SAMOA:

COUNTRY REPORT TO THE FAO INTERNATIONAL TECHNICAL CONFERENCE ON PLANT GENETIC RESOURCES

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Note by FAO

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CHAPTER 1
Introduction

Western Samoa[1] is an independent small island developing state (SIDS) in the central South Pacific, lying about latitude 14 degrees south and longitude 170 degrees west and not far from the international dateline.

The country is located 2,600 miles north west of Hawaii, and north east of New Zealand 1,800 miles and 2,700 from Sydney, Australia. The total land area is about 2,930 km^2. Of the two main islands, Savaii is the largest at about 1,700 km^2. The population in 1991 was about 161,000 persons, mostly on the second largest island 'Upolu. The islands are of volcanic origin clearly visible in the form of several dormant volcanoes and lava fields.

Beyond the narrow coastal plains, mountain ranges rise steeply to a maximum of 1,860 metre (m) on Savaii and 1,100 m on Upolu intersected by fertile valleys. The greatest part of the country was covered by lush vegetation and rain forest. The country's 362 villages are divided into 43 districts.

The climate is tropical with abundant rainfall. Humidity is high averaging about 80 percent (%). The average monthly temperature averages about 27°C with little seasonal variation. There are two main seasons with the rainier season from November through April when cyclones may occur, and the drier season from May through October, the latter with more regular south east trade winds. The mean annual rainfall is about 2,900 mm although there is great variation with latitude and location.

The country's farming systems are characterised by closely independent production activities that cut across the crops, livestock, fisheries and forestry sub-sectors. The food crops sector is dominated by the production of root crops such as taros (giant *Alocasia macrorrhiza, Colocasia esculenta*, American *Xanthosoma* sp.), yams, manioc/cassava, etc., and bananas and plantains. *Colocasia* sp. taro, the main staple and export, was devastated by *Phytophthora colocasiae* taro leaf blight (TLB) in 1993 and has largely been replaced by giant taro, bananas and plantains.

[1] Samoa was known as Western Samoa when this report was prepared.

Coconut and cocoa were severely damaged by Samoa's worst cyclones in 1990 and 1991, but have now largely recovered and are again important cash crops and sources of food.

The production base is narrow being confined to a few root crops, vegetables and fruits. However, with the FAO Fruit Tree Project and the Australian Agency in International Development (AusAID) Farming Systems Project, the production base is being diversified with the introduction of exotic fruit trees as well as the development of economically viable crops in ecologically suitable and sustainable farming systems for production by farming communities.

CHAPTER 2
Indigenous Plant Genetic Resources

As well as truly indigenous/endemic PGRs for food and agriculture (-FA), this section will also equally consider Polynesian/Austronesian introductions, and even some important ones since missionary contact in 1830 and later by Chinese and Solomon Islanders who have naturalised as for some of their introductions.

Western Samoa's native vegetation types with major species have been well documented by Whistler (1992) while Pearsall and Whistler (1992) mapped them in terrestrial environments. The latter did not consider the lagoon where the seagrasses *Halophila ovalis* vao sami and *H. o. var. bullosa limulimu* provide food for dwindling sea turtles, and edible seaweeds/algae *Caulerpa clavifera* limu fu'afu'a and *Sargassum* spp. limu tala are harvested (Morton *et al.*, 1988).

2.1 FOREST GENETIC RESOURCES (FGRS)

The main forest types are littoral (6 sub-types), coastal rainforest (*Syzygium* and *Diospyros* spp.), lowland rain forests (4 sub-types, i.e. *Dysoxylum, Pometia, Syzygium*, and *Planchonella* sp., including *Elaeocarpus tonganus* a'amatia and *Calophyllum neo-ebudicum tamanu*), montane rainforest, cloud, swamp, and secondary forests.

Most of the coastal and lowland forests of Upolu island have been cleared (about 80% agricultural) and the resource has been projected to be finished by about the year 2007 while largely exotic plantation forests recover from cyclones. The State of the Environment Report (Taule'alo, 1992:23) noted fruitbats' (*Pteropus samoensis* pe'a vao) role in pollinating/dispersing up to 30% of the forest species, so the sustainability of these ecosystems is under question as the bats/birdlife also recover from cyclones under protection.

Western Samoa notes FAO's priority to include only *Casuarina equisitifolia* toa, a very minor species here perhaps due to out-competition under high rainfall and temperature. *Canarium* and *Acacia* spp. are different ones from Samoa's *C. harveyi* (syn. *mafoa*)/*C. vitiense* (syn. *samoense*) ma'ali, with *A. simplex titania* only on western Savaii island. *Peraserianthes falcateria tamaligi*

("tamarind") was introduced and has naturalised as a very fast-growing nitrogen-fixing tree (NFT) being used for firewood as preferred hardwoods are replaced. *Swietenia* sp. is another important exotic here.

The South Pacific Regional Initiative on FGRs (SPRIG) and national priorities include *Calophyllum* spp. (e.g. *C. inophyllum fetau*), *Pometia* spp. (e.g. *P. pinnata tava*), and *Terminalia* spp., but not *T. catappa/samoensis* (syn. *littoralis*) *talie.* These are supplemented by *Aleurites molucanna lama, Broussonetia papyrifera* u'a, Intsia bijuga *ifilele, Inocarpus edulis* if*i, Rhizophora* spp. (e.g. R. mangle/*samoensis togo),* and *Spondias dulcis vi.* The latter is included in FAO's Fruit Trees Project here as also exotic and locally selected mangoes. The Forestry Division stresses high priority for *Flueggea* (syn. *Securinega*) *flexuosa* (not *samoana*) *poumuli.* Other FGRs of importance include *Syzygium malaccensis* nonu fi'afi'a.

Yen (1993) noted *Syzygium spp., Pometia pinnata, Terminalia catappa, Canarium harveyi,* etc. with "new crop" potential.

With such great agro-deforestation, many species are endangered/threatened. Whistler (in Taule'alo, 1993: 65-69) lists 136 (of about 780, including about 260 weeds introduced since missionary times). Those last collected before him (1968) must truly be so, as also for others, e.g. species nova of Macaranga, etc. Park et al. (1992) recommended conservation of 14 lowland areas, while Pearsall and Whistler (ibid) added another six upland areas (Appendix 1). The later noted the main swamp forest converted for hydropower before assessing the impacts. A survey of the remnant is only now being completed.

The flora has the most species of ferns (about 200 spp.) and orchids (about 100 spp., e.g. 12 *Dendrobium*, 11 *Bulbophyllum* spp. etc.). Next most numerous are 45 family *Rubiaceae* (coffee, etc.), with 20 *Psychotria* spp. and two endemic *Sarcopygme* spp. 'u'unu/'ulu vao, followed by 24 *Urticaceae* (nettles, with 12-14 *Elatostema* spp.), 20 each *Fabaceae* (peas, etc.), *Gesneriaceae* (*Cyrtandra* spp.), *Myrtaceae* (*Syzygium* spp.), and 19 *Euphorbiaceae* (spurge) family.

2.2 POLYNESIAN INTRODUCTIONS

Samoa was first settled about 3,300 years ago and from then began the anthropological disturbance of the natural vegetation. In only two areas has this resulted in fernlands. Most continue in a shortening cycle of managed to secondary scrub and forest, including *Erythrina* sp. *gatae.*

Poly-/Austro-nesian introductions were mainly monocotyledons, i.e. root crops *Dioscorea* spp. (5), Araceae/aroids (*Colocasia, Alocasia, Cyrtosperma, Amorphophallus* sp.; with *Xanthosoma* spp. recent), etc.; *Musa* spp. plantains (xAAB, xABB/ABBB; *M. troglodytarum*), and *Pandanus* spp. (3; Appendix 1). *Pandanus tectorius* may be native, but the unarmed-leafed lau'ie is a selection. It is noted that these have different distributions in the Pacific, i.e. some only in Western Polynesia, or only as far as the Cook Islands, or South east Polynesia (*Cyrtosperma* sp. was recently found to also be on Henderson island 550-400 years ago). The more important seem to have been introduced as far as Hawaii including *Cocos, Saccharum*, and even *Tacca* sp. *pia/masoa.* The latter's use for cooking starch has largely been replaced firstly by *Metroxylon* sp. and now by Manihot sp., the major use here for the latter until TLB.

In order of numbers of cultivars (Appendix 1), Samoa's main PGRFAs are *Artocarpus* sp. 'ulu (30), *Colocasia* talo (27), *Dioscorea alata* 'ufi tau (24), *Musa* xAAB fa'i Samoa (20), *Alocasia* ta'amu (12), *Cocos* sp. niu (11+). Traditional introductions of various of these include from Manu'a (former kingdom now part of American Samoa), Tonga (Toga), Fiji (Fiti), Uvea (Uea; Wallis Is.), Niue, and in missionary times New Guinea (Niu Kini).

As a result of introduced PGRFAs, cyclones, and TLB, all have suffered genetic erosion since 1935 (Christopherson in Parham, 1972). The South Pacific Commission's (1959) breadfruit collection at Vailima near the Forestry Division was neglected (Ragone, 1991). There have been significant accessions of exotic *Cocos* sp. as well as *Musa* xAAA(A), and most recently *Colocasia* sp. Traditional cultivars are now hardly recognised for *Cyrtosperma* sp. (9), *Inocarpus* (8), *Cordyline* (8, except ti vao*)*, *Dioscorea esculenta* 'ufi lei (5), *Syzygium corynocarpum seasea* (3), *Terminalia catappa* (3), and *D. bulbifera* ('ufi sina). There are however still important cultivar differences for *Piper* sp. 'ava (6), *Musa troglodytarum* soa'a (5), and *D. nummularia* palai (4). For most of the others, domesticated cultivars are not recognised as well as for other possible introductions.

Important studies of isoenzymes include Samoa's taro (Lebot and Aradhya, 1991; and RAPDs by Cho, unpubl.), kava (Lebot et al., 1991; also chemotypes), plantains (Lebot et al., 1993), breadfruit (Ragone, unpubl. Ph.D., not cited), and RAPDs of sweet potato (Jarret and Austin, 1994). Other studies will hopefully be extended to include Samoa, ie. taro chromosomes (Coates et al., 1988), and ribosomal and mitochondrial DNA (Matthews et al., 1992), and *D. bulbifera* chloroplast DNA (Terauchi et al., 1991). It is hoped that these will also be extended to other Araceae, *Dioscorea* spp., *Cocos* spp., *Saccharum/Schizostachyum/Erianthus* spp., *Pandanus* spp., *Syzygium* spp., *Citrus* spp., etc. Studies of Coix sp. *sanasana* and Benincasa

sp. *fagu* could particularly enlighten the route of the introductions and domestication by Austronesians versus Non-Austronesians. (The latter are suggested for *Alocasia* sp. as well as domesticated-type taro on Bougainville.)

It is most interesting that taro cultivars Niue and Manu'a have the same corm prolamine and albumin group by isoelectric focusing as Hawaiian Lehua cultivar. Samoan yellow-cormed *Pula samasama* etc. are in a different group with Hawaiian Api'i etc. (Nip and Wei, 1991).

The correlation of *Musa* xAAB Pacific plantains with Hawaii (HI)'s is particularly illuminating, ie. 'Aumalie/Lapo'a (Maoli HI), Fa'i usi (Popoulu), and Mamae ('Iholena). *Musa acuminata ssp.* banksii (Samoan *taemanu*/bird droppings) may be the progenitor (AA) from Papua New Guinea, rather than Malaysia.

Kava-lactone chemotypes are equally illuminating, ie. type H only in Vanuatu and Samoa (2 short-noded le'a), G also in Tonga (Samoan 'ava talo/ulu), whereas I is found from Fiji to Pohnpei and HI (Samoan 'ava la'au/sa/mumu). Chemotype E was not found in Samoa but has a distribution from Vanuatu (via Tonga?) like I. Vanuatu is the proposed origin for *Piper wichmannii* from which kava was domesticated (Lebot *et al.*, 1991).

Analysis by RAPD has separated three Western Samoan, other Oceanian and United States' Ipomea batatas 'umala/sweet potato accessions from Peruvian ones (Jarret and Austin, 1994).

Taro and probably all other Polynesian cultivars, e.g. sugarcane, etc. have a vulnerable/narrow genetic base (Lebot, 1992). For improvement, cooperation is needed with Papua New Guinea, Solomon Islands, and/or South east Asia.

Medicinal plants

In spite of introduced medicines, medicinal plants still remain important. Whistler (1992b, 1996) reported 17% from recent, and 30% from Polynesian introductions, compared with 53% for native species, similar to Tonga's percentages. Two-thirds of the species are the same as Tonga's, but only half of the uses. Perhaps the most significant find to date is of prostratin in *Homalanthus nutans* foga/fanua-mamala to have activity against AIDS/HIV virus (Cox and Balik, 1994). The latter raises the issue of intellectual property rights (IPR), while the PGRs are yet to be protected by legislation.

CHAPTER 3
National Conservation Activities

For forest conservation, the Forestry Division (FD) of the Ministry of Agriculture, Forests, Fisheries and Meteorology (MAFFM) will implement the following measures to prevent further loss of natural ecosystems and species:

- Restrict indigenous and plantation forestry logging activities on steep slopes and in areas of ecological importance.
- Discourage agricultural clearance of forests within these areas particularly watershed areas.
- Develop fiscal and management measures which discourage the clearance of forests and ensure that where clearance occurs its extent is limited and that there is sufficient use of the forest products that arise from these clearance activities so that pressure to clear other areas is reduced.
- Through photo interpretation and ground assessment work, FD with the support of the Department of Lands, Surveys and Environment (DLSE) will monitor the rate of forest clearance caused by agriculture and forest activities. Using this information the Division of Environment and Conservation (DEC) will identify critical ecosystems threatened by these activities and review its Biological Diversity.

The FD will assist DEC as and where required in instigating an action program based on existing information and taking into account results of subsequent studies to establish, manage and monitor ecological reserves.

The FD will assist DEC in extending the National Ecological Survey to include higher altitude forest areas/ecosystems not surveyed to date. Areas of high conservation value identified should be incorporated by DEC into its Biological Diversity Conservation Strategy and Action Program.

It has been reported from the University of the South Pacific (USP) at Alafua that practically all field collections there have been lost due mainly to bad management, which to some extent is the result of limited resources. In 1986 it was recorded that there were 28 accessions of taro and 23 of yam (*Dioscorea* spp.) maintained in field collections. Local varieties of *Alocasia* sp. and *Xanthosoma* spp. were also held in field collections but there is no information on the number of accessions held. A recent review (1994) recorded that virtually all accessions in the field collections were lost and that only seven unidentified accessions of yam (*D. alata*) remain. Within the USP

there is an European Union (EU)-funded regional Tissue Culture Laboratory that is part of the Pacific Regional Agricultural Program (PRAP).

This laboratory concentrates on maintaining accessions that are representatives of the region's germplasm and so very few accessions are of local germplasm.

At present the following are the numbers of local accessions held: bananas 10, *Colocasia* taro 11, *Cyrtosperma* giant swamp taro 1, and sweet potato 12. The MAFFM's National Tissue Culture Laboratory that is concerned mainly with the production of planting materials for growers, has five accessions of taro.

A small Botanical Garden at Vailima is under the supervision of DLSE-DEC.

Following TLB, the AusAID Western Samoa Farming Systems Project assisted the diversification to other root crops and bananas by targeting for three acre (1.4 hectare) multiplication plots. Only that for bananas was achieved, with half of that for *Alocasia* sp. giant taro, with one acre each of *Xanthosoma* sp., yams (*Dioscorea nummularia* and *D. alata*), and sweet potato.

CHAPTER 4
In-Country Uses of PGRs

Germplasm that has been imported from overseas has been multiplied at both USP-Alafua and MAFFM Tissue Culture Laboratories, before releasing to farmers.

Taro germplasm was used in the past in an on-going breeding program at the USP's Institute for Research, Extension and Training in Agriculture (IRETA) which resulted in the release of the hybrid 'Sunrise'.

Taro material, e.g. cv. Niue, has also been distributed to Bubia Research Station, Lae, Papua New Guinea where it is being crossed with TLB tolerant cvs. with the hope that Niue-quality cvs. with tolerance can be indexed as lethal virus-free for further trial here against a possibly different mating type of TLB.

Local bananas, sweet potato, manioc, ginger, cocoa, coconuts, coffee, and fruit trees like mango, lime, orange, spondias vi, etc. have been multiplied and distributed to local growers.

CHAPTER 5
National Goals, Policies, Programs and Legislation

The National Environment and Development Management Strategies (NEMS) contains strategies relating to Biological Diversity. Under each of the following strategies are listed suggested activities aimed at implementation, together with relevant legislation.

Strategy 1: Protect and conserve biodiversity

Protect the natural ecosystems of forests and river environments and preserve typical examples:

- Lands, Surveys and Environment Act 1989
- National Parks and Reserves Act 1974
- Stevenson Memorial Reserve and Mount Vaea Scenic Reserve Ordinance 1958
- Water Act 1965

Strategy 2: Integrate the sustainable development of biodiversity into environmental planning and assessment

- Develop planning controls to protect and conserve biodiversity
  - Lands, Surveys and Environment Act 1989
  - Forest Act 1967
- Control and/or Prevent the Introduction of Inappropriate or Foreign Plants
  - Noxious Weeds Ordinance 1961
  - Plants Act 1984 and Regulations
- Strengthen the Capabilities of Agricultural Inspection and Quarantine Services
  - Agriculture, Forests and Fisheries Ordinance 1959 and Regulations

- Other strategies include: (national) parks; jointly cooperate with Non-Government Organisations, Covenants, and (water) catchments.
- Other objectives for the conservation of biodiversity include to:
  - maximise the potential benefits related to biodiversity;
  - develop knowledge and promote understanding of local biodiversity; and
  - create public awareness of the need to conserve biological and genetic resources.

CHAPTER 6
International Collaboration

There has been collaboration with international centres, mainly INIBAP and ACIAR for bananas, IITA for African yams, CIP for potato, CIAT for cassava, and ICRISAT for groundnut germplasm for testing under local conditions. Information has also been obtained from them on the availability of new material and optimum conditions for *in vitro* conservation.

There has been exchange of germplasm with countries of the South Pacific as well as Asia. With the recent devastation by TLB, taro germplasm has been sourced from the Philippines and the Federated States of Micronesia. Others with tolerance to TLB and free of lethal virus is sought.

Amelanado cocoa has been introduced from the Solomon Islands and Amazonian x Trinitario hybrid seed from Papua New Guinea.

CHAPTER 7
National Needs and Opportunities

The size of Western Samoa and the majority of the South Pacific island countries reflects their disadvantage in maintaining national programs in areas such as conservation and breeding. In addition many countries share the same crops and therefore in many instances it is more realistic to consider sub-regional or regional policies. In a recent study financed by ACIAR (Jackson, 1994) the need for all of the South Pacific island countries to attend to the conservation of their plant genetic resources was highlighted. The report concentrated on taro and yam germplasm, as it was felt that for these two crops, there is no international centre with a mandate for their conservation.

The previous Regional Representative (Seve Imo) from the Asia and Pacific to the CGIAR raised the need for CGIAR to consider including taro in their research programs due to the importance of taro to countries of the Pacific. As has been outlined field collections have not been successful in the secure maintenance of plant germplasm. The losses experienced in Western Samoa can be seen in other island countries. In addition there is an associated inability to exploit the genetic diversity available in order to solve production constraints. It is generally felt that there is an urgent need to attend to collections where losses have been severe and where further losses are likely to occur. It has been suggested that these field collections should be duplicated *in vitro*, and arrangements made for their conservation while countries consider new strategies for maintaining taro and yam germ-plasm for the long term, either as national or shared regional collections. The EU funded PRAP tissue culture laboratories in six of the non-atoll countries. Each of these laboratories will be supported initially by the project to duplicate field collections *in vitro*. If considered necessary, then some of this material will be duplicated *in vitro* in the PRAP regional laboratory. However, the resources of this unit are limited and its main functions are research and dissemination of plant germplasm. Therefore it would not be possible for the PRAP unit to be a regional centre for germplasm conservations. In addition as a regional laboratory, it would only be able to play a supporting role in any national policy.

The ACIAR report made certain recommendations regarding further collections. It was recognised that in order to formulate conservation strategies, both national and regional, there was a need to investigate the genetic diversity of taro and yam in the region. Isoenzyme studies have shown that taro in Polynesia constitutes as narrow genetic base, whereas greatest

variation in this region was found in taro from PNG and possibly the Solomon Islands. There is need therefore to confirm these findings possibly through the use of molecular techniques. Analysis of the variations of existing collections will indicate where genetic diversity is greatest, and where further collecting might be necessary to establish a collection representative of total crop gene pools. In addition, an assessment of the genetic diversity and use of molecular markers will avoid the problem of duplicates, which arises when collections are made in every country where the crop is grown.

A further recommendation of the ACIAR report was the need for a taro and yam network with an associated Germplasm Centre for the Pacific, and possibly to include Asia as well. The Germplasm Centre would be staffed and equipped for *in vitro* conservation and pathogen indexing. It is only with the establishment of such a centre that the future of the genetic resources of taro and yams in the Pacific and Asia is relatively secure.

To protect endangered PGRFAs locally, a network is needed starting with botanist/collectors, village council protection, multiplication of seed(ling)s/cuttings on Savai'i as well as Upolu, education on the need to conserve them, and sales through Flower Growers Association and others.

CHAPTER 8
Proposal for a Global Plan of Action

- In the immediate future carry out a search of what can be found of local cultivar accessions of important food and cash crops particularly root crops.
- Such must be duplicated in other island countries with similar climatic conditions for security reasons.
- The same crops must be in tissue culture as well.
- Local authorities must be convinced of the importance of safeguarding germplasm so that funding for appropriate activities may be made available in the local budget.
- Need to have global assistance in enforcing the ban or restriction on export of PGRs.
- Need to have farmers rights laws enacted as soon as possible.
- An appropriate agency should assist the National effort in setting up a network for the conservation of species of national/regional importance.

APPENDIX 1
Distribution of Intentional Polynesian Introductions

Species (spp.)	Samoan Cvs.	Exotics	Other f/ssp/spp
To Hawaii (27 spp.)			
Aleurites moluccana lama	1		
Alocasia macrorrhiza ta'amu	10+2	Toga, Niu Kini	ornamentals
Artocarpus altilis 'ulu	29+1	Manu'a++	sp. heterophyllus
Broussonetia papyrifera u'a	1		
*Calophyllum inophyllum fetau	1		neo-ebudicum tamanu
*Cocos nucifera niu	11+	MD x Samoa, Rennell	
Colocasia esculenta talo	27	Fiti, xSunrise Niue(4), Manu'a(4)	ornamentals
*Cordia subcordata tauanave	1		
*Cordyline fruticosa ti	8	Toga, Uea	f. montana tivao
Curcuma longa ago/lega	1		
Dioscorea (D.) alata 'ufi (tau)	24	Toga, Ue'a	
D. bulbifera soi/'ufi sina	2		
D. pentaphylla pilita (alofi lima)	1		
Gardenia taitensis pua Samoa	1		
Ipomea batatas 'umala	1+		4 spp.
Lagenaria siceraria (fagufagu Samoa)	1		
*Morinda citrifolia nonu	1		
Musa (M.) xAAB fa'i Samoa	20	Niue, Toga	AA ssp. banksii taemanu; xAAA(A)
M. xABB fa'i pata	1	/pata Toga	xABBB
*Pandanus tectorius lau'ie/?fala	1		8, see below
Piper methysticum 'ava	6	Fiti, Toga	'ava('ava)'atua; 'ava'ava aitu (3)
Saccharum officinarum tolo	7	Fiti	(hybrids)

Species (spp.)	Samoan Cvs.	Exotics	Other f/ssp/spp
Schizostachyum glaucifolium ‘ofe(Samoa)	1		
Solanum viride polo(‘ite)	1		3, see below
Syzygium malaccense nonu fi’afi’a	1+		15, see below
*Tacca leontopetaloides (pia)/masoa 1			sp. maculata
Tephrosia purpurea ‘ava sa	1		
*Thespesia populnea milo	1		
Zingiber zerumbet ‘avapui	1		sp. officinale fiu
To South east Polynesia (12 spp.) and Atolls (2 spp.)			
Amorphophallus paeoniifolius teve	1		
Benincasa hispida fagu	1		
Casuarina equisetifolia toa	1		
Cucumis melo ‘atiu	1		
Erianthus maximum fiso	1		
*Erythrina variegata gatae	1		2, see below
*Ficus tinctoria mati	1		4 spp.
Hibiscus rosa-sinensis ‘aute	4+		4, see below
Inocarpus fagifer ifi	8		
Musa troglodytarum soa’a	5		
Pandanus spurius fala	1		7, see below
*Pipturus argenteus (fau) soga 1			sp. polynesicus
Solanum repandum taulo’u	1		2 other
Spondias dulcis vi	1		
To Cook Islands (2 spp.)			
Bischofia javanica ‘o’a	1		
Cyrtosperma chamissonis pula’a	9	pula Manu’a	
Western Polynesia (21 spp.)			
Atuna racemosa ififii	1		
Canaga odorata moso’oi	1		
Citrus macroptera moli ‘u’u/va	1		9 spp.
Coix lacryma-jobi sanasana	1		
Dioscorea esculenta ‘ufi lei	5		
D. nummularia (‘ufi)palai	3	Niu Kini	
*Erythrina fusca lalapa	1		

Species (spp.)	Samoan Cvs.	Exotics	Other f/ssp/spp
Euodia hortensis usi(Samoa)	1		
Garcinia sessilis seilala	1		
*Intsia bijuga ifilele	1		
*Manilkara dissecta pan	1		
Metrosideros collina (‘anume)	1		
Pandanus whitmeeanus paogo	1		6 other
Parinari insularum sea	1		2 spp.
*Pometia pinnata tava	1		
*Pritchardia pacifica (niu)piu	1		
Pueraria lobata a’a	1		
Syzygium corynocarpum seasea	3		
*Sy. neurocalyx fena(manogi)	1		
*Terminalia catappa talie	3		2 spp.
Tonga only (2 spp.)			
Aglaia sp. Laga’ali	1		samoensis
Diospyros sp. ‘Au’auli	1		samoensis

***: These plants may be native over part of their range**

+: Others known to the authors than those in Parham (1972) referring largely to Christophersen (1935)

++: SPC collection (Parham, 1959).

(Adapted from Whistler, 1991; Parham, 1972)

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