat, sec
39. <i>Nothocestrum</i> spp.	Ha	FR	nat, vil
40. <i>Palaquium stehlini</i>	Sa	CA, NP, FR	nat, sec
41. <i>Pandanus edulis</i>	Co		
42. <i>Pandanus tectorus</i>	To, Wa&Fu	----, ----	sec, vil, agri
43. <i>Planchonella linggensis</i>	Wa&Fu		nat
44. <i>Planchonella samoense</i>	AmSa, Sa	CA, NP, RF, O	nat, sec, plan,
45. <i>Pometia pinnata</i>	*AmSa, To, Sa, Wa&Fu	CA, NP, RF, ---	nat, sec, plan, vil, agri
46. <i>Pouteria sandwicensis</i>	Ha	FR	nat
47. <i>Prichardia</i> spp.	*Ha	FR	nat

Species	Country	Protection status	Land use category
48. <i>Psychotria hawaiiensis</i>	*Ha	NP, FR, SP	nat
49. <i>Rhizophora mangle</i>	*AmSa		nat
50. <i>Santalum ellipticum</i>	Ha	FR	nat
51. <i>Santalum freycinetianum</i>	Ha	FR	nat
52. <i>Santalum haleakalae</i>	Ha	NP, FR	Nat
53. <i>Santalum insulare</i>	Co		
54. <i>Santalum paniculatum</i>	Ha	NP, FR	nat
55. <i>Santalum yasi</i>	To	CA, NP, FR	sec, plan, vil, agri
56. <i>Sapindus saponaria</i>	Ha	NP, FR	nat
57. <i>Sophora chrysophylla</i>	Ha	CA, NP, FR, SP	nat
58. <i>Spondias dulcis</i>	*To	CA	vil, agri
59. <i>Syzygium clusiaefolium</i>	Wa&Fu		nat
60. <i>Syzygium corynocarpum</i>	To	RF	vil, agri
61. <i>Syzygium inophylloides</i>	AmSa, Sa, Wa&Fu	CA, NP, FR, O	nat, sec
62. <i>Syzygium malaccense</i>	Ha		vil
63. <i>Syzygium patentinerve</i>	Sa	CA, NP, FR	nat, sec
64. <i>Syzygium</i> spp.	Wa&Fu		nat
65. <i>Tarenna sambucina</i>	*To	CA, NP, FR	nat, sec, vil, agri
66. <i>Terminalia catappa</i>	Sa, To	CA, NP, FR	nat, sec, vil, agri
67. <i>Terminalia richii</i>	AmSa, *Sa	CA, NP, FR, O	nat, sec, plan,
68. <i>Thespesia populnea</i>	Co, Ha, *To,	CA, --- CA, NP	vil, agri
69. <i>Xylocarpus moluccensis</i>	*AmSa		nat
70. <i>Xylocarpus</i> spp.	*To	CA	vil

This table shows the country reporting, the protection status and the current land use categories for each species.

\* denotes that the species is threatened at population level in this country.

Countries

AmSa = American Samoa

To. = Tonga

Co. =Cook Islands

Sa. = Samoa

Ha. = Hawai'i

Wa&Fu = Wallis and Futuna

Protection

CA = Conservation Forest

SP = State Park

NP = National Park

O = Other

RF = Reserve Forest

Land use category

nat = native forest

vil = village gardens

sec = secondary forest

agri = agricultural areas

plan = plantation

{--} No protection areas

**Appendix 11: priority species for urgent and immediate action in all three areas of concern – Germplasm exploration & collection, evaluation & supply, conservation**

Species	Country in group 1	Country in group 2	Country in group 3	Comments
1. <i>Acacia koa</i>			Hawai'i	
2. <i>Agathis macrophylla</i>	Solomon Is.			Also in tables of appendices 13, 14
3. <i>Calophyllum</i> spp.	PNG			Species not specified
4. <i>Diospyros hebecarpa</i>	Solomon Is.			
5. <i>Flueggea flexuosa</i>			Samoa	Also in table of appendix 14
6. <i>Garcinia sessilis</i>			Tonga	
7. <i>Gmelina moluccana</i>	Solomon Is.			
8. <i>Intsia bijuga</i>			Tonga, Samoa	Also in tables of appendices 12, 13, 14
9. <i>Manilkara hoshinoi</i>			Samoa	
10. <i>Nothoestrum</i> spp.			Hawai'i	
11. <i>Pometia pinnata</i>			Samoa	Also in tables of appendices 13, 14
12. <i>Prichardia</i> spp.			Hawai'i	
13. <i>Pterocarpus indicus</i>			Solomon Is.	Also in tables of appendices 13, 14, 15
14. <i>Rhizophora mucronata</i>		Kiribati		<i>Rhizophora</i> spp. also priority for Federated States of Micronesia, Marshall, Tuvalu
15. <i>Santalum austrocaledonicum</i>	Vanuatu, New Caledonia			Also in table of appendix 14
16. <i>Santalum freycinetianum</i>			Hawai'i	
17. <i>Santalum insulare</i>		Cook Is.		
18. <i>Santalum yasi</i>	Fiji		Tonga	
19. <i>Spondias dulcis</i>			*Tonga	
20. <i>Swietenia macrophylla</i>	*Fiji		Tonga	Exotic species listed as priority D by Tonga
21. <i>Syzygium inophylloides</i>			Samoa	
22. <i>Terminalia richii</i>			Samoa	Also in table of appendix 14
23. <i>Xanthostemon</i> spp.	Solomon Is.			Species yet to be named

\* Exotic species

Group 1 comprises the Melanesian countries

Group 2 comprises the Micronesian countries

Group 3 comprises the Polynesian countries

**Appendix 12: priority tree species for urgent and immediate action in two of the three areas of concern – Germplasm exploration & collection, evaluation & supply, conservation**

Species	Country in group 1	Country in group 2	Country in group 3	Comments
1. <i>Agathis robusta</i>			*Tonga	
2. <i>Agathis silbai</i>	Vanuatu			
3. <i>Artocarpus altilis</i>		Kiribati		Also in tables of appendices 14, 15
4 <i>Cordia aspera</i>			*Tonga	
5. <i>Cordia subcordata</i>	Solomon Is.			Also in tables of appendices 14, 15
6. <i>Dacrydium nausoriense</i>	Fiji			
7. <i>Endospermum medullosum</i>	Solomon Is.			Also in tables of appendices 13, 15
8. <i>Fagraea beteroana</i>			Tonga	
9. <i>Intsia bijuga</i>	Solomon Is.			Also in tables of appendices 11, 13, 14
10. <i>Montrouziera cauliflora</i>	New Caledonia			
11. <i>Sonneratia alba</i>		Kiribati		
12. <i>Toona sureni/ciliata</i>	Papua New Guinea		Tonga	
13. <i>Vitex cofassus</i>	Solomon Is.			

\*Exotic for country

Group 1 comprises Melanesian countries

Group 2 comprises Micronesian countries

Group 3 comprises Polynesian countries

**Appendix 13: priority species for urgent and immediate action in one of the three areas of concern - Germplasm exploration & collection, evaluation & supply, conservation**

Species Name	Country in group 1	Country in group 2	Country in group 3	Comments
1. <i>Agathis labillardienii</i>	Papua New Guinea			
2. <i>Agathis macrophylla</i>	Vanuatu			Also in tables of appendices 11, 14
3. <i>Agathis robusta subsp. nesophila</i>	Papua New Guinea		Tonga	
4. <i>Agathis spathulata</i>	Papua New Guinea			
5. <i>Aglaiia saltatorum</i>			*Tonga	
6. <i>Artocarpus marianensis</i>		Kiribati		Also in table of appendix 14
7. <i>Barringtonia (edible)</i>	Fiji			Species unspecified
8. <i>Calophyllum inophyllum</i>		Federated States of Micronesia, Marshall, Tuvalu	Wallis & Futuna Cook Is.	Also in tables of appendices 14, 15
9. <i>Canarium harveyi</i>	Vanuatu			Also in table of appendix 14
10. <i>Canarium indicum</i>	Vanuatu			
11. <i>Cinnamomum solomonense</i>	Solomon Is.			
12. <i>Dacrydium nidulum var. nidulum</i>	Fiji			
13. <i>Dillenia salomonensis</i>	Solomon Is.			
14. <i>Dysoxylum amooroides</i>	Vanuatu			
15. <i>Endospermum medullosum</i>	Vanuatu			Also in tables of appendices 12, 15
16. <i>Endospermum robbianum</i>	Fiji			
17. <i>Gmelina vitiensis</i>	Fiji.			
18. <i>Hernandia nymphaeifolia</i>	Solomon Is.			Also in table of appendix 14
19. <i>Intsia bijuga</i>	Vanuatu, Fiji			Also in tables of appendices 11, 12, 14
20. <i>Metrosideros polymorpha</i>			Hawai'i	
21. <i>Morinda citrifolia</i>		Kiribati		Also in table of appendix 15
22. <i>Myoporum sandwicense</i>			Hawai'i	
23. <i>Pandanus tectorius</i>		Marshall	Tonga	Also in tables of appendices 14, 15
24. <i>Pinus caribaea</i>	*Fiji		*Tonga	Introduced in the sub-region. Also in appendix 14
25. <i>Pometia pinnata</i>			Am. Samoa	Also in tables of appendices 11, 14
26. <i>Pterocarpus indicus</i>	Vanuatu			Also in tables of appendices 11, 14, 15
27. <i>Santalum album</i>	*Fiji		*Tonga	Introduced in the sub-region
28. <i>Santalum mcgregorii</i>	Papua New Guinea			
29. <i>Sophora chrysophylla</i>			Hawai'i	
30. <i>Tarennia sambucina</i>			Tonga	

## Appendices

Species Name	Country in group 1	Country in group 2	Country in group 3	Comments
31. <i>Terminalia catappa</i>	Vanuatu			Also in tables of appendices 14, 15
32. <i>Thespesia populnea</i>			Cook Is., Tonga	Also in tables of appendices 14, 15
33. <i>Xylocarpus</i> spp.			Tonga	

Group 1 comprises the Melanesian countries

Group 2 comprises the Micronesian countries

Group 3 comprises the Polynesian countries

\* Exotic species for country

**Appendix 14: priority species for which action is required in the next five years for at least two of the three areas of concern - Germplasm exploration, evaluation, conservation**

Country Group	Species	Country
Group 1	<i>Acacia mangium</i>	PNG
	<i>Agathis macrophylla</i>	Fiji
	<i>Alstonia scholaris</i>	Solomon
	<i>Anisoptera thurifera</i>	PNG
	<i>Artocarpus altilis</i>	Fiji, Solomon
	<i>Barringtonia edulis</i>	Vanuatu
	<i>Barringtonia procera</i>	Vanuatu
	<i>Casuarina oligodon</i>	PNG
	<i>Cordia subcordata</i>	Fiji
	<i>Diospyros ferrea</i>	PNG
	<i>Endospermum macrophyllum</i>	Fiji
	<i>Flueggea flexuosa</i>	PNG, Solomon, Vanuatu
	<i>Inocarpus fagifer</i>	Fiji
	<i>Intsia bijuga</i>	PNG
	<i>Paraserianthes falcataria</i>	Solomon
	<i>Pinus caribaea</i>	*New Caledonia
	<i>Pleiogynium timorense</i>	Vanuatu
	<i>Pometia pinnata</i>	Fiji, PNG, Solomon, Vanuatu
	<i>Pterocarpus indicus</i>	PNG
	<i>Swietenia mahagoni</i>	*Fiji
	<i>Syzygium malaccense</i>	Fiji, PNG, Solomon, Vanuatu
	<i>Tectona grandis</i>	*PNG,* Solomon.
	+ <i>Agathis corbassonii</i>	New Caledonia
	+ <i>Agathis ovata</i>	New Caledonia
+ <i>Araucaria nemorosa</i>	New Caledonia	
<i>Araucaria montana</i>	New Caledonia	
+ <i>Terminalia cherrieri</i>	New Caledonia	
Group 2	<i>Acacia farnesiana</i>	Kiribati
	<i>Aidia cochichinensis</i>	Nauru
	<i>Argusia argentea</i>	FSM, Marshall, Nauru, Tuvalu
	<i>Artocarpus mariannensis</i>	Guam
	<i>Barringtonia asiatica</i>	FSM, Marshall, Nauru, Tuvalu
	<i>Bruguiera gymnorhiza</i>	FSM, Nauru
	<i>Calophyllum inophyllum</i>	Kiribati
	<i>Calotropis gigantea</i>	Kiribati
	<i>Cerbera manghas</i>	Nauru
	<i>Cordia subcordata</i>	FSM, Marshall, Nauru, Tuvalu
	<i>Elaeocarpus joga</i>	Guam
	<i>Erythrina variegata</i>	Nauru
	<i>Eugenia plumbis</i>	Guam
	<i>Ficus tinctoria</i>	FSM, Kribati, Marshall, Tuvalu
	<i>Heritiera longipetiolata</i>	Guam
	<i>Hernandia nyphaeifolia</i>	Nauru
	<i>Intsia bijuga</i>	FSM, Guam
	<i>Leucaena insularum var guamensis</i>	Guam
	<i>Mermodendron megacarpum</i>	Guam

Country Group	Species	Country
Group 2 (suite)	<i>Neisosperma oppositifolium</i>	Nauru
	<i>Pandanus tectorius</i>	Kiribati, FSM, Marshall, Tuvalu
	<i>Pemphis acidula</i>	FSM, Kiribati, Marshall, Tuvalu
	<i>Pisonia grandis</i>	FSM, Kiribati, Nauru
	<i>Terminalia catappa</i>	FSM,
	<i>Terminalia samoensis</i>	Nauru, FSM,
	<i>Thespesia populnea</i>	Nauru, FSM, Marshall, Tuvalu
Group 3	<i>Antidesma platyphyllum</i>	Hawai'i
	<i>Atuna racemosa</i>	*Tonga
	<i>Aglaiia saltatorum</i>	*Tonga
	<i>Calophyllum neo-ebudicum</i>	Samoa
	<i>Canarium harveyi</i>	Tonga
	<i>Canarium vitiense</i>	Samoa
	<i>Cordia subcordata</i>	Cook Is. Hawai'i
	<i>Decaspermum fruticosum</i>	Tonga
	<i>Diospyros major</i>	Tonga
	<i>Dysoxylum samoense</i>	Samoa
	<i>Erythrina sandwicensis</i>	Hawai'i
	<i>Flueggea flexuosa</i>	Wallis & Futuna
	<i>Garuga floribunda</i>	Am.Samoa
	<i>Guettarda speciosa</i>	Tonga
	<i>Myrsine lessertiana</i>	Hawai'i
	<i>Neonauclea fosteri</i>	Wallis & Futuna
	<i>Planchonella linggensis</i>	Wallis & Futuna
	<i>Planchonella samoense</i>	Am. Samoa, Samoa
	<i>Pometia pinnata</i>	Tonga, Wallis & Futuna
	<i>Santalum austrocaledonicum</i>	*Cook Is.
	<i>Santalum ellipticum</i>	Hawai'i
	<i>Santalum haleakalae</i>	Hawai'i
	<i>Santalum paniculatum</i>	Hawai'i
	<i>Syzygium clusiaefolium</i>	Wallis & Futuna
	<i>Syzygium corynocarpum</i>	Tonga
	<i>Syzygium inophylloides</i>	Wallis & Futuna
	<i>Terminalia catappa</i>	Tonga
<i>Terminalia richii</i>	Am. Samoa	

\* Exotic species for country

+ New Caledonian priority species listed without indication of time frame.

The species identified for Nauru are listed as endangered in that country.

Countries

Group 1 comprises the Melanesian countries

Group 2 comprises the Micronesian countries

Group 3 comprises the Polynesian countries

AmSa = American Samoa

Cook = Cook Islands

FSM = Federated States of Micronesia

FrPol = French Polynesia

Kiri = Kiribati

PNG = Papua New Guinea

Sam = Samoa

Sol = Solomon Islands

Ton = Tonga

Van = Vanuatu

Wal&Fut = Wallis & Futuna

**Appendix 15: species for which either no action is required or action is required mostly in the next ten years for the areas of concern – Germplasm exploration, evaluation, conservation**

Country Group	Species	Country
Group 1	<i>Alphitonia zizyphoides</i>	Vanuatu
	<i>Amoora cucullata</i>	Solomon Islands
	<i>Araucaria cunninghamii</i>	PNG
	<i>Araucaria huntstenii</i>	PNG
	<i>Artocarpus altilis</i>	Vanuatu
	<i>Azadirachta indica</i>	*Fiji
	<i>Barringtonia edulis</i>	Solomon Islands
	<i>Calophyllum kajewski</i>	Solomon Islands
	<i>Calophyllum vitiense</i>	Solomon Island
	<i>Castanopsis</i> spp.	PNG
	<i>Castanospermum australe</i>	PNG
	<i>Cordia subcordata</i>	Vanuatu
	<i>Cryptocarya</i> spp.	PNG
	<i>Elmerrilliana papuana</i>	PNG
	<i>Endospermum medulosum</i>	PNG
	<i>Eucalyptus camaldulensis</i>	*Fiji
	<i>Eucalyptus pellita</i>	PNG
	<i>Ganophyllum falcatum</i>	PNG
	<i>Garuga floribunda</i>	Vanuatu
	<i>Gmelina aroborea</i>	*Fiji
	<i>Octomeles sumatrana</i>	Solomon Island
	<i>Palaquium firmum</i>	Solomon Island
	<i>Palaquium</i> spp.	PNG
	<i>Phylocladus</i> spp.	PNG
	<i>Pterocarpus indicus</i>	*Fiji
	<i>Syzygium</i> spp.	PNG
<i>Terminalia catappa</i>	Fiji	
<i>Terminalia solomonense</i>	Solomon Island	
Group 2	<i>Calophyllum inophyllum</i>	Nauru
	<i>Callicarpa cadicans</i>	Guam
	<i>Casuarina equisetifolia</i>	*FSM, *Guam, *Kiribati, *Nauru
	<i>Cerbera alata</i>	Guam
	<i>Cordia subcordata</i>	Kiribati
	<i>Cycas circinalis</i>	Guam
	<i>Delonix regia</i>	*Kiribati
	<i>Dodonaea viscosa</i>	Nauru
	<i>Eugenia thompsonii</i>	Guam
	<i>Ficus tinctoria</i>	Kiribati
	<i>Guettarda speciosa</i>	Kiribati, Nauru
	<i>Hernandia ovigera</i>	Kiribati
	<i>Hibiscus tiliaceus</i>	FSM, Marshall, Tuvalu, Nauru
	<i>Lumnitzera littorea</i>	Kiribati
	<i>Macaranga caroliniensis</i>	Kiribati
	<i>Morinda citrifolia</i>	FSM, Marshall, Nauru, Tuvalu
	<i>Ochrosia elliptica</i>	Nauru
	<i>Pandanus tectorius</i>	Guam, Nauru

Country Group	Species	Country
Group 2 (suite)	<i>Polyscias grandiflora</i>	Kiribati
	<i>Premna serratifolia</i>	Kiribati
	<i>Scaevola sericea</i>	Nauru
	<i>Serianthus nelsonii</i>	Guam
	<i>S. kanehirae</i>	FSM, Palau
	<i>Sida fallax</i>	Kiribati
	<i>Tabernaemontana</i> spp.	Guam
	<i>Terminalia catappa</i>	Kiribati, Nauru
	<i>Terminalia samoensis</i>	Kiribati
	<i>Tristiropsis obtusangula</i>	Guam
	<i>Vitex negundo</i>	Nauru
Group 3	<i>Calophyllum inophyllum</i>	Hawai'i
	<i>Cibotium</i> spp.	Hawai'i
	<i>Colubrina oppositifolia</i>	Hawai'i
	<i>Garuga floribunda</i>	Samoa
	<i>Ilex anomala</i>	Hawai'i
	<i>Neonauclea fosteri</i>	Samoa
	<i>Palaquium stehlini</i>	Samoa
	<i>Pouteria sandwicensis</i>	Hawai'i
	<i>Psychotria hawaiiensis</i>	Hawai'i
	<i>Syzygium malaccense</i>	Hawai'i
	<i>Syzygium patentinerve</i>	Samoa
	<i>Terminalia catappa</i>	Samoa
	<i>Tectona grandis</i>	Tonga
	<i>Thespesia populnea</i>	Hawai'i

\* Exotic species for country

Countries

Group 1 comprises the Melanesian countries

Group 2 comprises the Micronesian countries

Group 3 comprises the Polynesian countries

AmSa = American Samoa

FrPol = French Polynesia

Sam = Samoa

Van = Vanuatu

Cook = Cook Islands

Kiri = Kiribati

Sol = Solomon Islands

Wal&Fut = Wallis & Futuna

FSM = Federated States of Micronesia

PNG = Papua New Guinea

Ton = Tonga

## **Appendix 16: list of required actions identified during the Apia workshop**

### IN SITU CONSERVATION

- establish protected forests and reserves;
- encourage the protection and re-establishment of threatened species;
- incentives and benefits, including recognition, for communities and owners, contributing to conservation actions;
- need for improved planning, land use planning (zoning) for both rural and urban areas;
- provide funds to finance the establishment and management of reserves.

### EX SITU CONSERVATION

- planting and protection of endangered species and the establishment of plantings and germplasm at the national and local levels;
- promotion of urban and houseyard agroforestry;
- establishing ex-situ repositories and germplasm collections in other countries, within and outside the region, to backstop against extreme events and local extinction events;
- develop and implement genetic resource recovery plans.

### SUSTAINABLE USE AND MANAGEMENT

- promote sustainable logging, where commercial logging is an option;
- support the sustainable utilization and rehabilitation of mangrove and coastal forests;
- encourage and support reforestation and replanting programs;
- establish plantations to reduce pressures of human use/demand on indigenous forests;
- promote traditional and modern agroforestry development;
- encourage the replanting of trees and use of improved tree fallow after agricultural abandonment;
- promote multiple-use management of forest resources;
- develop improved land/resource use planning (zoning);
- improve forest fire management through prevention, awareness raising, capacity building in fire fighting;
- strengthen quarantine services and develop regional and national plans for the prevention, elimination and control of invasive alien plants, animals and other organisms;
- ensure proper certification of chemical pesticides and of users, and rigorous screening of potential biological control agents;
- encourage involvement and commitment of all stakeholders in particular land owners;
- ensure the involvement and participation of traditional leaderships and networks;
- where appropriate, use traditional knowledge, customs, taboos, etc.
- strategies ought to be a combination of the best of traditional methods and science-based approaches;
- encourage and promote appropriate co-management options;
- involve local communities in local resource surveys and monitoring of conservation actions;
- to strengthen management planning for the sustainable utilization of forest and tree resources across the region.

## RESEARCH NEEDS

- proper species selection to prepare for, respond to, or to recover from extreme events, and for *in situ* and *ex situ* conservation purposes;
- studies of forests and agricultural land-use, forest and tree species distribution, genetic resources and conservation status;
- identify key endangered indicator species, keystone species for protection, and, using gap analysis (GIS), identify key ecosystems, biodiversity hotspots that are in need of protection;
- identify key economic and cultural species that are in need of protection;
- examine systems of harvesting (logging) to determine their sustainability;
- assess requirements for species-based conservation plans for different countries, with specific focus on priority economic/cultural species and threatened species;
- generate relevant information for decision making for designing and planning an adequate system of regional, national and community conservation areas;
- evaluate community-based conservation approaches for their value in conserving forest genetic resources;
- develop guidelines for species exchange and transfer;
- gather information on potential and existing pests and invasive organisms that affect forests and tree resources;

## ENHANCEMENT/CAPACITY BUILDING

- public awareness at all levels;
- provide appropriate technical training at the diploma and degree levels;
- training of local communities in appropriate skills;
- integrate human resources needs into the overall national planning;
- involve local communities in local resource surveys;
- that local communities be given the skills to carrying out monitoring of conservation actions;
- develop and enact appropriate legal enforcement mechanisms and quarantine laws;
- strong legislation to prohibit the introduction and control the proliferation of invasive species and disease organisms;
- support the implementation of plans and strategies;
- call on the support of international organizations to provide technical information and to assist in tree crop improvement and development;
- encourage formation of networks of PICs technical experts and facilitate their exchange and flow of information and skills.

## MONITORING

- that all actions have an associated plan for monitoring the success of the action in terms of the conservation of forest and tree genetic resources;
- that appropriate indicator species be identified that can be use for monitoring;
- that local communities be involved in the development and implementation of monitoring activities.

## **Appendix 17: summary report of the Pacific Sub-Regional Workshop on Forest and Tree Genetic Resources**

### Background and Organization

The Pacific Sub-Regional Workshop on Forest and Tree Genetic Resources was held in Apia, Samoa, from 12 to 16 April 1999. This meeting is part of a series of workshops facilitated by FAO to assist countries and territories in the preparation of regional action plans on forest tree genetic resources, following the recommendations of 13<sup>th</sup> Session of the Committee on Forestry (March 1997). The planning of the meeting, the first of its kind in Oceania, has been strongly supported by Heads of Forestry of the Pacific Islands. Invitations to the workshop had been sent by the Secretariat of the Pacific Community to 22 Heads of Forestry, to international, regional and bilateral organizations interested in the field of forest genetic resources, and to resource persons.

The major workshop sponsors and organization committee were the South Pacific Regional Initiative on Forest Genetic Resources (SPRIG) and the Australian Agency for International Development (AusAID), the FAO Forestry Department and FAO Sub-Regional Office, the Pacific Island Forests & Trees Support Programme of the Secretariat of the Pacific Community (SPC/PIF&TSP), the South Pacific Regional Environment Programme (SPREP), the Forestry Division, Ministry of Agriculture, Forests, Fisheries and Meteorology, Samoa. Additional support was provided by other regional and international organizations including IPGRI, ACIAR and the Pacific German Regional Forestry Project.

### Opening ceremony

The meeting was attended by 60 participants from 18 countries and territories and 10 international, regional or national organizations and corporations. The following islands were represented: American Samoa, Cook Islands, Fiji, Federated States of Micronesia, French Polynesia, Guam, Hawai'i, Kiribati, Marshall Islands, Nauru, New Caledonia, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Vanuatu and Wallis and Futuna. In addition to the organizers, the following international, regional, bilateral and national organizations and corporations were present: Cirad-Forêt, CSIRO, the FAO FORSPA project, Fiji Hardwood Corporation Ltd, Pacific German Regional Forestry Project, IUFRO, QFRI, University of the South Pacific, and USDA-Forest Service. Apologies had been received from Northern Marianas, Tonga, Tuvalu, the Secretariat of the Convention on Biological Diversity (CBD) and CIFOR. Partial attendance was made by officers from several national authorities of Samoa.

Discussions took place at the Conference Room of the FAO Sub-Regional Office for the Pacific Islands in Apia and field trips were organized in Upolu and Savaii islands.

In the Opening Session on Monday 12 April, Mr Afioga Tuisugaletaua A.S. Aveau, Director of Agriculture, Forests, Fisheries and Meteorology (MAFFM), the Rev. Peteru Tone, Mr Muliagatele Iosefata Reti, Director of South Pacific Biodiversity Conservation Program (SPREP), Dr Vili Fuavao, FAO Sub-Regional Representative, Seumanutafa Dr Malcolm Hazelman, IPGRI Board of Trustees, and H.E. Paul O'Callaghan, Australian High Commissioner, made presentations. The opening address was delivered by the Minister of Agriculture, Forests, Fisheries and Meteorology, the Hon. Mafasolia Papu Vaai.

### Working sessions

The draft programme included in the invitation letter was adopted with the possibility of further amendments as required.

The international context in forest genetic resources and the aims and goals of the workshop were presented by Mr Pierre Sigaud (FAO Forestry Department, Rome). Forestry matters and genetic resources have received increased attention in the past decade. Although no truly global mechanism is yet available, several regionally-based initiatives on forest genetic resources have proved successful in framing coordinated strategies and in fostering action at national level.

Representatives from countries and territories gave summary accounts of their reports on the status of forest genetic resources. Participants reported the diversity of values and functions traditionally attached to forests and trees. They also stressed that heavy pressures on forests and woodlands were leading to an overall loss of biological diversity and forest genetic resources. In several islands, there was an urgent need for targeted conservation measures. In addition to technical considerations, addressing land tenure issues and involving local populations were reported as crucial factors in planning sustainable forest management. Wide-ranging issues common to several countries and territories, and opportunities for exchange of experience and know-how were identified.

On Tuesday 13 April, participants from international, regional and bilateral organizations, including Cirad-Forêt, CSIRO, FAO, IPGRI, SPC/GTZ/Pacific-German Regional Forestry Project, SPC/PIF&TSP, SPC/Plant Protection Service, SPREP, SPRIG and USDA-Forest Service, representatives from NGOs and the University of the South Pacific (USP), provided information on the work carried out by their respective agencies in the field of forestry and forest genetic resources.

Four thematic areas were proposed for discussions in the following days, and incorporation in the regional action plan, viz prioritization of species and operational needs; ways to support sustainable utilization and management of forest and tree resources; issues related to germplasm exchange and access; and institutional strengthening and training.

Participants were split into three eco-geographic groups covering Polynesia and eastern Pacific (American Samoa, Cook Islands, French Polynesia, Niue, Samoa and Wallis & Futuna); Melanesia (Fiji, New Caledonia, Papua New Guinea, Solomon Islands and Vanuatu) and Micronesia/Central Oceania (Guam, Hawai'i, Kiribati, Marshall Islands, FRS. Micronesia, Nauru, and Palau). The relevance of a species approach, suggested as an entry point of the action plan, was debated and endorsed. It was recognized that such a strategy, based on an utilitarian approach to priority species and tree populations, could help focus discussions on operational needs and requirements. In addition, it complemented other conservation strategies based on an ecosystem approach presently being addressed in other fora. The main chapters of the action plan (overview of the current status of forest biological diversity and genetic resources; identification of opportunities; strategy and guidelines; recommendations on in situ and ex situ conservation; sustainable use and management; research needs; capacity building and policy issues; and monitoring of developments) were adopted in principle. It was agreed that the detailed elements of the plan of action would be completed later by SPRIG and FAO, in close collaboration with rapporteurs, and circulated to all participants.

### Closing

The workshop was closed by Mr Malaki Iakopo, Assistant Director (Forestry), MAFFM, Samoa, and Mr Stephen Midgley, Programme Manager, CSIRO Forestry and Forest Products, Australia, who expressed their satisfaction and complimented participants for their commitment and achievements. The meeting was followed by a post-workshop field visit to Savaii island where participants could study the work undertaken by the Forestry Division and the SPRIG Project on enrichment planting and field trials with eucalypts, mahoganies, Toona, and native species (*Terminalia*, *Pometia*, *Syzigium*) and visit the facilities used in the Masamasa nursery facilities for the vegetative propagation of important native tree species.

### Conclusions and immediate follow-up actions

The workshop provided a forum for discussion of key issues related to forest genetic resources in the region. The participants recognized the need for, and agreed to develop, a regional action plan for the conservation and sustainable use of forest and tree genetic resources in the Pacific. A draft based on the workshop discussions will be circulated to participants by the Organization Committee and the final document will be finalized within 2000. The plan will be complemented by a synthesis of the status of forest genetic resources in the Pacific islands, based on data available in country reports. The synthesis and the action plan will be widely disseminated to institutions and organizations inside and outside of the region. These publications will be complemented by the proceedings of the workshop, detailing country and territory reports and other workshop reports and papers of relevance.

Information on the workshop and its outputs and documentation will be provided to other fora and meetings. It is planned to make information available on line through the world-wide FAO Information System on Forest Genetic Resources (REFORGEN), the SPRIG Regional Data Base of Forest Genetic Resources, and the Clearing House Mechanism of the Convention on Biological Diversity.



## Appendix 18: list of tree species identified as highest priority for genetic resource operations and activities in Melanesia/South-west Pacific

SPECIES	EXPLORATION & GERMPLASM COLLECTION <sup>2</sup>			EVALUATION, IMPROVEMENT & GERMPLASM SUPPLY <sup>3</sup>			CONSERVATION		REMARKS <sup>4</sup> (including information on countries, related species and common names)
	Biological information	Gene-ecological studies	Germplasm collection & research	Field testing & evaluation	Selection and breeding	Germplasm supply	Ex situ conservation	In situ conservation	
<b>Indigenous</b>									
1. <i>Acacia</i> spp. (wattles)		3	1*	3*	3*	2*	2	3	<i>A. auriculiformis</i> (PNG, northern black wattle), <i>A. crassicaarpa</i> (PNG, thick-podded salwood), <i>A. mangium</i> (PNG, mangium), <i>A. peregriana</i> (PNG, New Guinea salwood), <i>A. richitii</i> (F, qumu) and <i>A. spirorbis</i> (NC, faux gaia; V, namariu)
2. <i>Agathis macrophylla</i> (kauri)	2	1	1*	1*	3	2	3	1*	F, SI, V. Other priority species include <i>A. labillardieri</i> (PNG), <i>A. lanceolata</i> (NC), <i>A. moorei</i> (NC), <i>A. ovata</i> (NC), <i>A. robusta ssp. nesophila</i> (PNG), <i>A. spathulata</i> (PNG) and <i>A. silbae</i> (V)
3. <i>Calophyllum</i> spp (tamanu or damanu)	2(T)	2	2	2	3	2	2	2	Regionally priority species: <i>C. inophyllum</i> (F, NC, PNG, SI, V; beach tamanu, dilo), <i>C. neo-ebudicum</i> (PNG, SI, V, F; damanu), <i>C. peekelii</i> (PNG; SI, ba'ula). Nationally important species: <i>C. caledoniacum</i> (NC, tamanou), <i>C. cerasiferum</i> (F, damanu) and <i>C. vittense</i> (F, damanu).
4. <i>Cordia subcordata</i> (island walnut)	2	2	2*	2	3	3	2	1	F (nawanawa), PNG, SI (kerosine wood), V (buraou blong solwota), NC (faux gommier)
5. <i>Diospyros</i> spp. (Pacific ebonyes)	2(T)	2	2	2	2	2	3	2	Important species include <i>D. hebecarpa</i> (SI), <i>D. elliptica</i> (F), <i>D. major</i> (F), <i>D. samoensis</i> (F, V) and <i>D. aff. ferrea</i> (PNG)
6. <i>Endospermum medullosum</i> (whitewood, a'asa, PNG basswood)	1	2	1*	1*	1	1	2	1	PNG, SI, V. Other priority species include <i>E. macrophyllum</i> (F, kauvulu) and <i>E. robbieanum</i> (F, kauvula).
7. <i>Intsia bijuga</i> (island teak)	2	1	1*	2	2	2	3	1*	F (vesi), NC (kohu), PNG (kwila), SI (u'ula), V (natora)
8. <i>Pometia pinnata</i> (Pacific lychee)	2	2	1*	1	1	2	2	3	F (dawa), PNG (taun), SI (ako), V (nandao), NC (pomet)
9. <i>Pterocarpus indicus</i> (New Guinea rosewood)	2	1	1*	1	1	2	3	1	PNG, SI (itiki), V (bluwota)

SPECIES	EXPLORATION & GERMPLASM COLLECTION <sup>2</sup>			EVALUATION, IMPROVEMENT & GERMPLASM SUPPLY <sup>3</sup>			CONSERVATION		REMARKS <sup>4</sup> (including information on countries, related species and common names)
	Biological information	Gene-ecological studies	Germplasm collection & research	Field testing & evaluation	Selection and breeding	Germplasm supply	Ex situ conservation	In situ conservation	
10. <i>Santalum</i> spp. (sandalwoods)	1	1	1*	1*	1*	1	2	1	Priority species are <i>S. austrocaledonicum</i> (V & NC), <i>S. macgregorii</i> (PNG), & <i>S. yasi</i> (F, yasi).
11. <i>Canarium indicum</i> & <i>C. harveyi</i> (galip, nangai or ngarli nuts)	3	3	1	1	1	2	2	3	PNG,SI,V,F
12. <i>Dacrydium nidulum</i> (yaka)	2	2	3	3			2	1	PNG,F,SI. Nationally significant species include <i>D. guillauminii</i> (NC, queue de chat), <i>D. nausoriense</i> (F) & <i>D. novoguineense</i> (PNG).
13. <i>Flueggea flexuosa</i> (mamufu'a, namaumau)	3	3	2	1	2	2		3	PNG,SI,V
14. <i>Gmelina moluccana</i> (white beech)	2	2	2	1	3	2	3	1*	PNG, SI (arokoko). <i>G. vitiensis</i> (rosawa) important in F.
15. <i>Pleiogygium timorense</i> (tulip plum)	3	3	2	2	3	3	3	2	V (red nakatabol), (PNG,SI,F- manuwai)
16. <i>Serianthes</i> spp.	2	1T	1	2					<i>S. ebdarum</i> (V), <i>S. hooglandii</i> (PNG,SI- mamufai), <i>S. minahassae</i> (PNG,SI- fai), <i>S. melanesica</i> (F – Vaivai ni veikau,NC,V), <i>S. vitiensis</i> (F)
17. <i>Syzygium</i> spp. (yasiyasi, yasidravu, water gum, aimela)	3	3	2	2	2	3	2	3	F, NC, PNG, SI, V. Many important timbers including <i>S. buettnerianum</i> (PNG, SI, V), <i>S. effusum</i> (PNG, SI, F), <i>S. fijiense</i> (F), <i>S. leucanthum</i> (F), <i>S. neepau</i> (V), <i>S. niddie</i> (F, V) & <i>S. papuasicum</i> (PNG, SI) & <i>Cleistocalyx</i> spp.
18. <i>Terminalia</i> spp.	2	3	2	2	2	2	1	2	<i>T. catappa</i> (F, SI, V – beach almond), <i>T. brassi</i> (PNG – brown terminalia, SI - dafo) & <i>T. calamansanai</i> (PNG – yellow terminalia, SI - kako) very important in Melanesia. National priority species include <i>T. cherrieri</i> (NC), <i>T. kaernbachii</i> (PNG – okari nut), <i>T. solomonense</i> (SI).
19. <i>Toona</i> spp (sureni & ciliata) (cedars)	1(T)	2	1	2	3	2	3	2	PNG, SI
20. <i>Xanthostemon</i> sp. (ainigao)	2(T)	2	3	3			2	1*	PNG, SI

SPECIES	EXPLORATION & GERMPLASM COLLECTION <sup>2</sup>			EVALUATION, IMPROVEMENT & GERMPLASM SUPPLY <sup>3</sup>			CONSERVATION		REMARKS <sup>4</sup> (including information on countries, related species and common names)
	Biological information	Gene-ecological studies	Germplasm collection & research	Field testing & evaluation	Selection and breeding	Germplasm supply	Ex situ conservation	In situ conservation	
<b>New Caledonia</b>									
1. <i>Araucaria nemorosa</i>	3	3	3	3	3	3	3	2*	NC. Additional priority species include <i>A. columnaris</i> (NC, pin colonnaire), <i>A. cunninghamiana</i> (PNG, hoop pine), <i>A. humsteini</i> (PNG, klinke pine), <i>A. montana</i> & <i>A. schmidii</i> (NC, sapin de montagne).
2. <i>Montrouziera cauliflora</i> (houop)	2	2	2	2	3	2	2	2	NC
<b>Exotic</b>									
1. <i>Gmelina arborea</i> (gmelina)				3	2	2			SI
2. <i>Pinus caribaea</i> (Caribbean pine)				1	1	1			F, V, NC
3. <i>Santalum album</i> (sandalwood)				2	2	2			F
4. <i>Swietenia macrophylla</i> (big-leaf mahogany)				1	1	1			F, SI, V
5. <i>Syzygium malaccense</i> (Malay apple)				3	2	2			PNG,SI,V,F
6. <i>Tectona grandis</i> (teak)				2	2	2			PNG,SI

1. Top priority, action urgently needed

2. Action within next 5 years

3. Action within next 10 years

Blank Action not required

\* Action in progress

<sup>2</sup> Biological information, includes natural distribution, ecology, phenology

Gene-ecological studies = morphology, isozyme, DNA

(T) = taxonomic study needed; Germplasm collection and research = for evaluation and *ex situ* conservation; research on seed physiology & storage regimes

(S) selected cultivars

## Appendices

<sup>3</sup> Field testing & evaluation includes trials at provenance, progeny and clonal levels; Germplasm supply refers to development of seed production stands, clonal hedges etc for production of reproductive materials for general plantings.

### Countries/territories

F	Fiji	NC	New Caledonia
PNG	Papua New Guinea	SI	Solomon Islands
		V	Vanuatu

### Appendix 19: list of tree species identified as highest priority for genetic resource operations and activities in Polynesia/eastern Pacific

SPECIES	EXPLORATION & GERMPLASM COLLECTION <sup>2</sup>			EVALUATION, IMPROVEMENT & GERMPLASM SUPPLY <sup>3</sup>			CONSERVATION		REMARKS <sup>4</sup> (including countries and related species)
	Biological information	Gene-ecological studies	Germplasm collection & research	Field testing & evaluation	Selection and breeding	Germplasm supply	Ex situ conservation	In situ conservation	
<b>Indigenous</b>									
1. <i>Calophyllum inophyllum</i> (fetau, beach mahogany, Alexandrian laurel, ati)	1	2	1	2	2	2	2	1	T,N,WF,CI,FP,Tk
2. <i>Calophyllum neo-ebudicum</i> (tamanu)	2	3	3	2	3		2	3	AM,S,WF
3. <i>Cordia subcordata</i> (taunave, puataukanave, tou)	2	2	1*	2	3	2	2	1	T,FP,Tk
4. <i>Intsia bijuga</i> (ifilele, fehi)	2	2	2*	2	3	2	2	1*	AS,S (planned to introduce into FP)
5. <i>Planchonella samoensis</i> (mamalava) (syn. <i>P. torricellensis</i> )	3		2	1			3*		AS,N,S,WF
6. <i>Pometia pinnata</i> (tava, kava)	1	1	1	1	1	1	1	1	AM,N, S,T,WF
7. <i>Santalum</i> spp. (sandalwood)	1	1	1*	1*	1	1	1	1	Priority species are <i>S. insulare</i> (FP & CI; ahi ute, puahi, santal rouge), & <i>S. yasi</i> (T, ahi).
8. <i>Syzgium inophylloides</i> (asi toa)	1	2	1	1	2	1	1	1	AS, N, S, WF: Other priority species include <i>S. neurocalyx</i> (koli) in AS, T & WF, <i>S. patentinerve</i> (S) and <i>S. clusifolium</i> (asi vat) in S, T & WF and <i>S. samarangense</i> (hevula) in N & FP
9. <i>Terminalia richii</i> (malili)	1	2	3	2	2	3	1	2	AS,N,S. <i>T. catappa</i> (talie, telie) important in S and T.

SPECIES	EXPLORATION & GERMPLASM COLLECTION <sup>2</sup>			EVALUATION, IMPROVEMENT & GERMPLASM SUPPLY <sup>3</sup>			CONSERVATION		REMARKS <sup>4</sup> (including countries and related species)
	Biological information	Gene-ecological studies	Germplasm collection & research	Field testing & evaluation	Selection and breeding	Germplasm supply	Ex situ conservation	In situ conservation	
10. <i>Thespesia populnea</i> (milo, miro)	1	1	1	2	2	2	2	1	CI,FP,T
<b>Indigenous</b>									
11. <i>Alphitonia zizyphoides</i> (toi, manee)	1	2	1	3	1	2	2	2	FP,N,T
12. <i>Bischofia javanica</i> (koka, 'o'a)	3	3	3	3	3	3	3	3	N,T
13. <i>Canarium harveyi</i> (mafoa, 'ai)	3		3				2	2	AS,N,T, WF. <i>C. vitense</i> important in S and AS
14. <i>Diospyros samoensis</i> ('au' auli, tutuna)			3	3			3	3	AS,N,S. <i>D. major</i> important in Tonga
15. <i>Dysoxylum forsterii</i> (mo'ota)				3					N. <i>D. samoense</i> important in S
16. <i>Garcinia sessilis</i> (heilala)	3		3	3		2	3	3	AS, T
17. <i>Garuga floribunda</i> (manau)			3	3		3			AS, S, T
18. <i>Manilkara</i> spp.	2		3*	3				2	<i>M. hoshinoi</i> (pau) important in S, and <i>M. dissecta</i> (pani, ngesi) in S & T
19. <i>Morinda citrifolia</i> (nonu, nono, noni)	2	1	1	1	1	1	2		CI,T,N
20. <i>Neonauclea forsterii</i> (afa, mara)	3		3						FP,S,WF
21. <i>Serianthes</i> spp.	3	3T	3	3					<i>S. melanesica</i> (mohemohe) in T,S; <i>S. myriadenia</i> in FP
22. <i>Xylocarpus</i> spp (lekileki, le'ile'i)	3		3					2	<i>X. granatum</i> and <i>X. moluccensis</i> (AS,S,T)

SPECIES	EXPLORATION & GERMPLASM COLLECTION <sup>2</sup>			EVALUATION, IMPROVEMENT & GERMPLASM SUPPLY <sup>3</sup>			CONSERVATION		REMARKS <sup>4</sup> (including countries and related species)
	Biological information	Gene-ecological studies	Germplasm collection & research	Field testing & evaluation	Selection and breeding	Germplasm supply	Ex situ conservation	In situ conservation	
<b>Exotic</b>									
1. <i>Flueggea flexuosa</i> (poumuli)			3	3		3			AS, S, W&F
2. <i>Pinus caribaea</i> (paini)	3			2	2				CI, FP
3. <i>Santalum</i> spp. (sandalwood)				2*		2			<i>S. austrocaledonicum</i> in CI and <i>S. album</i> in T
4. <i>Swietenia macrophylla</i> (mahokani)	3			3	3	3			AS, FP, S

1. Top priority, action urgently needed
2. Action within next 5 years
3. Action within next 10 years

Blank = Action not required

\* Action in progress

<sup>2</sup> Biological information, includes natural distribution, ecology, phenology; Gene-ecological studies = morphology, isozyme, DNA; (T) = taxonomic study needed; Germplasm collection and research = for evaluation and *ex situ* conservation; research on seed physiology & storage regimes (S) selected cultivars

<sup>3</sup> Field testing & evaluation includes trials at provenance, progeny and clonal levels; Germplasm supply refers to development of seed production stands, clonal hedges etc for production of reproductive materials for general plantings.

Countries/territories

AS	American Samoa	CI	Cook Islands	FP	French Polynesia	N	Niue
S	Samoa	T	Tonga	Tk	Tokelau	WF	Wallis and Futuna

**Appendix 20: list of tree species identified as highest priority for genetic resource operations and activities in Micronesia plus Hawai'i / north-central Pacific**

SPECIES	EXPLORATION & GERMPLASM COLLECTION <sup>2</sup>			EVALUATION, IMPROVEMENT & GERMPLASM SUPPLY <sup>3</sup>				CONSERVATION		REMARKS <sup>4</sup> (including countries and related species)
	Biological information	Gene-ecological studies	Germplasm collection & research	Field testing & evaluation	Selection and breeding	Germplasm supply	Ex situ conservation	In situ conservation		
<b>Indigenous</b>										
1. <i>Artocarpus</i> spp. ( <i>A. altalis</i> & <i>A. mariannensis</i> ) (breadfruit, te mai, mei)	1	1	3	1	1	2	3			FSM, G, H, K, M, N, T. National Tropical Botanical Garden (H) maintains the world's largest ex situ germplasm collections (> 173 accessions).
2. <i>Barringtonia asiatica</i> (te bairiati, futu)	2	2	2	3						FSM, M, N, T
3. <i>Calophyllum inophyllum</i> (te itai)	1	2	2	1	3	3		3		FSM, H, K, M, N, T
4. <i>Cordia subcordata</i> (te kanawa)	1	1	2	2	2	3		3		FSM, H, K, M, N, T
5. <i>Intsia bijuga</i> (ifil)	3	3	3	3	3			2		FSM, G
6. <i>Morinda citrifolia</i> (te non, nonu)	3	3	3	3	2	3				FSM, H, K, M, T
7. <i>Pandanus tectorius</i> (fala, te kina)	1	1	1	1	1	1		2		FSM, G, K, M, N, T
8. <i>Pisonia grandis</i> (puuka, te buka)	1	1	2	2	1	3				FSM, K, M, N, T
9. <i>Terminalia</i> spp. ( <i>T. catappa</i> & <i>T. samoensis</i> ) (te kuniikun, talie)	2	1	2	2	2	3		3		FSM, K, M, N, T
10. <i>Thespesia populnea</i> (milo)	3	3	1	1	2	2		2		FSM, M, N, T
11. <i>Argusia argentea</i> (te ren, tausunu) (syn. <i>Tournefortia argentea</i> )	2	2	2	1	2					FSM, M, N, T
12. <i>Bruguiera gymnorrhiza</i> (te tongo buangai)	2	3	2	2				2		FSM, N
13. <i>Camptosperma brevipetiolata</i>								3		FSM, P
14. <i>Ficus tinctoria</i> (te bero, felo)	2		2	2						FSM, K, M, T
15. <i>Hibiscus tiliaceus</i> (fau, te kiai, te rau)	1		2	3	3					FSM, M, N, T

SPECIES	EXPLORATION & GERMPLOASM COLLECTION <sup>2</sup>			EVALUATION, IMPROVEMENT & GERMPLOASM SUPPLY <sup>3</sup>				CONSERVATION		REMARKS <sup>4</sup> (including countries and related species)
	Biological information	Gene-ecological studies	Germplasm collection & research	Field testing & evaluation	Selection and breeding	Germplasm supply	Ex situ conservation	In situ conservation		
16. <i>Neisosperma oppositifolium</i> (te kiebutinang, fao, paopao)				3	3					FSM, M, N, T
17. <i>Pemphis acidula</i> (te ngea, gie, g'igie)	2	3	3	3	3			3		FSM, K, M, T
18. <i>Rhizophora</i> spp (togo, te tongo)				3	3			2		FSM, K, M, T
19. <i>Serianthes</i> spp.	3*		3*	3*		3		3		<i>S. nelsonii</i> (G, NM) & <i>S. kanehirae</i> (P, FSM)
20. <i>Xylocarpus granatum</i>								2		FSM,
<b>Hawai'i</b>										
1. <i>Acacia koa</i>	1	1	1	1	1	1		1	1	H
2. <i>Meterosideros polymorpha</i>	1	1	1	2	2	2		3	1	H
3. <i>Nothocestrum</i> spp.	1	1T	1			2		1	1	H. Includes four rare, little-known species
4. <i>Pritchardia</i> spp.	1	1T	1			2		1	1	H
5 <i>Santalum</i> spp.	2	1T	2			3		2	1	H. Four endemic species <i>S. ellipticum</i> , <i>S. freycineianum</i> , <i>S. haleakalae</i> & <i>S. apiculatum</i>
6. <i>Sophora chrysophylla</i>	1	1T	1					3	1	H.
<b>Exotic</b>										
1. <i>Casuarina equisetifolia</i> (te katurina, lakau kilisimasi)	3		2	3	3					FSM, G, K
2. <i>Acacia</i> spp.	3*		2	2*	2*	3		3*		FSM, G, K. Priority species include <i>A. auriculiformis</i> , <i>A. mangium</i> & <i>A. ampliceps</i>

1. Top priority, action urgently needed

2. Action within next 5 years

3. Action within next 10 years

Blank Action not required

\* Action in progress

<sup>2</sup> Biological information includes natural distribution, ecology, phenology.

Gene-ecological studies: morphology, isozyme, DNA.

(T) = taxonomic study needed

## Appendices

Germplasm collection and research = for evaluation and *ex situ* conservation; research on seed physiology & storage regimes

(S) = selected cultivars

<sup>3</sup> Field testing & evaluation includes trials at provenance, progeny and clonal levels; Germplasm supply refers to development of seed production stands, clonal hedges etc for production of reproductive materials for general plantings

<sup>4</sup> Countries/territories

FSM Federated States of Micronesia

G Guam

H Hawai'i

K Kiribati

MI Marshall Islands

NM Marianas

N Nauru

P Palau

T Tuvalu

**Appendix 21: list of participants to the Pacific sub-regional Workshop on forest and tree genetic resources – Apia, Samoa, 12-16 April 1999**

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Appendices

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## Appendix 22: list of country papers available on the Internet

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<http://www.ffp.csiro.au/tigr/atcmain/whatwedo/projects/sprig/marshall.pdf>

More reports are being posted on line at the SPRIG Website:  
<http://www.ffp.csiro.au/tigr/atcmain/whatwedo/projects/sprig/apia.htm>

See also the FAO website on forest genetic resources:  
<http://www.fao.org/forestry/fgr>  
and look under information by country.

**Appendix 23: map of the South Pacific sub-region**



Map provided courtesy of SPREP – Not all countries and territories may be included