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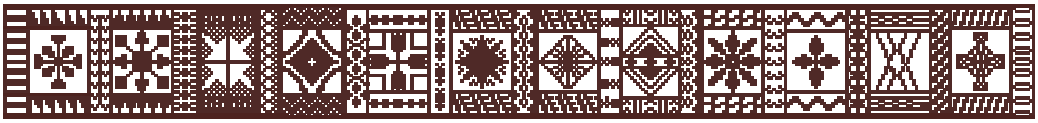

WORKING PAPER No. 7
GEOGRAPHY DEPARTMENT
UNIVERSITY OF THE SOUTH PACIFIC
SUVA, FIJI
2000

TRADITIONAL ENVIRONMENTAL KNOWLEDGE AND COMMUNITY-BASED BIODIVERSITY CONSERVATION IN FIJI: CURRENT STATUS AND PRIORITIES FOR ITS PROTECTION AND UTILISATION

R. R. Thaman[1]

1 INTRODUCTION

The purpose of this paper is to examine the importance of traditional environmental knowledge (TEK) as a basis for the community-based biodiversity conservation in Fiji.. It is based on some of the findings of the National Biodiversity Strategy and Action Plan (BSAP) Technical Working Group 4 on the "Importance of Traditional Knowledge as a Basis for the Conservation and Sustainable Use of Biodiversity in Fiji" (Thaman *et al*. 1998) and on studies conducted by the author over the past twenty five years on the importance of biodiversity as a foundation for the economic, cultural and ecological survival in the Pacific Islands.

With respect to the importance of traditional environmental knowledge as a basis for the conservation and sustainable use of biodiversity in Fiji, the objectives of BSAP Technical Working Group 4 were to:

1. Document and assess the current status and availability of information on Fiji's TEK, resources use systems and conservation practices as an important basis for the conservation and sustainable use of Fiji's biodiversity for the benefit of future generations.

2. Identify gaps in TEK and suggest strategies and priorities for the protection and utilization of this knowledge as a priority component of the BSAP. This would include the protection of the rights ("intellectual property rights") of local communities and the nation to any benefits or remuneration that might be derived from the use or publication of this knowledge.

2 DEFINITIONS OF BIODIVERSITY AND TRADITIONAL ENVIRONMENTAL KNOWLEDGE

For the purposes of this paper and the BSAP Technical Working Group 4 the term "biodiversity" includes:

1. **Ecosystem Diversity:** all of Fiji's natural AND CULTURAL terrestrial, freshwater and marine ecosystems;

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2. **Species and Taxonomic Diversity:** all species and "taxa" of wild and domesticated plants, animals and micro-organisms found in these ecosystems (e.g., types, groups, classes, families, etc. above the species level, such as vertebrates, invertebrates, sharks, shellfish, palms, gymnosperms, grasses, ferns, mosses, fungi, algae, bacteria, phytoplankton and zooplankton);

3. **Genetic Diversity:** all genetic types, breeds, cultivars or varieties of all of the wild and domesticated or cultivated plants and animals found in these ecosystems, and, **for the purpose of protecting intellectual property rights**, all chemical extracts from these organisms; and, finally,

4. **Ethnobiological Diversity,** which itself is defined as the knowledge, uses, beliefs, resource-use and conservation practices and language that Fiji's peoples (our different ethnic groups) have for their ecosystems, species, taxa and genetic diversity.

It is stressed that this final category or "level" of biodiversity, **ethnobiological diversity**, must be seen as central to the definition of biodiversity itself, and can, for the purposes of this paper be considered to be almost synonymous with the more widely used term "Traditional Environmental Knowledge" (TEK). This is because, in Fiji, people and their knowledge and traditions are seen as integral to all terrestrial, freshwater and marine ecosystems (i.e., as part of the *vanua* and *iqoliqoli*), rather than as separate external entities.

The term traditional is used rather than "indigenous" because both Fiji's indigenous and non-indigenous communities have been in close contact with their biodiversity for generations and, as a result, have "traditional" environmental knowledge that serves as an important basis for environmentally sustainable development in Fiji. The critical importance of TEK as a basis for more effective biodiversity conservation and the promotion of environmentally sustainable development has been stressed by numerous writers internationally (Johnson 1992; Hunn 1993ab; Mousson *et al*. 1994ab), and for the Pacific Islands (Klee 1976; 1980ab; Carew-Reid 1990).

3 IMPORTANCE OF COMMUNITY-BASED BIODIVERSITY CONSERVATION AND THE PRESERVATION AND RECORDING OF TEK

Two basic assumptions related to the importance of TEK as a basis for biodiversity conservation in Fiji are:

1. That the conservation and sustainable use of biodiversity can be most successfully implemented **by and for** the benefit of local communities.

2. That for this to take place, there is an urgent need to preserve and use TEK, along with modern scientific knowledge (MSK), as a foundation for community-based biodiversity conservation (CBBC).

3.1 Importance of Community-Based Biodiversity Conservation in Fiji

Whereas the predominant emphasis of biodiversity conservation in more developed countries includes uniqueness or endemism, scientific importance, importance as potential gene pools for plant breeding, medicinal discoveries or other technological breakthroughs for the benefit of humankind, export or touristic potential, or the ecological benefits of biodiversity and ecosystem preservation, for Fiji, where the majority of people still depend on the use of biodiversity for most of their day-to-day subsistence needs AND their cash income, and where biodiversity is central to their cultures, **the main reason for the conservation of biodiversity must be the conservation of Fiji's biodiversity for the sustainable use by local communities, whether it be in coastal or inland sites, in sugarcane farming and other commercial agricultural areas, or in and around our rapidly expanding urban areas.** Although there are new technologies, types of "development", and some new plant and animal species and varieties that could enhance biodiversity and the quality of life in Fiji, the basis for survival will remain its **vanua** ("lands") and **iqoliqoli** ("marine areas and rivers" or "fisheries") and its wild and domesticated plants and animals that have served Fiji's people for over three thousand years.

It is argued that, in terms of cost- and biodiversity-conservation effectiveness (measured in terms of the number of endangered and ecologically and culturally important ecosystems, species and genetic varieties that are protected or types of biodiversity that are used sustainably), AND in terms of maintaining cultural and spiritual links with biodiversity, **conservation of biodiversity at the local community or landowner level should be based on the implementation of "community-based biodiversity conservation" (CBBC)**, rather than on centralized conservation area development and large-scale government initiated and administered conservation initiatives (Thaman 1994ab). This is seen as critical for the following reasons:

1. because of the fragmented and isolated nature of Fiji's islands and island groups and their many constituent communities, larger national- or island-level terrestrial and marine conservation area development and conservation initiatives would benefit only a small minority of Fiji's people;

2. because most land use or conservation decisions in Fiji are made and implemented at the landowner or community level, and not at the national or regional level, the success or failure of most conservation initiatives rests with the landowners and whether or not they clearly see the benefits of biodiversity conservation, and are involved in the planning, implementation and monitoring of such programs; and,
3. because of lack of finance, personnel, transport and technical support, governments in the Pacific Islands, including the Fiji Government, have shown to be ineffective in, or have not had the political will to support, the systematic conservation and sustainable use of biodiversity at the national level.

This is not to suggest that national initiatives for the establishment of conservation areas and the conservation of biodiversity should not also be made a priority.

3.2 Importance of the Conservation, Recording and the Use of Knowledge of Biodiversity and Biodiversity-use Traditions

As suggested above, **a critical precondition for the conservation and sustainable use of biodiversity by local communities is the protection and promotion of the use of traditional knowledge of biodiversity and biodiversity-use traditions**. This body of TEK (ethnobiological knowledge) of Fiji's terrestrial, freshwater and marine biodiversity and traditional resource-use systems has been passed down for generations by Fiji's people, both indigenous and non-indigenous, who have lived in close contact with their biodiversity. As such, it constitutes a cultural foundation upon which rests the survival of the highly productive and sustainable ways of life in Fiji. It is stressed that this biodiversity inheritance (our ecosystems, plants and animals), including the traditional ethnobiological knowledge (TEK) concerning it, is now seriously endangered by modern development and education, and that there is a need to preserve, record and promote the use of this information as a basis for sustainable development in the future.

Numerous studies have shown that one of the main reasons for the loss and endangerment of biodiversity (i.e., ecosystems, species and genetic diversity) and the destruction of time-tested traditional marine and terrestrial production systems **is the loss of traditional knowledge about biodiversity (referred to here as "ethnobiological knowledge" or TEK), particularly among the younger generation, in urban areas, and among urban-based decision makers** (Thaman 1988a; 1990a).

Finally, it is argued that for community-based and national biodiversity conservation programs to be successful, a major component, in terms of both funding and personnel, must be devoted to public education with respect to the importance of biodiversity to cultural survival and sustainable development, and how it can be conserved or enhanced at the community, national, regional and global levels. To do so effectively, TEK in **both English and vernacular languages** must be considered the foundation for effective public education.

Consequently, one of the priority components of the Fiji National BSAP is the **documentation, preservation and promotion of the application to modern development planning and to formal education of traditional knowledge of Fiji's terrestrial, freshwater and marine biodiversity (i.e., TEK)**.

4 FINDINGS AND RECOMMENDATIONS

Based on this preliminary analysis of the status of TEK in Fiji, the following 21 "general and specific findings and recommendations" were presented, by Technical Working Group 4, as suggested integral components of the Fiji Biodiversity Strategy and Action Plan (BSAP). The more general findings and recommendations are presented in sections 4.1 to 4.11 and the more specific

findings and recommendations in sections 4.12 to 4.21. It is suggested that these 21 recommendations could form the core of an "Agenda 21" or "Action Plan" for the protection of TEK as a basis for the conservation and sustainable use of biodiversity in Fiji for the 21st Century.

4.1 The Importance of the Conservation of Fiji's Biodiversity for the Sustainable Use by Local Communities

Finding: Whereas the predominant emphasis of biodiversity conservation in more developed countries includes rarity, uniqueness or endemism, scientific importance, importance as potential gene pools for plant breeding, medicinal discoveries or other technological breakthroughs for the benefit of humankind, export or touristic potential, or the ecological benefits of biodiversity and ecosystem preservation, in Fiji, where the majority of people still depend on the use of biodiversity for most of their day-to-day subsistence needs AND most of their cash income, and where biodiversity is central to their cultures, **the main reason for the conservation of biodiversity must be the conservation of Fiji's biodiversity for the sustainable use by local communities**, whether it be in coastal or inland sites, in sugarcane farming and other commercial agricultural areas, or in and around our rapidly expanding urban areas.

RECOMMENDATION 1: That the primary objective of the BSAP be the conservation of Fiji's biodiversity for sustainable use by local communities.

4.2 The Importance of Community-Based Biodiversity Conservation (CBBC)

In terms of cost- and biodiversity-conservation effectiveness (measured in terms of the number of endangered and ecologically and culturally important ecosystems, species and genetic varieties that are protected or increase in numbers), AND in terms of maintaining cultural and spiritual links with biodiversity, **the primary emphasis of the BSAP should be conservation of biodiversity at the local community or landowner level (community-based biodiversity conservation/CBBC), rather than centralized conservation area development and large-scale government initiated and administered conservation initiatives**. This is not to suggest that national initiatives for the establishment of conservation areas are not also a priority.

RECOMMENDATION 2: That the systematic implementation of Community-based Biodiversity Conservation (CBBC) be made highest priority, and that this be supplemented by centralized conservation development and large-scale centralized conservation initiatives.

4.3 The Importance of the Protection and Promotion of the Use of Traditional Environmental Knowledge

A critical precondition for the conservation and sustainable use of biodiversity by local communities is the protection and promotion of the use of traditional knowledge of biodiversity and biodiversity-use traditions. The traditional knowledge of Fiji's terrestrial, freshwater and marine biodiversity and traditional resource-use systems that has been passed down

for generations by Fiji's people, both indigenous and non-indigenous, who have lived in close contact with their biodiversity constitutes the a cultural foundation upon which rests the survival of the highly productive and sustainable ways of life in Fiji. Consequently, initiatives to promote the conservation and sustainable use of biodiversity will be more successful if they are based on TEK and include traditional conservation and management practices as integral components of these initiatives.

RECOMMENDATION 3: That attempts be made in all biodiversity conservation initiatives to incorporate TEK, including traditional conservation and management practices, into the design, implementation and monitoring of such initiatives.

4.4 The Rapid Loss of TEK and the Lack of TEK Among the Younger Generations

Although detailed traditional ethnobiological knowledge is still considerable, particularly among selected older men and women in all of Fiji's ethnic communities, this knowledge is being lost rapidly and is seriously lacking in the younger generations, urban populations, and among urban-based leaders and policy makers. Without such knowledge, planning for sustainable development and the protection of biodiversity by both local communities and the government will be problematic. In short, Fiji's biodiversity inheritance, including traditional knowledge concerning it, is now seriously endangered by modern development and education, and there is an urgent need to preserve, record and promote this information as a basis for sustainable development in the future.

RECOMMENDATION 4: The protection, recording, and the application of traditional ethnobiological knowledge to the promotion of sustainable development among all Fiji's communities, including the provision of appropriate remuneration and recognition for its use by outside agencies, be a PRIORITY KEY ACTION in the BSAP as a foundation for the conservation and sustainable use of biodiversity in Fiji.

5. **Where traditional ethnobiological knowledge exists, in-depth systematic traditional knowledge is usually only held by a small number of men and women in the community.** There is, thus, an urgent need for the identification of knowledgeable men and women within all Fiji's communities, the systematic collection and documentation of this knowledge, and the acknowledgement of these persons as strategic resources of national importance.

RECOMMENDATION 5: That people with in-depth ethnobiological knowledge be identified, made active participants in the preservation, recording and the promotion of the use of ethnobiological knowledge as a basis for sustainable development, and formally recognized in a national "Register of Living Treasures" or in another appropriate manner.

6. Apart from the extensive work done by the Fijian Institute of Language and Culture, and a few other selected in-depth works on specific geographical areas, **there has been very**

little systematic documentation and publication of Fiji's traditional ethnobiological knowledge and biodiversity-use traditions, and the names and language associated with biodiversity and biodiversity-use traditions, among all of Fiji's ethnic communities.

RECOMMENDATION 6: That funds (recurrent or aid) be allocated, as a priority, to assist the Fijian Institute of Language and Culture, the Fiji Museum, the Indian Cultural Centre, the Rotuman Association, the Rabi and Kioa Councils, and other appropriate agencies to systematically compile and publish relevant topical studies and lexicons (dictionaries) of Fiji's traditional ethnobiological knowledge and biodiversity-use traditions (in both English and vernacular languages) that can be made available to the local communities, the general public, policy makers, planners, tourism developer, educationists, and other appropriate groups for use in the promotion of sustainable development, in the school curriculum, and for incorporation into the data base of the ongoing Fijian Dictionary Project.

7. Although numerous scientific (e.g., biological, botanical, zoological, pedological, hydrological, meteorological, geological, ecological, etc.) studies of Fiji's ecosystems, "natural history" and various groups of terrestrial, freshwater and marine plants and animals have been conducted and published, **there are still critical ecosystems and groups of plants an animals that have not been studied in detail, and few if any of these studies (e.g., on birds, ferns, timber trees, finsfish, freshwater animals, etc.) have systematically documented Fijian names and traditional ethnobiological knowledge** (See Table 1 and Appendix 1 for a preliminary listing of Fiji's main ecosystems).

   Similarly, although there have been countless social-scientific research publications on Fiji (e.g., anthropological, geographical, agricultural, fisheries development, gender and economic studies), the main emphases of these studies has been on areas such as social organization and economic systems, and some cultural aspects such as major food crops, commercial activities, and to a lesser extent handicrafts. **Very few social scientific studies of Fiji have include scientific information (e.g., scientific names) or in-depth ethnobiological information about biodiversity.**

RECOMMENDATION 7: That all researchers, in both the sciences and social sciences, be encouraged, or required, to collect relevant ethnobiological and scientific information (e.g, local and scientific names for plants and animals, natural features and ecosystem components and information and language related to biodiversity use systems and lore), and prepare lists or summary papers that can be translated into vernacular languages or used by local communities, and that this information be provided to the FILC, the Ministry of Education, and other designated agencies so it can used in the planning process or summarized in vernacular languages.

Table 1. Terrestrial, freshwater and marine ecosystems of Fiji that: 1) constitute the major resource-use zones; and, 2) could serve as the focus for multi-ecosystem "community-based biodiversity conservation" (CBBC) and national-level biodiversity conservation in Fiji (See Appendix I for descriptions of each ecosystem).

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1 **TERRESTRIAL/FRESHWATER ECOSYSTEMS**

1.1 Lowland Native Forest (**vei kau/veikau loa**)
1.2 Upland Rain Forest (**vei kau/veikau loa**)
1.3 Mature Fallow Forest (**vei kau/vanua raki**)
1.4 Mangrove Forest (**vei dogo**)
1.5 Coastal Strand Vegetation (**sarava**)
1.6 Grassland/Woodland (**talasiga/maumi**)
1.7 Scrubland/Scrub-Fernlands (**talasiga/maumi**)
1.8 Shifting Agricultural Lands (**raki, iteitei**)
1.9 Permanent/Semi-permanent Agriculture (i**teitei?)**
1.10 Perennial Plantations (**loga ni vei vunikau?)**
1.11 Plantation Forest (**vei kau tei**)
1.12 Pasture (**bai ni bulumakau/ose/me**)
1.13 Intensive Livestock Husbandry
1.14 Houseyard/Urban Gardens (**teitei i loma ni bai**)
1.15 Ruderal Sites (**bati ni gaunisala**, etc.)
1.16 Wetlands (**lobau/vanua luvu?**)
1.17 Rivers, Streams/Lakes/Ponds (**uciwai, lolowai, dreke ni wai/tobu)**
1.18 Fishponds/Aquaculture (**tobu ni ika**)
1.19 Beaches, Sandspits and Dunes (**matasawa, seva**)
1.20 Bare Rock (**baravi vatu, baranisavu**)
1.21 Caves (**qaravatu)**
1.22 Built/Urban (**vei vale/tauni**)

2 MARINE ECOSYSTEMS

2.1 Estuaries (**gusu ni wai**)
2.2 Intertidal Zone/Seagrass Beds (**dela ni wasa**, **tavola/ vei vutia**)
2.3 Lagoons/Bays (**namo, lomaloma/toba**)
2.4 Fishponds/Maricultural Areas (**tobu ni ika**)
2.5 Coral Reefs/Outer Reef (**cakau/batilili)**
2.6 Island Shelf/Reef Platform/Ocean Floor (**boto ni sauloa**)
2.7 Open Ocean (**waituiloa, wasa bula**)

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8. From a community perspective, **recent studies show that a high percentage of important terrestrial, freshwater and marine plants and animals of economic, cultural and ecological importance are locally extinct (extirpated), rare, endangered, in short supply or significantly declining in abundance, due mainly to increasing population, habitat destruction, overexploitation pollution, increasing commercialization and the employment of unsustainable harvesting/use practices**.

RECOMMENDATION 8: That studies be promoted and/or funded, at the community, regional and national levels, of plants, animals and ecosystems AND knowledge that are rare, endangered or in short supply; the reasons for their scarcity or endangerment; and actions that can be taken at the community, regional and national levels to remedy the situation and to promote sustainable use of biodiversity. Where possible, these studies should be participatory in nature and involve local communities and/or local students in the data collection, analysis and publication of the results.

9. **Little systematic effort has been made to insure that researchers (both foreign and local) provide results and/or copies of scientific, social-scientific, and, in particular, ethnobiological and ethnological research, in forms that are useful to the local communities that have been the focus of research**. There has also been little attempt to ensure that summary reports, including original hard data in the vernacular language, are provided to local communities, the government, educational institutions and other appropriate agencies within the country.

RECOMMENDATION 9: That a more systematic attempt be made to ensure that all researchers are required to provide results and/or copies of scientific, social-scientific, and, in particular, ethnobiological and ethnological research, in forms that are useful to the local communities and that have been the focus of research. This could take the form of a requirement that summary reports that include the basic data collected by researchers be provided in multiple copy to appropriate entities in Departments of Immigration, Education (e.g. CDU), Fijian Affairs (e.g., the Fijian Institute of Language and Culture), Health, Agriculture, Forestry, Fisheries, Commerce and Industry, etc.) and University of the South Pacific Library. Additonally, arrangements could be made, or required, to have someone translate results, or summaries of results, into vernacular languages so that they can be provided to local communities.

10. **There is need for a more systematic means of ensuring that: 1) outside researchers and bioprospectors obtain "informed prior consent" and, in the case of foreign researchers and bioprospectors, official government permission (permits), before commencing research on biodiversity and ethnobiology in Fiji; 2) local communities know what their rights and responsibilities are in terms of hosting and facilitating outside researchers and bioprospectors; 3) outside researchers and bioprospectors**

respect the cultural traditions of local communities; and, 4) local communities, researchers and informants are adequately and fairly compensated for sharing their knowledge and hospitality with outside researchers and bioprospectors.

RECOMMENDATION 10: That government and other appropriate non-government entities, such as The University of the South Pacific, develop and enforce appropriate guidelines, regulations and procedures that: 1) require outside researchers and bioprospectors to obtain informed prior consent and permission (permits) from local communities and appropriate government and non-government agencies **before** commencing their work; 2) inform local communities and the general public of both the benefits and potential disadvantages of such research/bioprospecting and the benefits and/or remuneration that they can expect to receive (e.g., this could include a public education program); 3) inform overseas and local researchers of appropriate local customs and expected behavior; 4) inform outside researchers and local communities of expected levels of remuneration/compensation/benefits that should be expected by local communities, researchers and informants who assist or host research and bioprospecting activities; and, 5) ensure appropriate levels of compensation for the discovery of economically or professionally profitable resources or knowledge which are the intellectual property of a local community or the nation.

11. **There is only limited social scientific or scientific content on Fiji's biodiversity and ethnobiological traditions in the current school curricula.** This is a situation that: 1) serves to accelerate the loss of valuable traditional ethnobiological knowledge, particularly among the younger generation; and, 2) reduces the chances of incorporating this information as an integral component of biodiversity conservation and modern development initiatives.

RECOMMENDATION 11: That school curricula at all levels include courses, modules and content (possibly case studies) on the ecological, economic and cultural importance of terrestrial, freshwater and marine biodiversity as a foundation for sustainable development in Fiji, with particular emphasis on the inclusion of local vernacular names, resources-use traditions, and a field component which can directly expose students to their natural and cultural ecosystems, their biodiversity-use traditions, and to resource persons with particular ethnobiological knowledge. This material should be examinable, with some questions related to the conservation of biodiversity and the importance of the sustainable use of biodiversity as a foundation for sustainable development included in all yearly standardized examinations at all appropriate levels (e.g., in subjects such as biology, geography, social science, economics and English).

2.2 Specific Conclusions and Recommendations

12. **Although traditional knowledge of the wide range of distinct ecosystems and habitats found in Fiji is considerable, particularly among selected older men and women in all of Fiji's ethnic communities, detailed knowledge of these ecosystems is being lost rapidly and there is an urgent need for systematic collection and documentation.**

Without knowledge of the nature of these ecosystems, language associated with them, their importance to local communities, and the impact of modern development and changing use systems on them, planning for sustainable development and the protection of biodiversity by both local communities and the government will be problematic. There is, thus, a need for the systematic collection of information on Fiji's important ecosystems before this information is lost. This could include the adoption of a simple ecosystems classification (such as that presented in Table 1, and described in detail in Appendix I). Although there is a need for more in-depth information on all ecosystems, ecosystems that are in particular need of documentation include cloud forests (mountain ecosystems), undisturbed tropical rainforests, river ecosystems, beaches, rocky shores and beach forests, swamplands, mangrove forests and estuaries, seagrass beds, coral reefs and deepwater fisheries.

RECOMMENDATION 12: That a simple functional ecosystem classification system be adopted that conforms to categories used by the people of Fiji, and which can be used at the community or landowner level, and in schools in the region, to promote community-based biodiversity conservation (CBBC) AND as a basis for systematically gathering traditional knowledge about these ecosystems. Although there is a need for more in-depth information on all ecosystems, ecosystems that are in particular need of documentation include cloud forests (mountain ecosystems), undisturbed tropical rainforests, river ecosystems, beaches, rocky shores and beach forests, swamplands, mangrove forests and estuaries, seagrass beds, coral reefs, reef passes and deepwater fisheries.

13. In terms of terrestrial biodiversity, although vascular plants, birds and some larger vertebrates have been widely studied, there has been only limited systematic collection and publication of information on the vernacular names and the corresponding scientific names and traditional ethnobiological knowledge for almost all other groups of terrestrial organisms. Although there remains a need for more systematic ethnobiological information on conifers, flowering plants and birds, there is a priority need to collect in-depth information on other plant groups and all terrestrial animals (Table 2 is an attempt to provide as classification or "check list" that could be used as a basis for the systematic gathering of information on all types of terrestrial **and** freshwater and marine organisms; see findings 14 and 15 below with regard to freshwater and marine organisms).

RECOMMENDATION 13: That the collection and publication of in-depth ethnobiological information on all groups of terrestrial plants and freshwater animals be made a priority of the BSAP. In particular, there is a need to gather ethnobiological information on the following groups of terrestrial organisms:

- lower (non-vascular) plants and micro-organisms
- fungi
- ferns and fern allies
- invertebrates (insects, spiders, worms, etc.)
- birds
- mammals (including bats)

- reptiles
- amphibians

Table 2. Classes, sub-classes, specific types and the utility of terrestrial, freshwater and marine resources that constitute the pool of ecologically important and functionally useful biological resources of community-level ecosystems in Fiji (Under "Utility", E, S and C = direct major Ecological, Subsistence (Traditional) or Commercial or Export (Modern) utility to people at the community and national level Fiji, and e,s and c = minor or indirect ecological, subsistence (traditional) or commercial/export (modern) importance, e.g. plankton is of indirect importance to commercial tuna fishing in terms of its importance in marine food chains; it must be stressed that taxa in some categories may also be harmful or have a negative impact on sustainable development, e.g. pathogenic virus or bacteria, taro beetles, mosquitos, etc.)

Class	**Sub-Classes**	**Specific Types**	**Utility**
Lower Lifeforms E,s,c		Bacteria E,s,c	
		Viruses E,s,c	
Plants	Indigenous	Phytoplankton	E,s,c
	Aboriginal Introductions	Algae	E,S,C
	Recent Introductions	Fungi	E,S,c
	Wild Plants	Mosses	E,s
	Domesticated Plants	Other Lower Plants	E,s,c
	Food Plants	Ferns	E,S,C
	Non-Food Plants	Herbs/Forbs	E,S,C
	Terrestrial	Grasses/Sedges	E,S,C
	Freshwater	Vines	E,S,C
	Marine	Shrubs	E,S,C
		Trees	E,C,C
Animals E,s,c	Indigenous	Protozoa	
	Aboriginal Introductions	Zooplankton	E,s,c
	Recent Introductions	Sponges	E,s,c
	Wild Animals	Corals	E,S,c
	Domesticated Animals	Jellyfish	E,S,c
	Food Species	Worms	E,S,C

	Non-Food Species	Molluscs		
E,S,C				
	Terrestrial	Insects	E,C,C	
	Freshwater	Crustaceans	E,S,c	
	Marine	Echinoderms	E,S,C	
		Holothurians	E,s,c	
		Other Invertebrates	E,S,C	
		Fish	E,s,c	
		Amphibians	E,S,C	
		Reptiles		E,S,C
		Birds	E,S,C	
		Non-Human Mammals		E,S,C
		Humans		E,S,C

14. In terms of freshwater, brackish-water and riparian biodiversity, although there have been scientific studies of a range of organisms (e.g., plants, finfish, shellfish and crustaceans), there has been almost no systematic collection and publication of information on the vernacular names and the corresponding scientific names and traditional ethnobiological knowledge for freshwater, riparian and brackish-water organisms. There is, thus, a priority need to collect systematic ethnobiological information on all freshwater, riparian and brackish-water organisms.

RECOMMENDATION 14: That the collection of in-depth ethnobiological information on all groups of freshwater, riparian and brackish-water organisms be made a priority of the BSAP. In particular, there is a need to gather ethnobiological information on the following groups of freshwater, riparian and brackish-water organisms

- algae and other non-vascular plants
- aquatic and riparian vascular plants
- shellfish, crustaceans, insects and other invertebrates
- eels and other finfish

15. In terms of marine biodiversity, although there is good knowledge of the scientific names and some local names for most major commercial finfish species, some shellfish and selected other invertebrate and seaweed species, there has been no systematic collection and publication of information on vernacular names and the corresponding scientific names and traditional ethnobiological knowledge on almost all marine organisms. If such information is not gathered soon, much of the knowledge on minor species, particularly non-commercial species and non-food species, and their ecological functions and cultural

importance will be lost. There is, thus, a priority need for the systematic gathering and documentation of ethnobiological information on all marine organisms.

RECOMMENDATION 15: That there is a priority need for the systematic gathering and documentation of scientific names, vernacular names and ethnobiological information on all marine organisms. In particular, there is a need to gather information on:

- uncommon commercial finfish species, minor subsistence food finfish species, small non-food finsfish species, deepwater and pelagic finfish species, eels, sharks and rays
- uncommon turtle species and sea snakes
- marine mammals (dolphins and whales)
- uncommon and minor edible shellfish species, all non-food shellfish species
- all crustaceans (crabs, hermit crabs, prawns, shrimps, lobsters)
- all echinoderms, sea anemones, echinoderms and other invertebrates
- all bait species
- preservation techniques and species preserved
- seasonal changes in marine ecosystems and species availability and their relation to marine resources availability and resources utilization
- sea boundaries and marine tenure systems as a basis for the establishment of village or community-based marine reserves
- non-material or spiritual importance of marine organisms as totems, or having other non-material cultural importance
- social structures that influence fishing activities and marine resources management (e.g., kinship ties, social grouping, gender relationships)
- distribution and exchange networks that influence marine resource utilization (e.g., between coastal and inland communities)

16. Although there has been an ongoing effort to gather information on traditional marine tenure systems, fisheries boundaries and social systems that influence fisheries sustainability and the protection of biodiversity, **there is a need to gather additional in-depth information on traditional social institutions that influence the use of marine biodiversity, and to formally recognize the local ownership or multiple local ownership of traditional fishing areas (iqoliqoli) as a basis for improved community-based fisheries management and the establishment of a system on community-based marine reserves.**

RECOMMENDATION 16: That additional in-depth local information on traditional marine tenure and use systems and social institutions that influence the use of marine biodiversity be gathered and that local ownership or multiple local ownership of traditional fishing areas (**iqoliqoli**) and traditional fishers (**kai wai** and **gone dau**) be formally recognized as a basis for improved community-based fisheries management and the establishment of a system of community-based marine reserves.

17. **The continued use and preservation of medicinal plants and knowledge about medicinal plants is critical to sustainable development in Fiji.** All of Fiji's indigenous communities and many of our immigrant communities have rich traditions of proven medical expertise (e.g., Indian Ayuvedic medicine and Chinese herbal medicine) that should be documented and preserved. This knowledge and many of the most useful and widely used medicinal plants are endangered as many of the older healers pass away, as modern development puts increasing pressure on the ecosystems where these plants are found, and as young children in the formal education system learn less about their traditional medical heritage. This is a serious situation because most of Fiji's rural people have little or no access to modern medical facilities and modern medicines. Almost all of their sicknesses and injuries are still treated with traditional medicine, almost all of which comes from medicinal plants. To lose these plants and the knowledge about their use would constitute a serious economic, cultural and health crisis for all of our communities.

RECOMMENDATION 17: It is recommended that a priority action of the BSAP be the systematic identification and recording of important medicinal plants, their uses, the extent of their use, the extent of trade or sale of traditional medicinal products, their economic value to Fiji, their potential for export, and the potential for local processing or adding value to such products. It is also recommended that traditional healers with particular in-depth knowledge be recognized in all communities and that they be involved in the systematic preservation and institutionalization of the use of medicinal plants, and that appropriate government and non-government agencies give support and assistance to groups like WAINIMATE that are actively involved in this process. Programs should also be put in place to:

- identify medicinal plant species that are becoming scarce and are under threat of extinction, and document their uses to protect Intellectual Property Rights (IPR)
- develop fact sheets to disseminate information about the value of medicinal plants
- establish a system of *in-situ*, community-based conservation areas to protect threatened medicinal plant species
- establish nurseries to regenerate medicinal plant resources that are under threat
- establish community gardens to grow medicinal plants that are extensively used for medicines for local consumption
- establish plantations to grow medicinal plants that have potential to be used in large quantities for developing local commercial medicine enterprises.

18. Despite the high nutritional, economic and ceremonial dependence of all of Fiji's communities on local food production, AND the fact that Fiji has some of the highest or most rapidly increasing incidences of nutrition-related non-communicable diseases (e.g., diabetes, cardiovascular disease, high blood pressure and stroke, gout, dental disease and some forms of cancer) that are due to a great extent on the change from a traditional diet to a diet based on highly processed, largely imported foods, apart from recent National

Food and Nutrition Surveys, and a number of other studies carried out under the auspices of the National Food and Nutrition Committee (NFNC), few systematic studies have been carried out on Fiji's traditional food systems and terrestrial, freshwater and marine food plants and animals and their nutritional and economic values. A further sign of this is rapidly increasing food dependency, particularly in urban areas, but also in rural areas, on imported foods, which constitutes a serious economic problems in terms of both the balance of trade and foreign exchange reserves, and in economic well-being at the household and community levels.

Results of existing studies indicate that: 1) many traditional food plants and animals, and in particular famine or emergency foods, are increasingly rare, or the younger generation no longer know how to procure or prepare them, or have lost a taste for such foods; 2) many traditional ceremonial foods used to satisfy communal obligations and maintain links between communities, such as yams, taro, pigs and special sea foods are increasingly scarce or too expensive for most people to afford; 3) a decline in the prolonged breastfeeding and a deterioration in traditional weaning practices and the use of nutritious weaning foods; 4) the increasing commercialization (monetization) and specialization (monoculture) of agricultural, wildland and marine food products and their production, and an overemphasis on export production at the expense of "national life-support systems" designed to satisfy subsistence needs and local markets; 5) breakdown in traditional food production systems and distribution networks; 6) poor nutritional hygiene and inadequate or unsafe water supplies; and, 7) a lack of systematic formal and informal nutrition education and increasing nutritional ignorance, often due to the commercialization and advertising of mainly nutritional inferior foods and drinks.

In short, most of the food products that are now in short supply, either can not be replaced with imported products, or their replacement would be too costly to both local communities and the country. Their loss, and the social technologies associated with them, would constitute an economic, cultural and nutritional disaster.

RECOMMENDATION 18: That systematic studies be carried out and programs be supported to address the very serious problem of the loss of nutritional diversity, one of the most fundamental and strategically important forms of biodiversity. In this context, there is a need for in-depth studies be conducted on major and minor cultivated and wild food crops and named cultivars or varieties, domesticated and wild animals food products, freshwater and marine food products, and their nutritional values and place in local diets, BEFORE the plants and animals and the production systems that supply these products or the traditional knowledge of their use and cultural importance is lost. Food categories, and food system components in particular need of systematic study include:

- cultivars/varieties of staple food crops (e.g., yams, sweet yams, wild yams, taro, giant taro, giant swamp taro, sweet potato, bananas and plantains, coconut, rice, pigeon pea and cow pea cultivars)
- cultivated and wild food trees, including cultivars and varieties

- minor or supplementary food crops (e.g., sugarcane, leafy greens, legumes, non-treee fruits, etc)
- wild food or emergency food species, and their harvesting, preservation and preparation
- minor or subsistence marine food species
- freshwater plant and animal foods
- breastfeeding practices and weaning foods
- food hygiene and food preparation techniques

19. Although there have been some relatively in-depth studies of Fiji's major timber species, their abundance, structural characteristics, their use, their Fijian names, and the effects of conventional timber exploitation systems on Fiji's timber species, there is a need for in-depth studies at the community level on the ethnobiology of Fiji's timber species, their genetic diversity, abundance, and the effects of current logging systems on forest species composition, forest ecosystems and plant and animal communities, and on the human communities that depend on forest resources. There have also been few studies of the ecology and environmental and cultural impacts of plantation forestry.

RECOMMENDATION 19: That in-depth studies be conducted at the community level on the ethnobiology of Fiji's timber species, their genetic diversity, abundance, and the effects of current logging systems on forest species composition, forest ecosystems and plant and animal communities, and on the human communities that depend on forest resources. Associated with this should be a systematic program conducted by the Ministry of Forestry, in conjunction with other appropriate agencies, to inform communities of, and to actively promote the adoption of sustainable rotational logging of Fiji's indigenous forests, along the lines of the model developed by the GTZ Fiji-German Forestry Project. It is also recommended that comparative studies be conducted of the ecological and cultural value of indigenous forests and plantation forests, and of the ecology and environmental and cultural impacts of the establishment of plantation forests in Fiji.

20. Although there have been some studies of handicraft production in Fiji (e.g., studies of tapa cloth and weaving of pandanus), there is absence of systematic studies on the wider range of handicrafts, and their cultural value and subsistence and commercial economic importance. This is particularly important from the point of view of gender equity given the critical role played by women in handicraft production. Many of these skills are being lost and not passed on the younger generation, and is of great cultural and economic concern among all of Fiji's ethnic communities.

RECOMMENDATION 20: That systematic studies be carried out on handicraft production among, and its cultural value and subsistence and commercial economic importance among all of Fiji's communities, and the production of materials that can be used in schools and other

appropriate places to insure that such knowledge is not lost. In such studies, and the teaching of such knowledge, emphasis should be placed on the involvement of people at the community level, especially women, and appropriate agencies such as the Fiji Museum, the Sogosogo Vaka Marama, and the Ministries of Multicultural Affairs, Education and Fijian Affairs.

21. Apart from some studies of medicinal plants, major food plants and animals (including common marine food species), timber species, and handicrafts, there have been few systematic studies of the uses and cultural importance of Fiji's terrestrial, freshwater and marine plants and animals for all traditional and modern purposes. For example, there have been few in-depth systematic studies of the use of all species for firewood, house construction, boatbuilding, fishing equipment, tools, wrapping/parceling, leis and garlands (**salusalu**), perfumes/scenting coconut oil, living fencing, dyes, poisons, bait, animal medicines, glues, fiber and cordage/twine, and many other purposes), and how they are used, BEFORE the plants and animals that supply these products or the traditional knowledge of their use is lost and cultural importance is lost. Most of these products either can not be replaced with imported products, or their replacement would be too costly to both local communities and the country.

RECOMMENDATION 21: That systematic surveys be conducted of the widest range of terrestrial, freshwater and marine plants and animals to identify all commercial and subsistence uses and their cultural values, and the local vernacular and scientific names of these species. Use categories that are in particular need of systematic study include:

- cultivars/varieties of staple food crops (e.g., yams, sweet yams, wild yams, taro, giant taro, giant swamp taro, sweet potato, bananas and plantains, coconut, rice, pigeon pea and cow pea cultivars)
- cultivated and wild food trees, including cultivars and varieties
- minor or supplementary food crops (e.g., sugarcane, leafy greens, legumes, non-treee fruits, etc)
- wild food or emergency food species
- minor or subsistence marine food species
- freshwater plant and animal foods firewood, house construction, boatbuilding, fishing equipment, tools, wrapping/parceling, leis and garlands (**salusalu**), perfumes/scenting coconut oil, living fencing, dyes, poisons, bait, animal medicines, glues, fiber and cordage/twine, and many other purposes, and what species have sprititual or cultural value), and how they are used, BEFORE the plants and animals that supply these products or the traditional knowledge of their use is lost. Most of these products either can not be replaced with imported products, or their replacement would be too costly to both local communities and the country.

Table 3, below, is an attempt to list some of the use categories (in this case for trees only), that could be applied to studies of all organisms.

Table 3. Ecological and cultural functions and uses of trees in the Pacific islands.

ECOLOGICAL

Shade	Soil Improvement	Animal/Plant Habitats
Erosion Control	Frost Protection	Flood/Runoff Control
Wind Protection	Wild Animal Food	Weed/Disease Control

CULTURAL/ECONOMIC

Timber(commercial)	Broom	Prop or Nurse Plants
Timber(subsistence)	Parcelisation/Wrapping	Staple foods
Fuelwood	Abrasive	Supplementary Foods
Boatbuilding(canoes)	Illumination/Torches	Wild/Snack/Emergency Foods
Sails	Insulation	
Tools	Decoration	Spices/Sauces
Weapons Hunting	Body Ornamentation	Teas/Coffee
Containers	Cordage/Lashing	Non-alcoholic Beverages
Woodcarving	Glues/Adhesives	Alcoholic Beverages
Handicrafts	Caulking	Stimulants
Fishing Equipment	Fibre/Fabric	Narcotics
Floats	Dyes	Masticants/Chewing Gum
Toys	Plaited Ware	Meat Tenderiser
Switch for Children/ Discipline	Hats	Preservatives
	Mats	Medicines
Brush/Paint Brush	Baskets	Aphrodisiacs
Musical Instruments	Commercial/Export Products	Fertility Control
Cages/Roosts		Abortifacients
Tannin	Ritual Exchange	Scents/Perfumes
Rubber	Poisons	Recreation
Oils	Insect Repellents	Magico-religious
Toothbrush	Deodorants	Totems
Toilet Paper	Embalming Corpses	Subjects of Mythology
Fire Making	Lovemaking Sites	Secret Meeting Sites

Source: Adapted from Thaman and Clarke 1987.

Similarly, Appendices II and III show the results of a study of the uses of Pacific Island coastal and mangrove plants and the kind of information that can be acquired through systematic ethnobiological surveys. For example, in terms of cultural utility, the analysis of these 140 coastal and mangrove plants showed that there are some 75 different purpose/use categories for these plants, with the total frequency of usage for 140 plants being 1024, an average of 7.3 purpose/use categories per plant (Appendix II), ranging from no reported uses for only two species to as many as 125 for the coconut, if distinct uses within categories (e.g., tools with distinct functions) are counted. Another 17 species have 20 or more reported uses, and 29 species have at least 7 uses each (Appendix III). Moreover, the list does not include the more strictly ecological functions of coastal plants, such as shade, protection from wind, sand and salt spray, erosion and flood control, coastal reclamation, animal and plant habitats, and soil improvement, all of importance to Pacific societies. Although this study was Pacific-wide, Fiji was a major focus of the study and most of the uses for the plants were the same in Fiji as they were elsewhere in the Pacific. In terms of specific uses, the most widely reported uses are for medicine, general construction, body ornamentation, fuelwood, ceremony and ritual, cultivated or ornamental plants, toolmaking, food, boat or canoe making, dyes or pigments, magic and sorcery, fishing equipment, cordage and fibre, games or toys, perfumes and scenting coconut oil, fertiliser and mulching, woodcarving, weapons or traps, food parcelisation or wrapping, subjects of legends, mythology, songs, riddles, and proverbs, domesticated and wild animal feed, handicrafts, cooking equipment, clothing, fish poisons, items for export of local sale, adhesives or caulking, and musical instruments, all of which were reported for at least eleven species

3 THE ROLE OF THE UNIVERSITY OF THE SOUTH PACIFIC

The University of the South Pacific, as the major educational and research organization in Pacific Islands, and in Fiji, has, in association with as wide a range of governement and non-government organizations, a critical role in providing scientific, educational and ethical leadership in the collection, application and storage of traditional knowledge, not only ethonbiological knowledge, but traditional knowledge in all areas of research, teaching and consultancy in which USP, as an institution, is engaged under its Charter. (**To be completed).**

4 CONCLUSION

As stressed in the introduction, it is argued that, in terms of cost- and biodiversity-conservation effectiveness (measured in terms of the number of endangered and ecologically AND culturally important ecosystems and taxa that are protected or increase in numbers), the major effort in Fiji should be placed on conservation of biodiversity at the local community or landowner level, through the implementation of multi-ecosystem "community-based biodiversity conservation" (CBBC). In other words, local communities and landowners (including reef, lagoon and ocean

owners) must be given the tools and incentives to protect all important ecosystems and plants and animals so that they will be available for use by future generations of landowners. This is not to suggest that national initiatives for the establishment of conservation areas is not also a priority.

There are obviously other means of promoting multi-ecosystem "community-based biodiversity conservation" (CBBC) by individuals, communities, local bodies, NGOs, the government, universities and international organizations. The main point that must be continually stressed, however, is that the main objective of biodiversity conservation, and the BSAP, in Fiji and elsewhere in the Pacific Islands, should be to benefit local communities, rather than to preserve endemic plants and animals for science or in the hope of finding a cure for AIDS in our forests or lagoons.

For such broad-based community or national biodiversity conservation programmes to be successful, a major component, in terms of both funding and personnel, must be devoted to the collection and application of traditional ethnobiological knowledge to biodiversity conservation at both the community and national levels, and the incorporation of this knowledge in **both** formal and non-formal public education to create (recreate?) awareness of the importance of biodiversity and biodiversity conservation **AND THE RECORDING, PROTECTION AND APPLICATION OR TRADITIONAL ETHNOBIOLOGICAL KNOWLEDGE AS A BASIS FOR SUSTAINABLE DEVELOPMENT IN FIJI, AND ELSEWHARE IN THE PACIFIC ISLANDS**.

Although there are undoubtedly new technologies and some new plant and animal species that could enhance cash incomes and the quality of life in all areas of Fiji as we enter the new millennium, the basis for survival will remain the wild and domesticated plants and animals and the traditional knowledge and technologies that have served Fiji's people for the last three millennia or more in their beautiful and biologically blessed island world!. It is the main objective of the Fiji National Biodiversity Strategy and Action Plan, and a major objective of The University of the South Pacific, WWF, The Fiji Department of Environment and all other organizations working in the areas of nature conservation and sustainable development to insure that this living heritage is protected for the benefit of Fiji's children and grandchildren, and their children and grandchildren, as they face the diverse challenges of the 21st century.

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Appendix I. Descriptions of the terrestrial, freshwater and marine ecosystems of Fiji that: 1) constitute the major resource-use zones; and, 2) could serve as the focus for multi-ecosystem "community-based biodiversity conservation" (CBBC) and national-level biodiversity conservation in Fiji.

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1 TERRESTRIAL AND FRESHWATER ECOSYSTEMS

1.1 Lowland Native Forest (vei kau/veikau loa)

Primary or relatively undisturbed indigenous lowland and slope forest. Found on most of the larger islands of Fiji. below 500 m elevation. Characterised by a high diversity of large broadleaved evergreen trees species, high populations of vines and lianas, ochids and other epiphytes, with the understorey occupied by ferns, some small trees and shrubs and seedling/saplings of the larger tree species. Main habitat for most of Fiji's indigenous birds, flying foxes, frogs, snakes, a wide range of insects and other indigenous invertebrates, and feral pigs.

1.2 Upland Rain Forest (vei kau/veikau loa)

Primary or relatively undisturbed forest above 500 m, generally slope and ridge forest, characterised by lower species diversity than lowland forest, but with a higher percentage of indigenous gymnosperms and a higher percentage of endemic species. Found on the larger main islands of Fiji. Generally stunted in the higher elevations on the main islands, where it is classified as "cloud forest", and dominated by shrubby windblown species.

1.3 Mature Fallow Forest (vei kau/vanua raki)

Old-age fallow forest, with a significant percentage of non-indigenous introduced species, often deliberately planted useful trees, and including stands of bamboo and village tree groves. Common in throughout Fiji in lowland and inland areas in and around active and former garden areas.

1.4 Mangrove Forest (vei dogo)

Salt tolerant trees and shrubs occurring in coastal, lagoonal and estuarine tidal areas; found throughout Fiji, with largest concentrations occurring on the major island near the mouths of the major rivers Melanesia, Western Polynesia and Micronesia, and as introduced communities in Eastern Polynesia.

1.5 Coastal Strand Vegetation (sarava)

Vegetation occurring along sandy or rocky coastal areas or small islets a few metres above sea level and under the influence of salt spray and storm surge; found throughout the Pacific and characterized by ubiquitous salt-tolerant pan-Pacific or pan-tropical plants.

1.6 Grassland/Woodland (talasiga/maumi)

Anthropogenic and natural grasslands, meadows, savanna lands and woodlands where grass or sedge cover is a dominant or co-dominant component of the vegetation, and where exotic species are often dominant (not including fenced or improved pasture); found in lowland and upland areas of all Fiji's islands, especially on the leeward sides of the major islands and on the drier smaller islands.

1.7 Scrubland/Srub-Fernlands (talasiga/maumi)

Natural or disturbed areas, where long term disturbance, such as burning or grazing or the poverty of the environment precludes the establishment of significant tree cover, and where a significant component of the plants consist scrub ferns or exotic, often weedy species; found throughout Fiji in both rural and urban areas.

1.8 Shifting Agricultural Lands (iteitei, were, raki)

Active agricultural areas characterised by extensive and intensive shifting agriculture with alternating cropping periods and variable fallow periods and a resultant mosaic of a wide range of root crops and other short-term ground crops and long-term tree crops and perennials interspersed with areas forest fallow, bush fallow or grassland fallow; common on large and small islands throughout Fiji and characterised by both subsistence and mixed subsistence-commercial cropping systems.

1.9 Permanent/Semi-permanent Agriculture

Active agricultural areas characterised characterised by intensive, almost permanent cropping, often with scattered trees but little fallow; found throughout Fiji in the forms of irrigated, mounded or excavated taro or sweet potato cultivation, rice cultivation or cash-cropping of short-term cash crops such as vegetable, sugarcane, ginger or tobacco, often on alluvial soils or in areas of high population density, such as urban or peri-urban areas.

1.10 Perennial Plantations (loga ni vei vunikau)

Active agricultural areas dominated by monocultural plantings of perennial tree crops or other long-term commercial crops, such as coconut palms, coffee, tea, cocoa, bananas or sugarcane, often with scattered trees or living fencing, or undergrazed by livestock. Found throughout Fiji in coastal, lowland and alluvial areasi.

1.11 Plantation Forest (veikau tei)

Deliberately planted single species forests of almost exclusively introduced exotic timber tree species. Consisting of large-scale silvicultural plantations on the larger islands, with the main

species being West Indian mahogany (*Swietenia macrophylla*) on wetter sites and Caribbean pine (*Pinus caribaea*) on the drier sides of the main islands, and in smaller plantings on some of the outer islands and as woodlots on individual landowners lands, on sugarcane farms and other private landholdings.

1.12 Pasture (**bai ni bulumakau/ose/me**)

Areas developed for grazing, including improved and unimproved grasslands and scrubland, often fenced and usually dominated by exotic species. Found on most of Fiji's larger islands and some smaller islands, but uncommon or absent on some smaller islands. Main grazing animals include cattle, horses and goats, although sheep have been successfully grazed in some areas.

1.13 Intensive Livestock Husbandry

Areas developed for intensive livestock productions systems in Fiji, including traditional community level systems of keeping pigs, chickens, ducks in pens, or the tethering of cattle, bullocks, horses and goats under highly controlled conditions, and modern battery production of chickens, for both egg and meat production, and modern piggeries which have a very high dependence on imported inputs, such as feed, medicines and equipment, and on improved overseas animal breeds, rather than on long-established breeds of chickens, pigs and other animals that have been raised at the village level.

1.14 Houseyard/Urban Gardens (**teitei i loma ni bai**)

Horticultural (the focus being on the plant rather than the crop) gardens characterised by permanent mixed-cropping of short-term ground crops and trees, shrubs and other perennials around dwellings or workplaces, but also including botanical gardens, parks, lawns, hedges and living fencing and roadside plantings. Found in urban and rural areas throughout Fiji. Major habitat for many food trees, short-term food plants, medicinal plants, and fragrant and ornamental plants (**"kau salusalu**")

1.15 Ruderal Sites (**bati ni gaunisala , etc.**)

Roadsides, trailsides, waste places and other disturbed sites usually dominated by exotic weedy species. Common throughout throughout Fiji, although less common in very isolated rural areas where there is little transportation or urban/built development.

1.16 Wetlands (**lobau/vanua luvu?**)

Poorly-drained freshwater and brackish water swamps, bogs and marshland vegetation found in many lowland sites, such as inland from Navua and Pacific harbour. Dominated by sago palms, sedges and other wetland vegetation..

1.17 Rivers/Lakes (**uciwai, lolowai, dreke ni wai/tobu)**

Freshwater bodies including rivers, lakes and ponds, and riparian vegetation bordering rivers and lakes or river floodplains found on most of Fiji's larger high islands, but absent on most raised limestone islands and low-lying reef islets where there is no surface water.

1.18 Fishponds/Aquaculture (tobu ni ika)

Freshwater aquacultural developments, such as fishponds developed for tilapia farming that have been developed in many areas throughout Fiji..

1.19 Beaches, Sandspits and Dunes (matasawa, seva)

Shorelines with unstable sand or rubble deposits; found throughout Fiji, sometimes consisting large, sparsely vegetated dune deposits, such as the Sigatoka Sand Dunes of southwestern Viti Levu..

1.17 Bare Rock (baravi vatu, baranisavu)

Unvegetated or sparsely vegetated areas dominated by bare rock, including cliff faces, beach rock, exposed limestone, recent volcanic deposits; found throughout Fiji's high volcanic islands and on raised limestone islands.

1.18 Caves (qaravatu)

Caves or caverns including limestone caves, lava tubes and other cave-like structure, where darkness and dampness predominate. Found occasionally throughout Fiji on both volcanic and limestone islands, often inhabited by insectivorous bats.

1.19 Built/Urban (vei vale/tauni)

Non-vegetated structures and developments including buildings, transportation networks, etc.; found throughout inhabited islands.

2 MARINE ECOSYSTEMS

2.1 Estuaries (gusu ni wai)

The lower, usually tidal sections of rivers where freshwater mixes with seawater; found on larger, more geologically-ancient islands with large rivers.

2.2 Intertidal Zone (dela ni wasa, tavola/ vei vutia)

Areas of old fringing reef or tidal flats that are above sea level during low tide, but submerged at high tide; found on most islands, except some raised limestone islands or reef islets with no fringing reef or submerged coastal plains; substrate can be muddy, sandy or rocky, and often is colonized by seagrass and algae beds, which can also be found in subtidal areas.

2.3 Lagoons (namo, lomaloma/toba)

Bodies of saltwater or brackish water more or less separated from the open sea by reefs, islets or other barriers; found associated with most islands, except some raised limestone islands or reef islets with no lagoons or barrier reefs.

2.4 Fishponds/Maricultural Areas (tobu ni ika)

Artificially constructed fishponds or other developments for the purpose of fishfarming or mariculture; found in coastal or lagoonal areas in many countries, sometimes of pre-European-contact origin.

2.5 Coral Reefs/Outer Reef (cakau/batilili)

Reefs including purely coral reefs, algal reefs, barrier reefs, fringing reefs and lagoon or patch reefs; found throughout Fiji.

2.6 Island Shelf/Reef Platform (boto ni sauloa)

Areas between depths of 50 and 200 m adjacent to islands or in the forms of banks, gradual slopes, pinnacles or seamounts; found off most island groups, although less extensive off most atolls and smaller islands.

2.7 Fishponds/Maricultural Areas (tobu ni ika)

Artificially constructed fishponds or other developments for the purpose of fish farming or mariculture. Found in coastal or lagoonal areas in some parts of Fiji, such as near Navua and Raviravi on Viti Levu..

2.8 Open Ocean (waituiloa, wasa)

Ocean areas deeper than 200 m; found within Fiji's EEZ; very important pelagic fishing areas.

Appendix II. Frequency of the usage for specified purposes of 140 Pacific island coastal plant species.

Purpose/Use	Ferns x/10	Herbs x/17	Grasses /Sedges x/11	Vines/ Lianas x/14	Shrubs x/26	Trees x/62	Total x/140
Medicinal/Health	6	15	7	11	23	51	113
General Construction	-	-	-	-	6	54	60
Body Ornamentation	6	8	3	7	12	26	62
Firewood/Fuel	-	-	-	-	8	43	51
Ceremony/Ritual	3	4	-	5	6	23	41
Cultivated/Ornamental	4	3	-	2	10	20	39
Tools/Toolmaking	-	-	-	-	4	33	37
Emergency/Famine Foods	4	5	2	2	4	18	35
Boat/Canoe Building	-	-	1	-	3	30	34
Dyes/Pigments	-	-	-	2	4	24	30
Magic/Sorcery	1	6	1	1	6	14	29
Fishing Equipment	-	1	2	-	8	17	28
Cordage/Fibre	2	2	2	6	3	10	25
Games/Toys	-	-	1	4	4	16	25
Supplementary Foods	2	2	-	2	3	14	23
Scenting Oil/Perfumery	1	1	1	1	6	11	21
Fertiliser/Mulching	1	2	2	1	4	11	21
Weapons/Traps	-	-	-	-	6	14	20
Woodcarving	-	-	-	-	1	18	19
Food Parcelisation	3	1	-	3	1	11	19
Animal Feed	1	4	-	3	2	9	19
Legends/Mythology	-	-	-	-	3	15	18
Handicrafts		1	1	3	2	1	9
17							
Clothing	-	1	3	-	1	9	14
Musical Instruments	-	-	-	-	1	13	14
Cooking Equipment	-	-	-	-	1	12	13
Fish Poisons	-	-	-	3	4	4	11
Export/Local Sale	-	1	-	-	2	8	11
Adhesive/Caulking	-	1	-	1	-	9	11
Fire by Friction	-	-	-	-	1	8	9
Soap/Shampoo	-	1	-	3	3	2	9
Containers		-	-	-	-	1	7
8							
Repellents/Fumigants	-	-	-	-	2	6	8

Wild Animal Foods	-	-	-	-	3	5	8
Tannin/Preservatives	-	-	-	-	1	6	7
Antitoxins		-	1	-	1	1	4
7							
Living Fences/Hedges	-	1	-	-	1	5	7
Staple Foods	-	1	-	-	-	5	6
Drinks/Beverage	-	1	-	2	1	1	5
Strainers/Filters	-	-	2	-	-	3	5
Toilet Paper		-	-	-	-	1	4
5							
Land Reclamation	-	-	-	-	-	5	5
Calendars/Clocks	-	-	-	-	-	5	5
Contraceptives/	-	-	-	-	3	2	5
Abortifacients							
Thatching/Roofing	-	-	-	-	1	3	4
Illumination	-	-	-	-	-	4	4
Combs	-	-	-	-	-	4	4
Animal Cages/Roosts	-	-	-	-	-	4	4
Oils/Lubricants	-	-	-	-	-	3	3
Brushes	-	-	-	-	-	3	3
Fans	-	-	-	-	-	3	3
Corks	-	-	-	-	-	3	3
Fishing bait		-	-	-	-	-	3
3							
Other Uses*		-	-	2	-	5	27
34							
TOTAL	**35**	**63**	**32**	**62**	**161**	**671**	**1024**
NO USES	**-**	**1**	**1**	**-**	**-**	**-**	**2**

* Other uses include stimulants/teas, flavouring/spices, ear cleaners, splints, aphrodisiacs, hair remover, masticants/chewing gum, abrasives, tooth brushes, cigarette wrappers, coconut climbing bandages or harnesses, measuring tapes, fireworks, windbreaks, sand screens, ladders, walking sticks, tethering posts, punishment/torture, communication/language, and computation or counting.

Appendix III. Coastal plant species of particular cultural utility based on an analysis of the uses of 140 widespread coastal littoral and mangrove species (Note: not including a wide range of ecological functions or uses).

Latin Name (Fijian Name)	Uses
Cocos nucifera (**niu**)	125
Hibiscus tiliaceus (**vau**)	57
Pandanus tectorius (**vadra, voivoi**)	53
Calophyllum inophyllum (**dilo**)	43
Cordia subcordata (**nawanawa**)	40
Guettarda speciosa (**buabua ni baravi**)	36
Scaevola sericea (**vevedu**)	32
Pemphis acidula (**gagie?**)	30
Thespesia populnea (**mulomulo**)	26
Rhizophora spp. (**tiri**)	25
Tournefortia argentea (**roro ni bebe, kau ni yalewa**)	23
Casuarina equisetifolia (**nokonoko**)	22
Premna serratifolia (**yaro**)	22
Morinda citrifolia (**kura**)	22
Pipturus argenteus (**?**)	21
Terminalia catappa (**tavola, tivi**)	21
Ficus tinctoria (**mati, nunu**)	21
Ficus prolixa (**baka, baka ni Viti**)	20
Erythrina variegata (**drala, rara**)	19
Inocarpus fagifer (**ivi**)	18
Hernandia nymphaeifolia (**evuevu**)	18
Lumnitzera littorea (**sagale**)	17
Pisonia grandis (**buka**)	17
Bruguiera gymnorrhiza (**dogo**)	16
Nipa fruticans	14
Barringtonia asiatica (**vutu, vutu rakaraka**)	14
Mammea odorata (**vetao**)	14
Intsia bijuga (**vesi**)	13
Cycas circinalis (**logologo**)	13
Gardenia taitensis (**jiale**)	12
Sida fallax	11
Triumfetta procumbens	11
Vitex spp. (**dralakaka, vulokaka**)	11
Dodonaea viscosa (**wase**, **usi**)	11
Santalum spp. (**yasi, yasi dina, yasi boi**)	10
Entada phasioloides (**walai, wa tikori?**)	10

Cerbera manghas (**vasa**)	10
Clerodendrum inerme (**verevere**)	10
Cassytha filiformis (**wa lutu mai lagi**)	10
Tacca leontopetaloides (**yabia**)	9
Crinum asiaticum (**viavia**)	9
Ficus obliqua (**baka ni Viti**)	8
Polypodium scolopendria (**vativati**)	8
Neisosperma oppositifolia (**vaokaka,?**)	8
Metroxylon spp. (**soga**)	7
Ipomoea pes-caprae (**wa vula?)**	7