
LITERATURE REVIEW OF TERRESTRIAL BIOLOGICAL SURVEY INFORMATION IN SAMOA

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1. Introduction

This report is the review of terrestrial biological information in Samoa and was written by MNRE with the technical support of Conservation International (CI). It is a contribution to Samoa's Programme of Work on Protected Areas (PoWPA) which is currently being implemented by the Ministry of Natural Resources & Environment (MNRE), with funding provided by the Global Environment Facility (GEF).

Samoa has 13 declared protected areas (PAs), including three Marine Protected Areas (MPAs) and 3 community managed conservation areas (CAs) (see annex 1). The terrestrial coverage of Samoa's protected area network is approximately 7% of Samoa's land area. However Samoa's Biodiversity Strategy and Action Plan (SBSAP) has a target protected area coverage of 15% of land and presumably, near shore (Schuster and Butler (eds) 2001).

Achieving effective management of 15% of the land area of Samoa in protected areas is constrained by a number of barriers, the key ones being:

- (i) The Biodiversity of Samoa remains poorly understood; protected areas cannot, therefore, be clearly identified or expanded or even managed without proper knowledge of the biological components within;
- (ii) There is an unresolved conflict between customary land ownership and government land ownership, with conservation goals remaining poorly understood by both parties;
- (iii) There is poor capacity to do conservation research and conservation governance, with conservation management still low to non-existent in some areas. The poor capacity of village councils to control or be engaged in protected area management (PAM) persists to this day.

Samoa's PoWPA focuses on eliminating these barriers and working to achieve or exceed Samoa's PA target of 15% terrestrial coverage. However, in order to achieve these objectives a "gap analysis" must first be conducted to assess where the gaps in our current biological knowledge exist and also to assess how effective existing PAs and CAs are in conserving biological values. Once an assessment of our knowledge gaps has been completed, research must be conducted to fill information gaps and to identify priority sites for addition to the PA network along with priority actions to improve management of PAs. Conducting such research to fill knowledge gaps is clearly identified as a priority in the SBSAP under both the Ecosystem Management and the Species Management themes of the SBSAP.

Conservation International (CI) is currently providing technical support to the Ministry of Natural Resources & Environment (MNRE) to conduct the gap analysis of protected areas and other key biodiversity areas (KBAs) in Samoa. KBAs are areas that contain populations of globally threatened species recognised as at risk from extinction by the International Union for the Conservation of Nature (IUCN). KBAs are also identified for restricted range species. Currently Samoa has 16 globally threatened terrestrial species (refer to annex 2) and six KBAs have been identified with healthy populations of these species (annex 3), three of which are National Parks, while the other three are current or planned community conservation areas.

The gap analysis has three main objectives:

- (a) To promote the strategic expansion of the existing Protected Area (PA) network in order to meet agreed country PA targets;
- (b) To strengthen and consolidate the management of existing PA networks;
- (c) To identify the information gaps required to inform (a) and (b).

The first component of the gap analysis is to review current terrestrial biological knowledge for Samoa and identify gaps in existing biological information (refer to Annex 4 for the full list of survey reports reviewed). Knowledge gaps can be grouped into three types- taxonomic gaps, thematic gaps and spatial gaps. While not all survey data was available to the authors (much of it is in grey literature) this report nevertheless identifies a number of knowledge gaps that need to be filled under the three main headings in order for Samoa to expand its PA network in a strategic manner.

2. Summary of Existing Terrestrial Biological Information in Samoa

2.1 Summary of National Terrestrial Surveys

Survey Title	Report Authors	Survey Area and Products	Survey Year	Taxonomic Group Surveyed
Recovery plan for Manumea or Tooth-Billed Pigeon (<i>Didunculus strigirostris</i>) 2006-2016	Division of Environment & Conservation (DEC) - MNRE	National survey of Samoa and Recovery Plan	2006	Birds
Recovery plan for the Ma'oma'o or Mao (<i>Gymnomyza samoensis</i>) Samoa's Large Forest Honeyeater 2006-2016.	DEC - MNRE	National survey of Samoa and Recovery Plan	2006	Birds
Strengthening the Institutional Capacity of the Samoa Forestry Division to effectively plan and manage Forest Resources.	FAO	National survey of Samoa with a forest inventory and updated land cover map	2004	Vegetation – land cover/forest classification
The Conservation of Biological Diversity in upland ecosystems of Samoa	Schuster et al	National survey report of the Uplands of the Samoan Islands	1996	Vegetation Birds Bats Insects
The National Survey of Western Samoa. The Conservation of Biological Diversity in the Coastal Lowlands of Western Samoa	Park et al	National survey report of the Coastal Lowlands of the Samoan Islands	1990-1991	Vegetation Birds Bats
Terrestrial Ecosystem Mapping For Western Samoa	Pearsall and Whistler	Mapping of terrestrial ecosystems in Samoa	1989	Terrestrial Ecosystems

Please refer to Annex 4 for a more details on each of these surveys and the reference list for full references.

2.2 Other Terrestrial Survey Reports and Relevant Scientific Papers

Taxonomic Group	Author	Title	Year	Survey Area	Comments/Recommendations
Flying Foxes	Banack, S.A	Flying foxes, genus <i>Pteropus</i> , in the Samoan Islands: Interactions with forest communities	1996	National - Samoa	No recent surveys.
	Brooke, A.	Trip report for Western Samoa <i>Pteropus samoensis</i> survey (Unpub. report)	1995		
	Wilson, D.E. & Engbring, J	Status of the Fruit Bat, <i>Pteropus samoensis</i> , in Samoa	1993		
	Mickleburgh, S.P., Hutson, A.M. & Racey, P.A	Old world fruit bats: An action plan for their conservation	1992		
	Wilson, D.E	The flying foxes <i>Pteropus samoensis</i> and <i>Pteropus tonganus</i> : Status in Fiji and Samoa	1992		
	Cox, P.A	Flying fox nearly extinct in Samoa	1984		
Birds	DEC - MNRE	Recovery plan for the Ma'oma'o or Mao (<i>Gymnomyza samoensis</i>) Samoa's Large Forest Honeyeater 2006-2016	2006	National - Samoa	Most recent surveys – 2006 during the Manumea and Maomao Project
	DEC - MNRE	Recovery plan for the Manumea or Tooth Billed Pigeon (<i>Didunculus strigirostris</i>) 2006-2016	2006		Future Survey Sites – Savaii uplands, Upolu: south-eastern corner and uplands.
	Beichle, U	Studies on the avifauna: Report on a proposed Conservation Area at Sataoa-Sa'anapu Mangrove Wetland, Upolu, Samoa	1997	Sataoa-Sa'anapu	Seabirds not well surveyed.
	Bellingham, M & Davis, A	Forest bird communities in Western Samoa	1988	National - Samoa	
	Muse, C. & Muse, S.	The birds and birdlore of Samoa / O manu ma tala'aga o manu o Samoa	1982		
	Watling, D.	Birds of Fiji, Tonga & Samoa	1982		
	Mayr, E	Birds of the Southwest Pacific: a field guide to the birds of the area between Samoa, New Caledonia & Micronesia	1978		

Taxonomic Group	Author	Title	Year	Survey Area	Comments/Recommendations
	Bellingham, M & Davis, A	Forest bird communities in Western Samoa.	1988		
	Merlin, M.D. & Juvik, J.O	Bird protection in Western Samoa	1985		
Insects	Karin S. Kami and Scott E. Miller	Samoa Insects and Related Arthropods checklist and Bibliography	1998		No recent surveys
	Buxton, P.A	Insects of Samoa	1935		
	British Museum (Natural History) Department of Entomology	Insects of Samoa and other Samoan Terrestrial Arthropoda	1927-1935		
Vegetation	Whistler, W.A	Plants in Samoan culture: the ethnobotany of Samoa	2000	National - Samoa	No recent assessment of threatened plants
	Elmqvist, T., Cox, P.A., Rainey, W.E. & Pierson, E.D	The rain forest and the flying foxes: an introduction to the rain forest preserves on Savaii, Western Samoa.	1998 (3 rd ed)	Savaii	
	Martel, F. & Atherton J.	Timber inventory of the Ifilele Resource: Uafato Conservation Area Project: Draft Report	1997	Uafato	
	Whistler, W.A	Botanical survey of the Uafato Conservation Area	1997	Uafato	
	Cribb, P. & Whistler, W.A	Orchids of Samoa	1996	National - Samoa	
	Whistler, W.A	Samoa herbal medicines	1996		
	Whistler, W.A	Samoa traditional medicines	1996		
	Whistler, W.A	Wayside plants of the islands: a guide to the lowland flora of the Pacific Islands: including Hawaii, Samoa, Tonga, Tahiti, Fiji, Guam, Belau	1995c		
	Elmqvist, T., Cox, P.A., Rainey, W.E. & Pierson, E.D	Effects of tropical cyclones Ofa and Val on the structure of a Samoan lowland forest	1994		
	Whistler, W. A	Flowers of the Pacific Island seashore: A guide to the littoral plants of Hawaii, Tahiti, Samoa, Tonga, Cook Islands, Fiji and Micronesia.	1992		
Wishart, F.	Western Samoa: A rainforest reprieved	1989			

Taxonomic Group	Author	Title	Year	Survey Area	Comments/Recommendations
	Whistler, W. A	Checklist of the weed flora of Western Polynesia: an annotated list of the weed species of Samoa, Tonga, Niue and Wallis and Fatuna, along with the earliest dates of collection and the local names	1988		
	Whistler, W.A	Annotated list of Samoan plant names	1984		
	Whistler, W.A	Vegetation of the montane region of Savaii	1978	Savaii	
	Uhe, G	Medicinal plants of Samoa; a preliminary survey of the use of plants for medicinal purposes in the Samoan Islands	1974	National - Samoa	
	Uhe, G	Wayside plants of the South Pacific: [a guide to some common and interesting herbs, shrubs, and trees found in Hawaii, Tahiti, Marquesas, Samoa, Tonga, Niue, Rarotonga, Fiji and New Caledonia]	1974		
	Parham, B.E.V	Plants of Samoa: a guide to their local and scientific names with authorities; with notes on their uses, domestic, traditional and economic	1972		
	Bryan, E.H	Samoa and scientific Names of plants found in Samoa	1935		
	Christopherson, E	Flowering plants of Samoa	1935-1938		
	Llyod, C.G. & Aiken, W.H	Flora of Samoa	1934		
Snails and Slugs	Cowie, R.H	Catalogue of the non-marine snails and slugs of the Samoan Islands	1998		No recent surveys
	Pilsbury, H.A., Cooke, C.M. & Neale, M.C	Land snails from Hawaii, Christmas Island and Samoa	1971	National - Samoa	Future survey sites – Upolu and Savaii (whole of Samoa)
	Schuster, C., Whistler, A. & Tuaillemafau, T.S.	The conservation of biological diversity in upland ecosystems of Samoa	1997	Uplands of Savaii and Upolu	Very limited ecological data available- especially of threatened species
	Robinson, A.C	Ecology of Samoa: an annotated bibliography	1994	National - Samoa	
	Pearsall, S.H	A geographical-ecological model for landscape conservation development in Western Samoa	1993	National - Samoa	

Taxonomic Group	Author	Title	Year	Survey Area	Comments/Recommendations
Other – Ecology	Lovegrove, T., Bell, B. & Hay, R	The indigenous wildlife of Western Samoa: impacts of cyclone Val and a recovery and management strategy	1992	National - Samoa	
	Parks, G., Hay, R., Whistler, A. & Lovegrove, T.	The National Ecological Survey of Western Samoa: The conservation of Biological Diversity in the Coastal Lowlands of Western Samoa	1992	Coastal Lowlands of Upolu and Savaii	
	Whistler, W.A	National Biodiversity review of Western Samoa	1992	National - Samoa	
	Pearsall, S.H. & Whistler, W.A	Ecosystem mapping for Western Samoa	1991	National - Samoa	
	Pearsall, S.H. & Whistler, W.A	Terrestrial ecosystem mapping for Western Samoa: Summary, project, report, and proposed national parks and reserves plan.	1991	National - Samoa	
	International Forest Environment Research & Management	Western Samoa: Ecological Survey and resource conservation review	1991	National - Samoa	

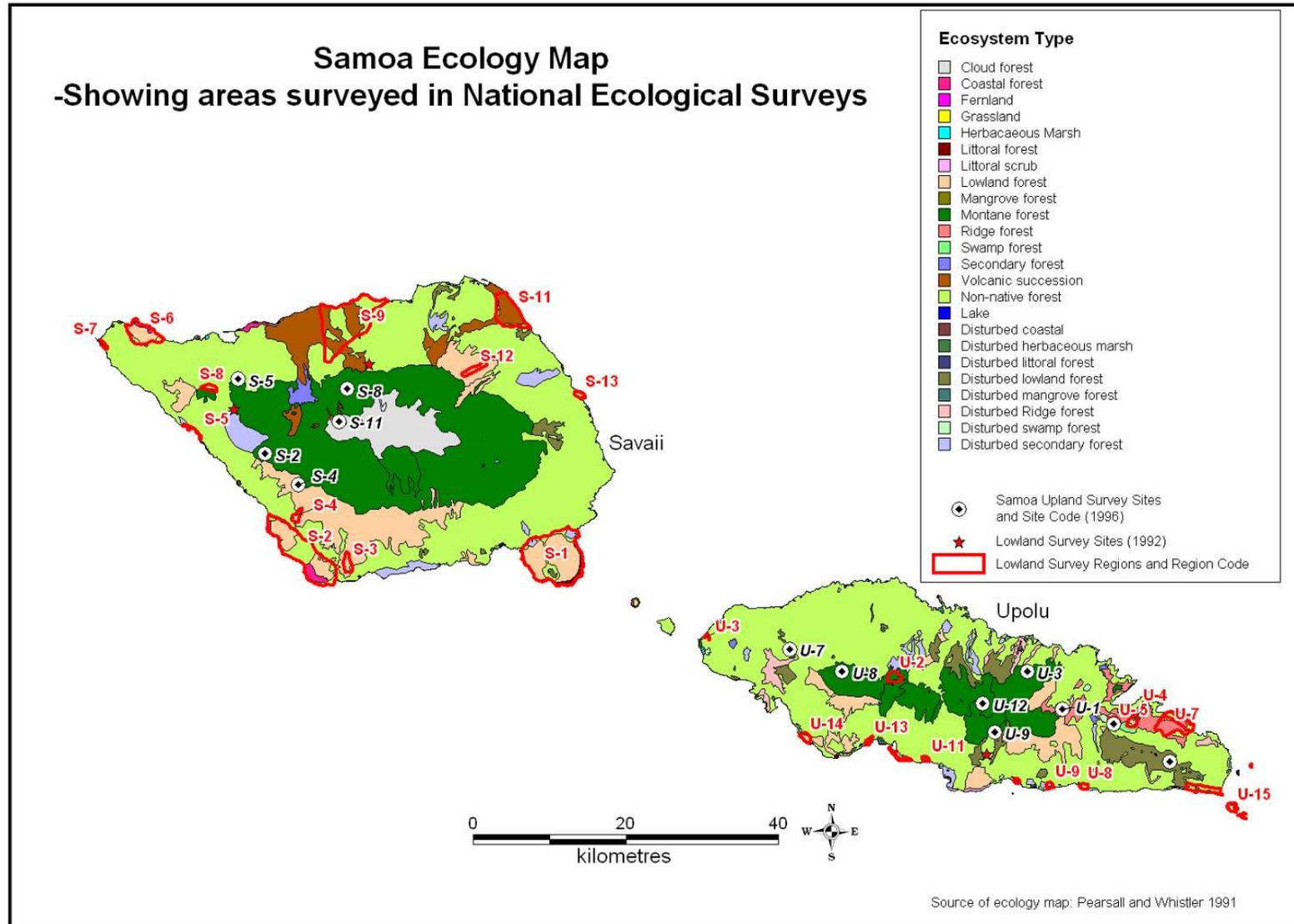
2.3 Summary of survey methods used for different taxonomic groups

Taxonomic Group	Survey Area	Survey Methodology Used	Authors	Survey Year
Vegetation	National – Samoa	<u>Methods used</u> 1. Vegetation highly damaged – checklist used. 2. Vegetation damaged but some large trees present – a diameter at breast height (dbh) of all trees over 5cm diameter was measured. 3. Good vegetation (not damaged) 100m x 10m plot – recorded all trees	Samoa Forestry Division	2004
			Schuster et al	1996
			Park et al	1991-1990
Birds	National – Samoa	5 minute bird count	DEC-MNRE	2006
			Schuster et al	1996
			Park et al	1991 - 1990
Mammals – Bats	National – Samoa	Noted when sighted during other surveys	Shuster et al	1996
			Park et al	1991-1990
Insects	1. Afulilo 2. Aopo 3. Fogasavaii 4. Le Pupu Pue National Park 5. Mata o le Afi 6. Mt Tafuaupolu 7. Palauli West 8. Silisili 9. Salailua	<u>Methods used</u> 1. Malaise trap – a trap was placed for 24 hours at each site surveyed 2. Light trap – the light trap used a coleman spirit lamp placed in the centre of a white sheet (2m x 1.8m) on the ground, lit at 8-9pm and run for about an hour. Insects were collected as they settled on the sheet. 3. Sweeping – ten sweeps with a net were conducted every 10m until 100 sweeps were achieved. Insects were collected and placed in a container after 10 sweeps.	Schuster et al	1996

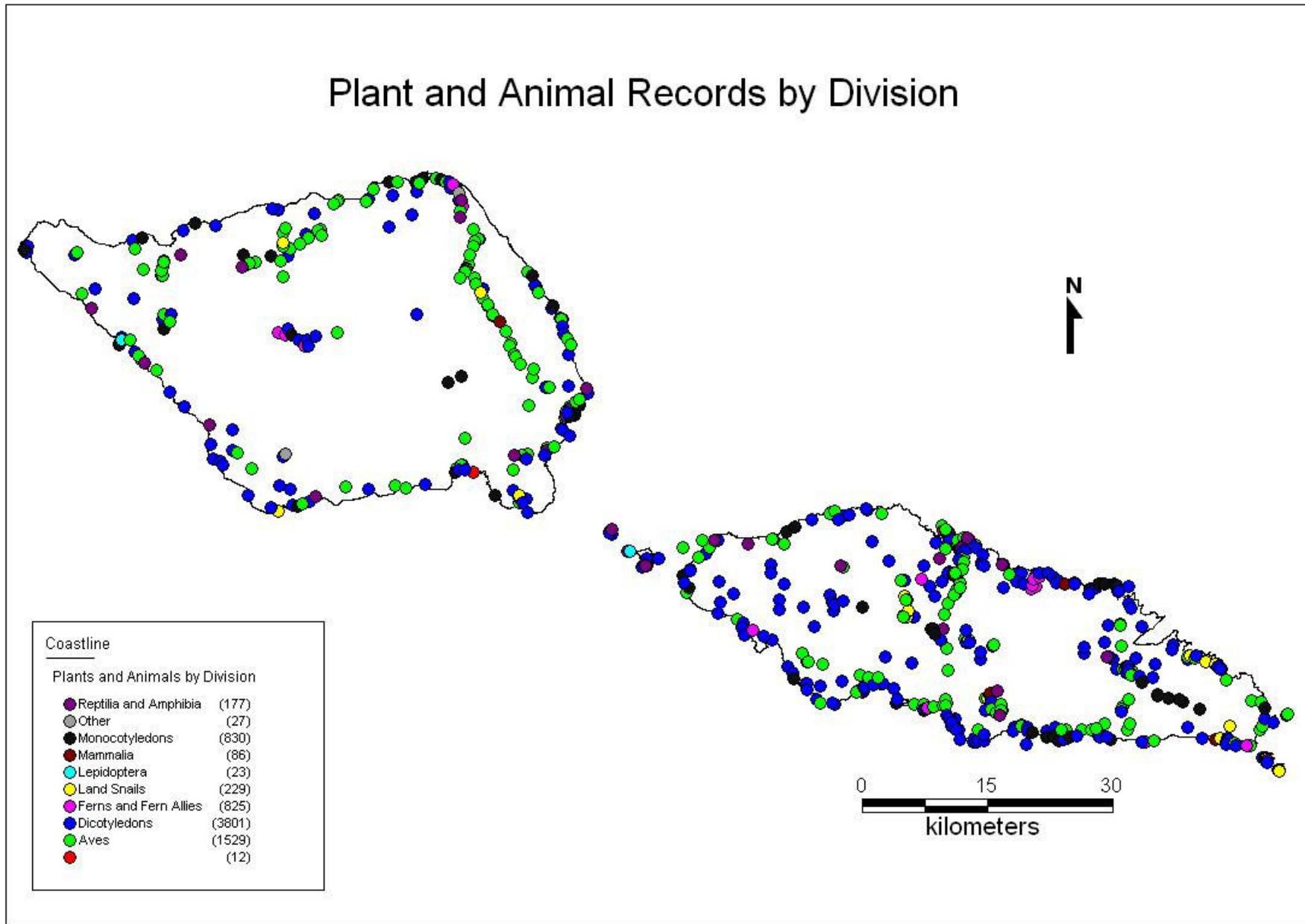
3. Maps of Species Observations by Taxonomic Group

The following maps are based on data records held by the MNRE and are current to 1994, unless stated otherwise on the map.

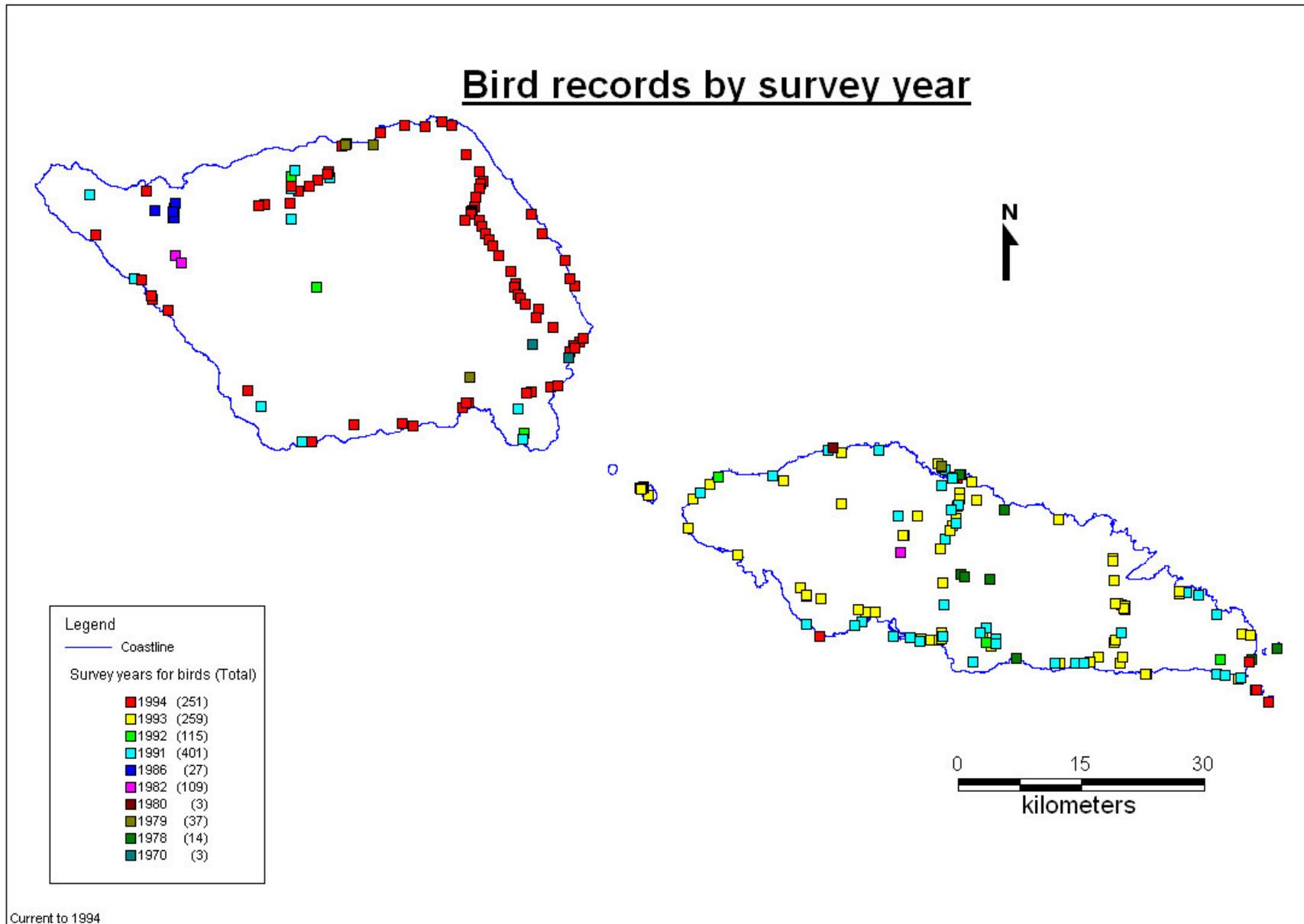
3.1 Map of National Lowland and Upland Ecological Survey Sites



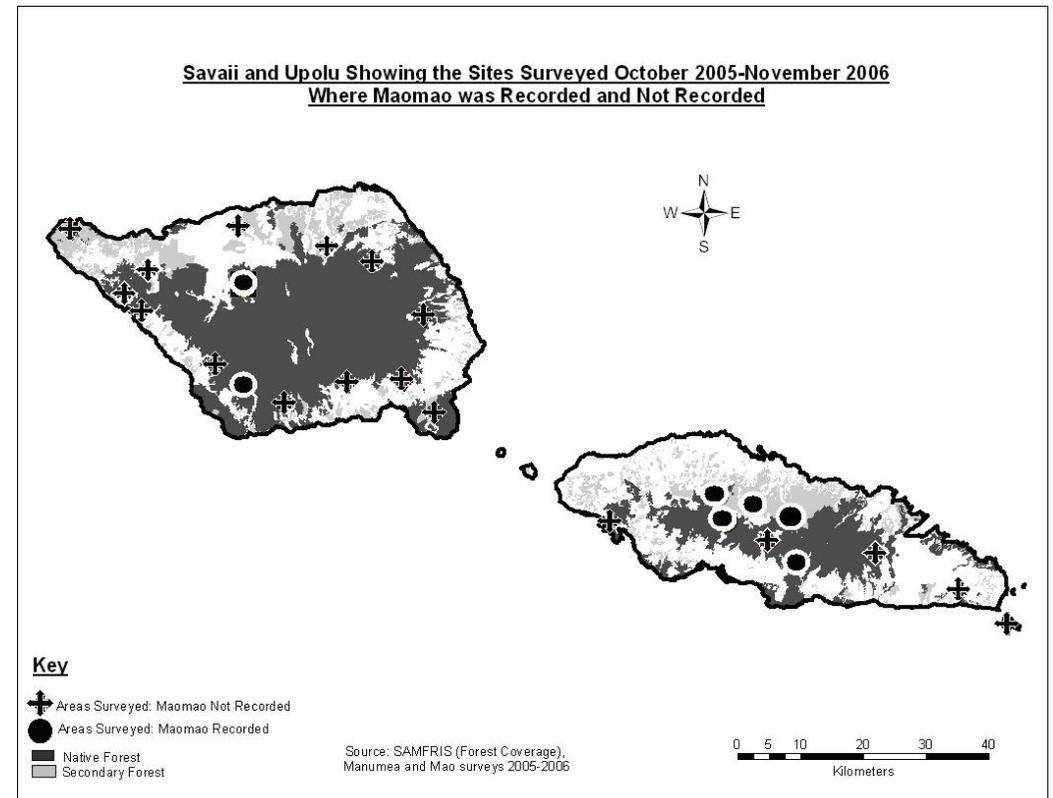
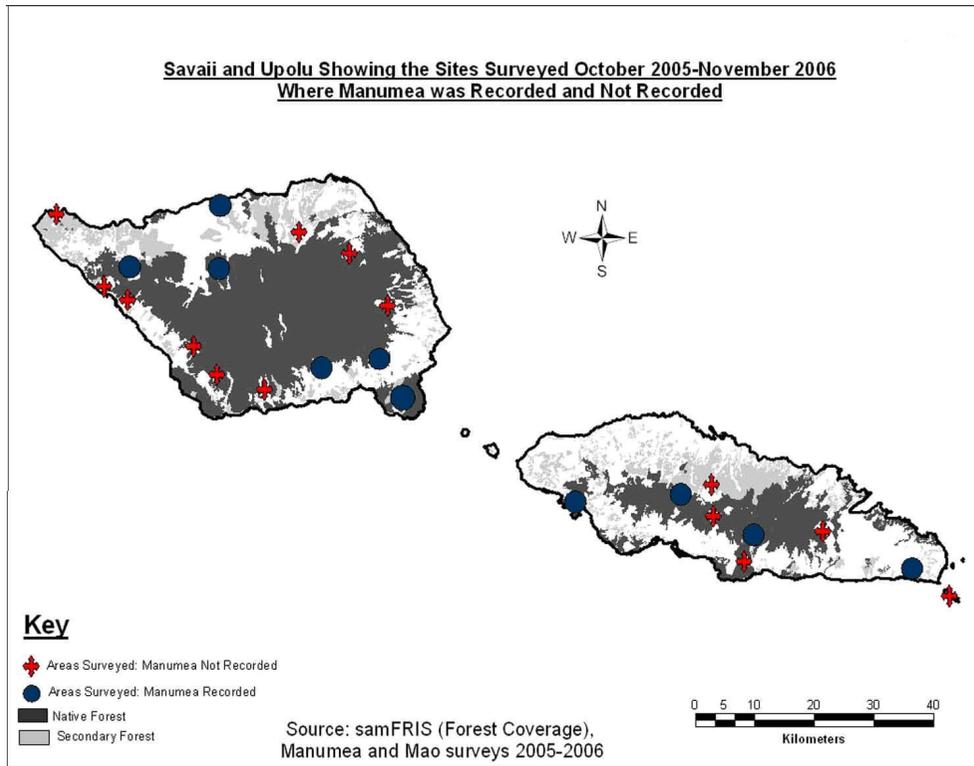
3.2 Map of all Plant and Animal Records by Taxonomic Division (1897 to 1994)



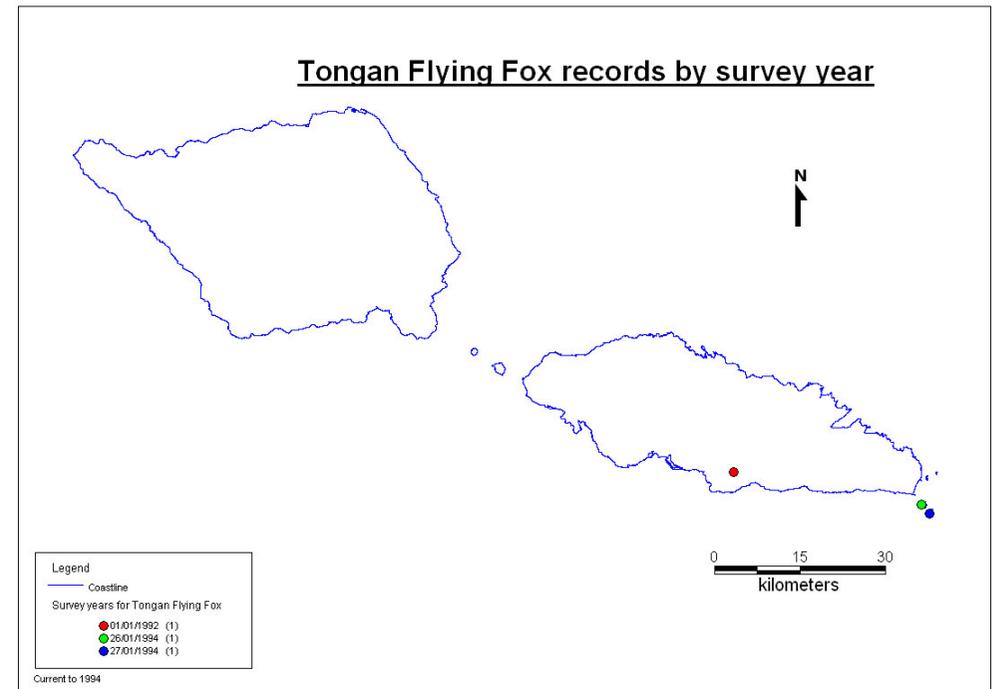
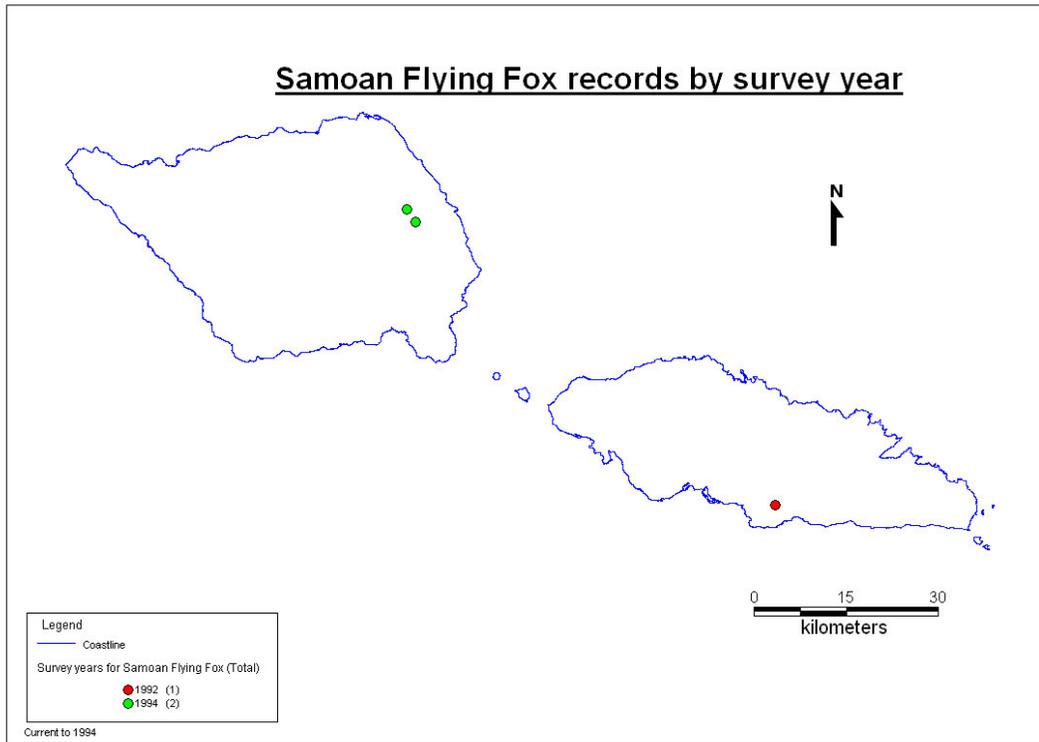
3.2.1 Map of all Bird Records (to 1994)



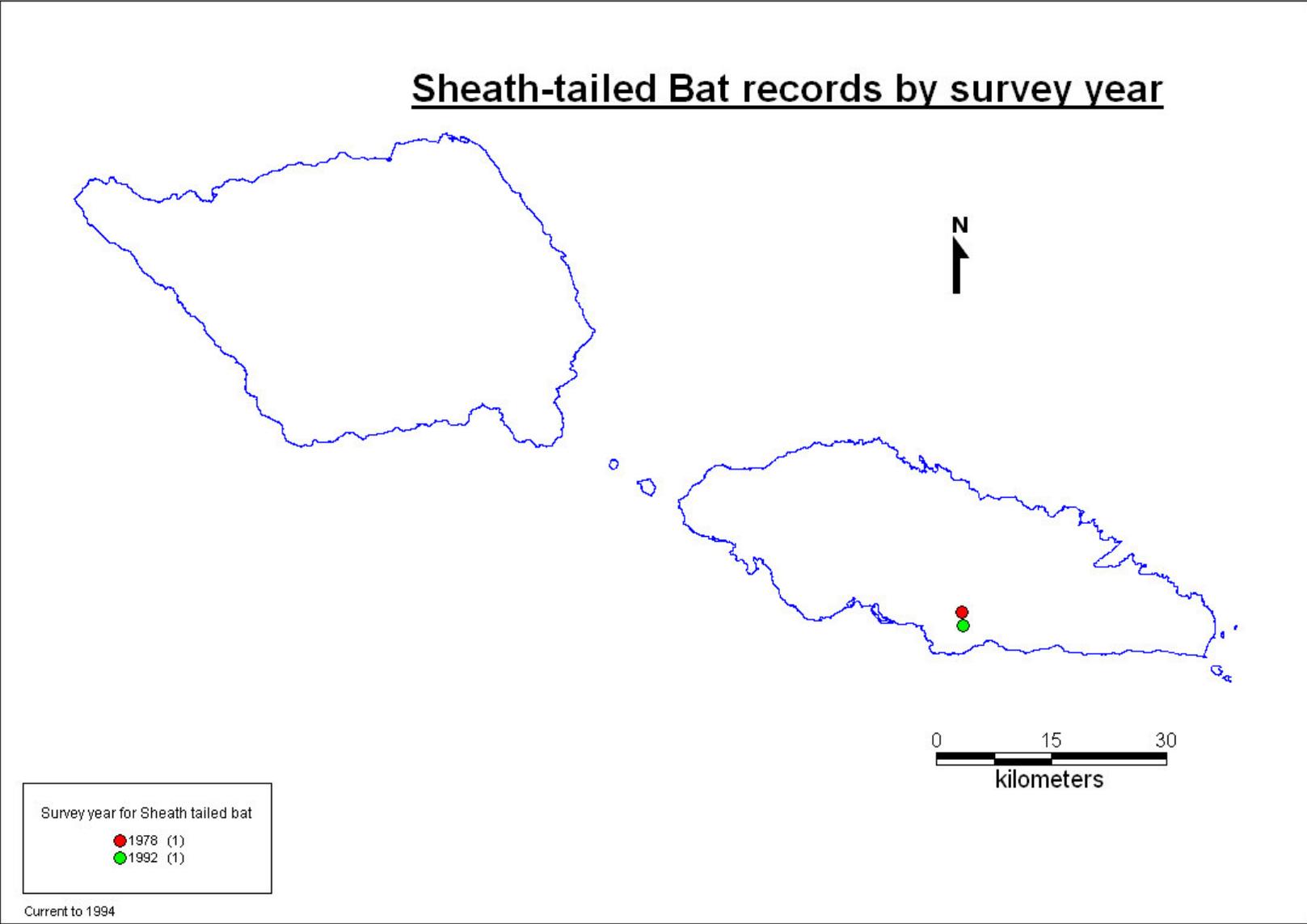
3.2.1.1 Map of Manumea (*Didunculus strigirostris*) and Maomao (*Gymnomyza samoensis*) observations (2006)



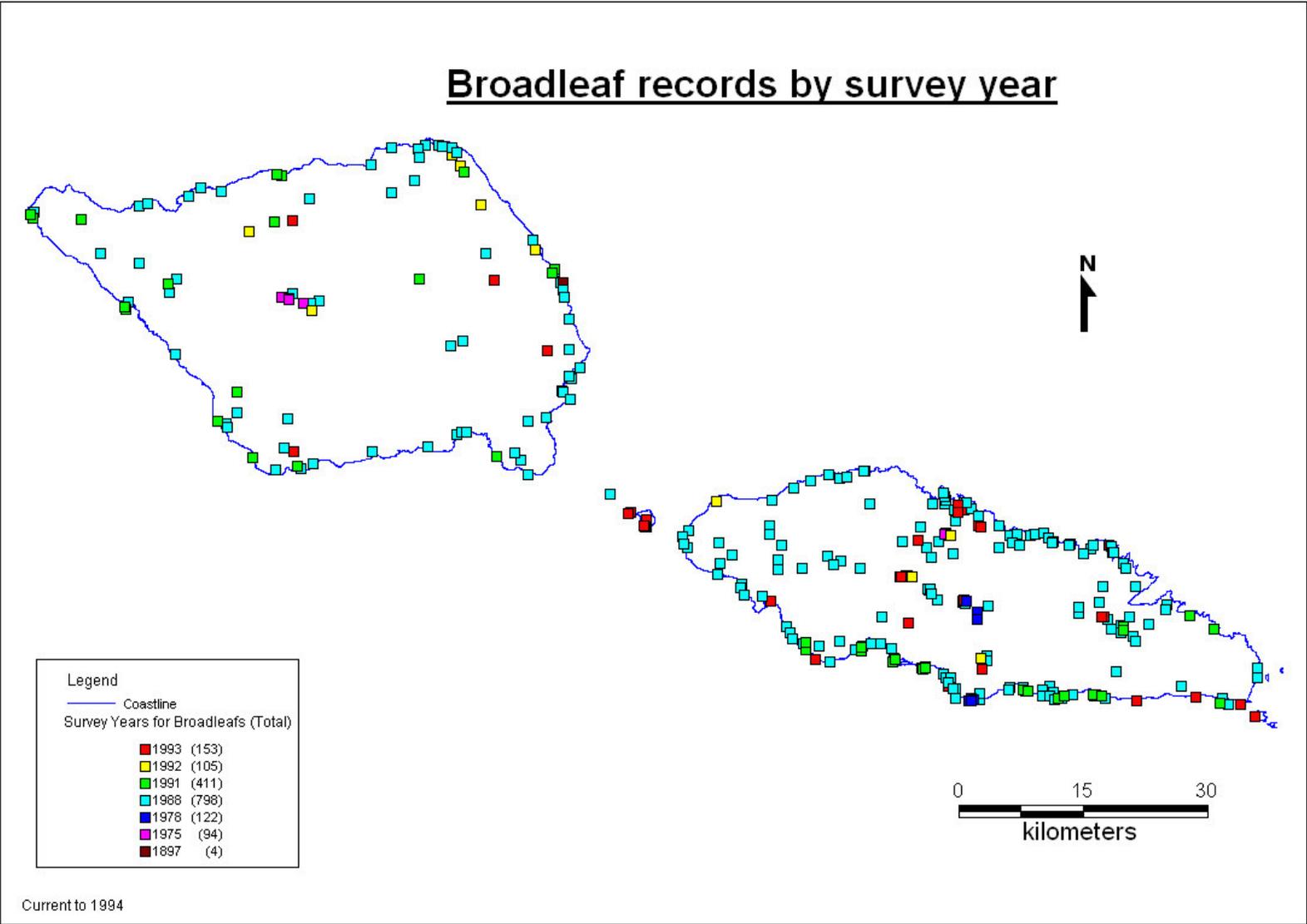
3.2.2 Map of Flying Fox (*Pteropus samoensis* and *Pteropus tonganus*) Records (to 1994)



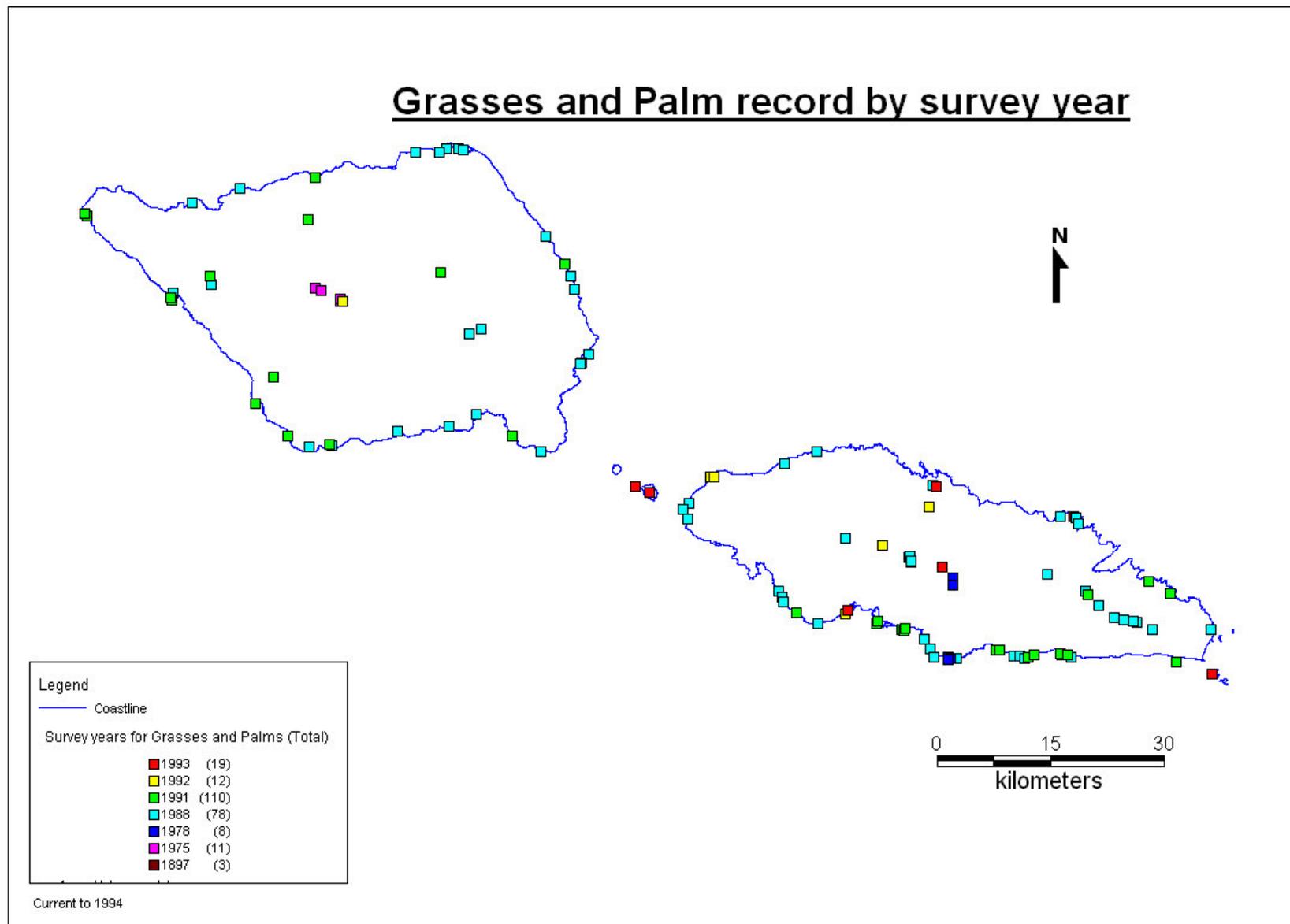
3.2.3 Map of Sheath-tailed bat (*Emballonura semicaudata*) records (to 1994)



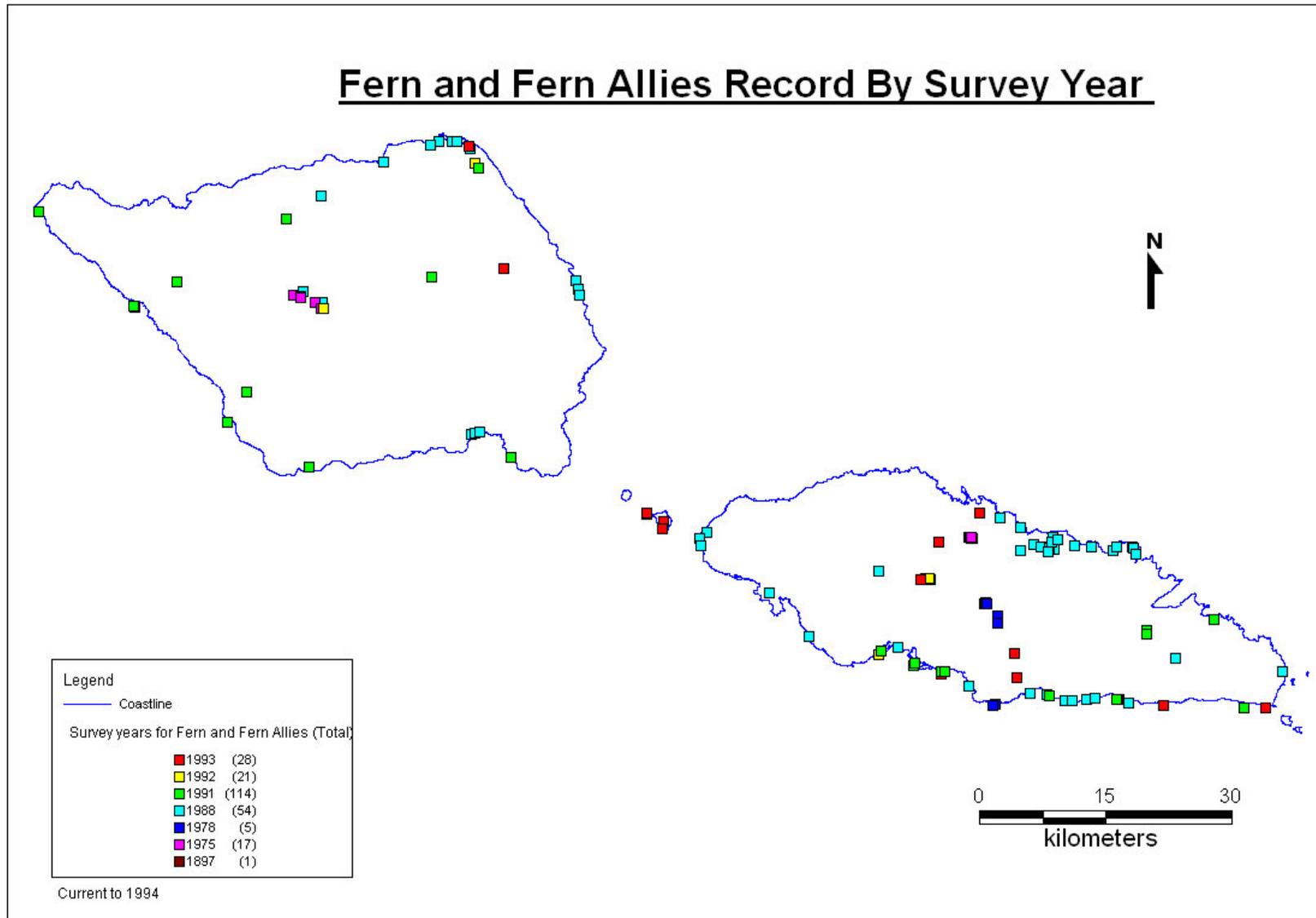
3.2.4 Map of Broadleaf (Dicotyledon) plant records (to 1994)



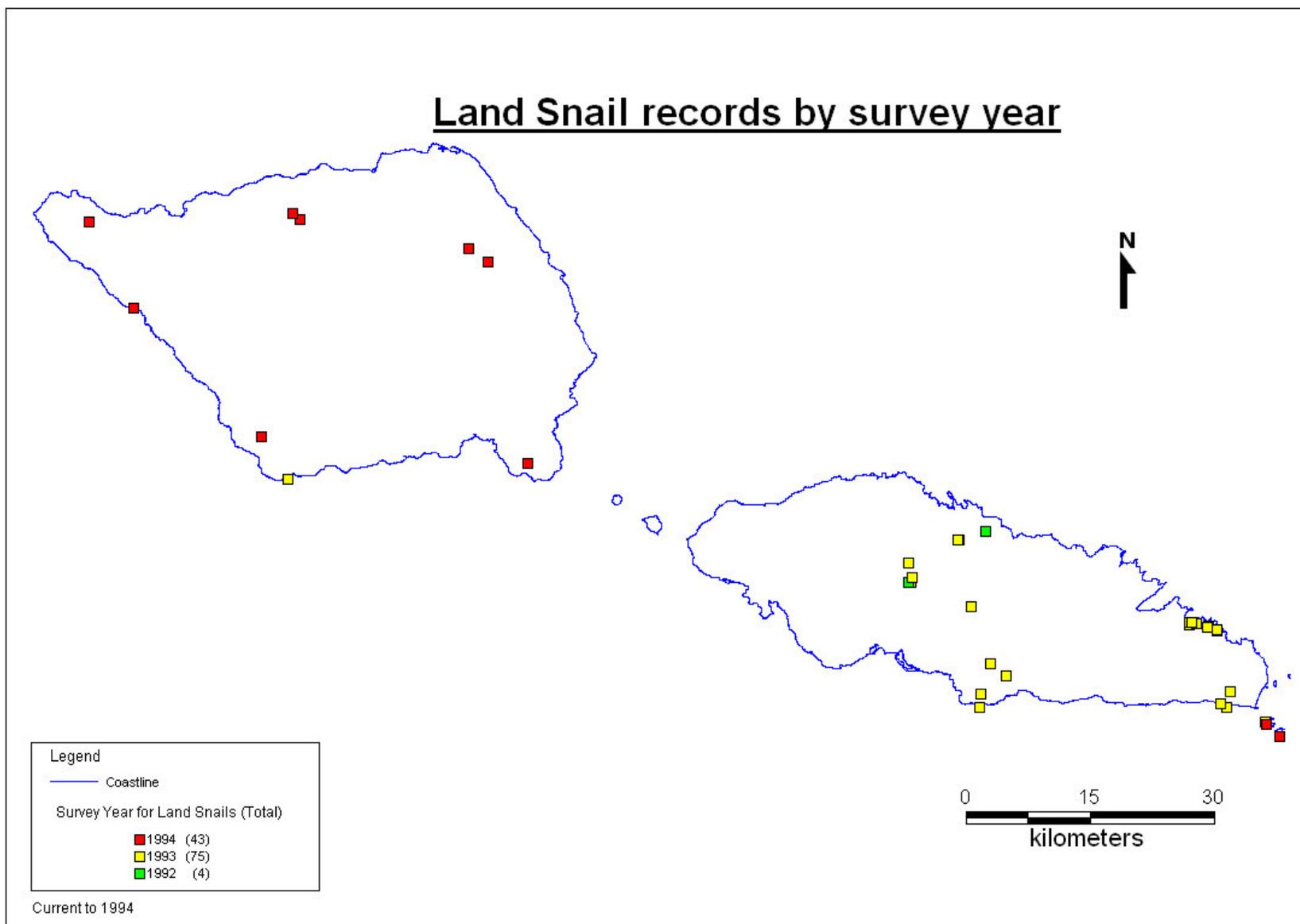
3.2.5 Map of Grasses and Palm (Monocotyledon) records (to 1994)



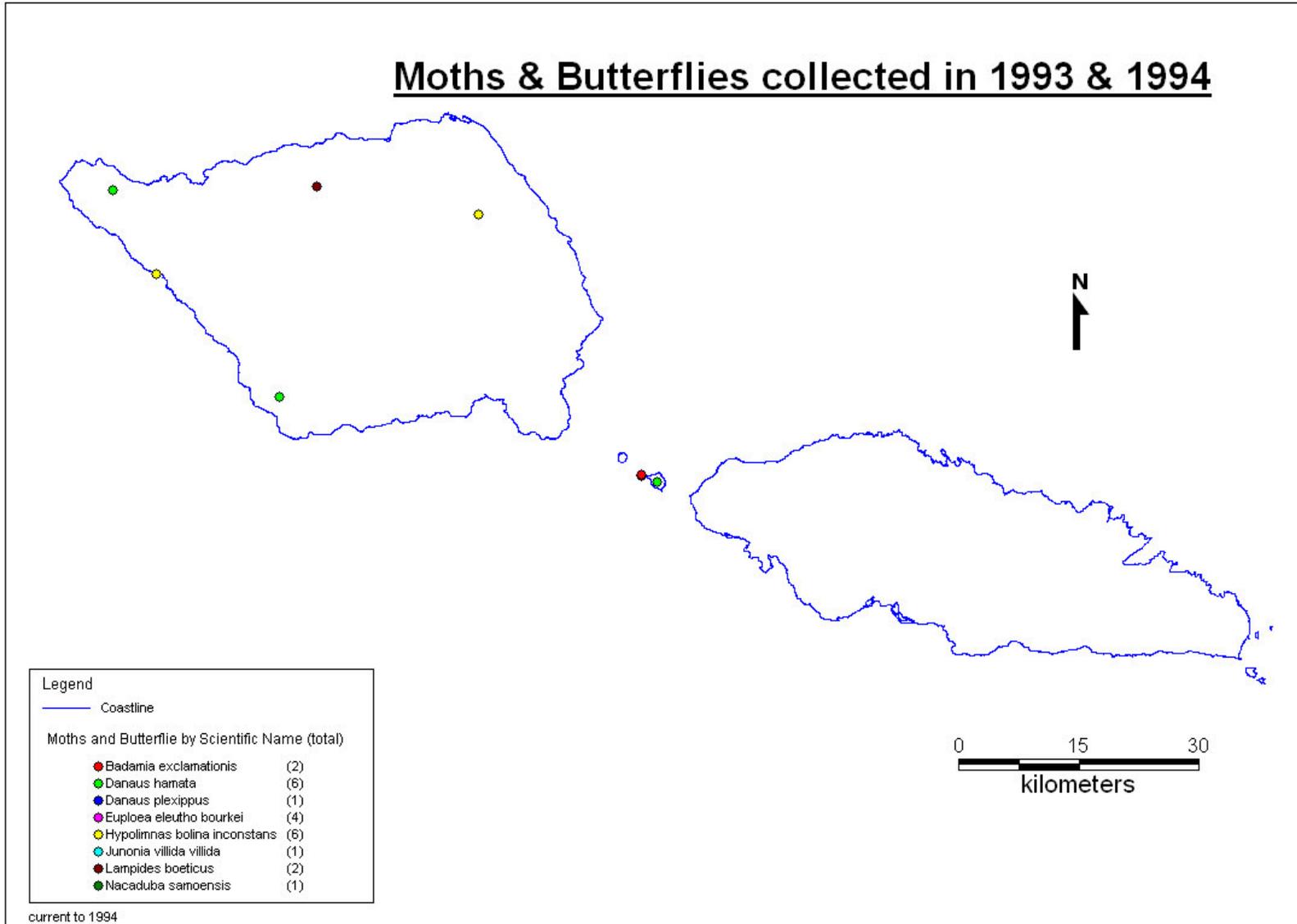
3.2.6 Map of Fern and Fern Ally records (to 1994)



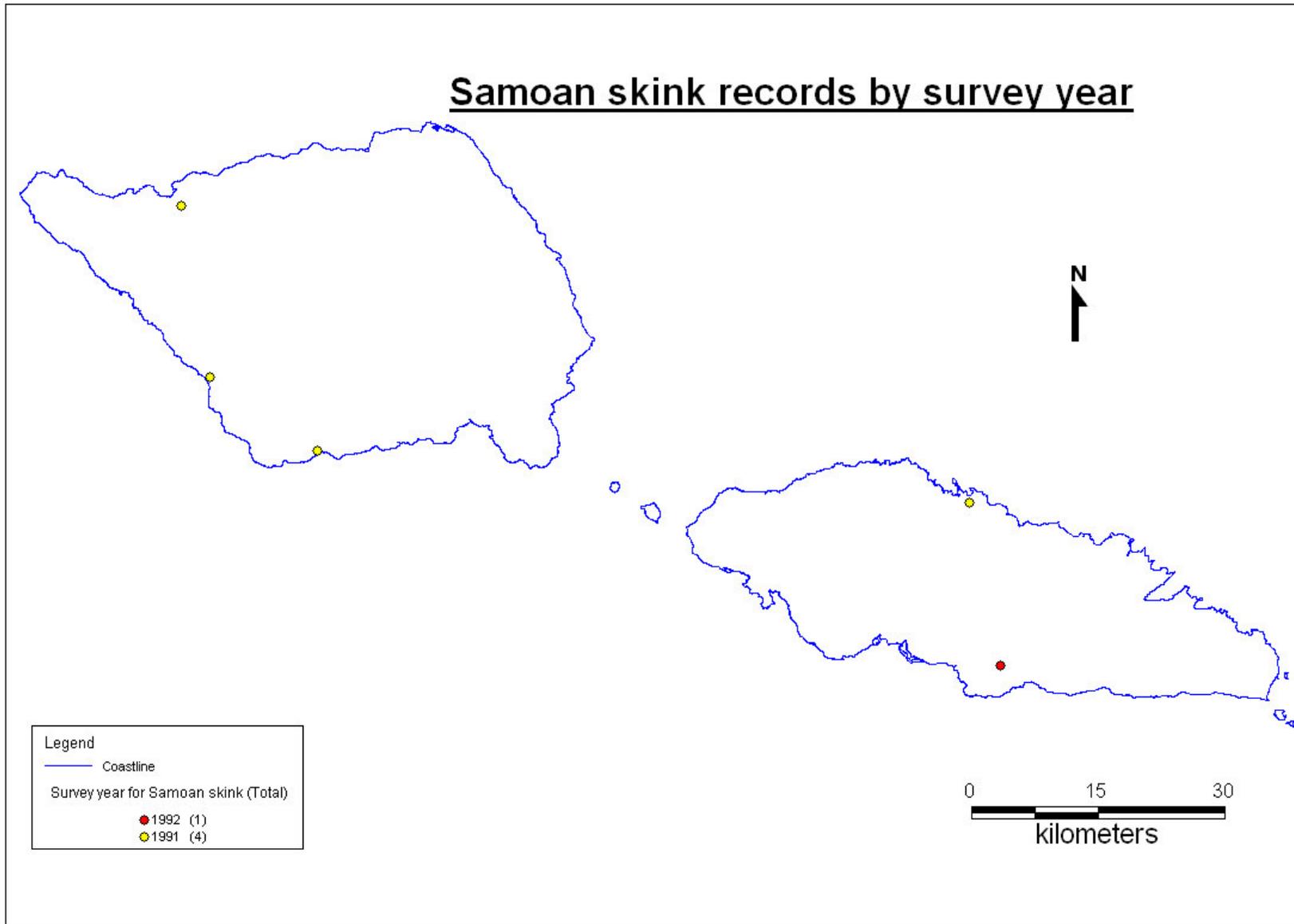
3.2.7 Map of land snail records (to 1994)



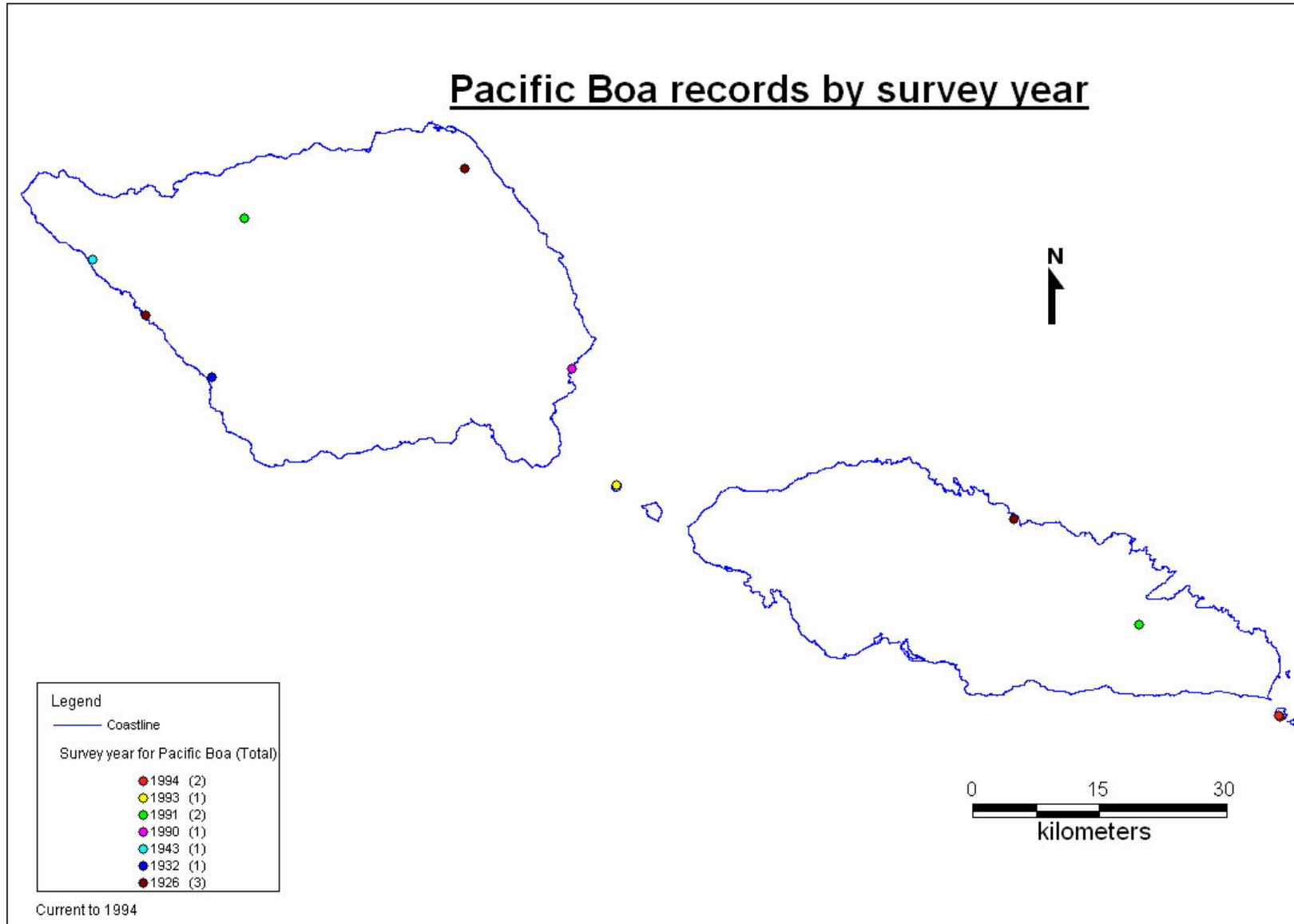
3.2.8 Map of butterflies and moths records (1993 and 1994)



3.2.9 Map of Samoan skink (*Emoia samoensis*) records (to 1994)



3.2.10 Map of Pacific boa (*Candoia bibrioni*) records (to 1994)



4. Data Gaps Identified

This review of terrestrial biological survey data in Samoa has identified a number of taxonomic, thematic and spatial gaps in data. Taxonomic gaps refer to particular taxonomic groups of species that have not been well studied at all, or not in recent years. Thematic gaps refer to gaps in our knowledge of the ecology of otherwise well-known species (eg population data, species breeding biology, threats and overall conservation status). Spatial gaps refer to particular areas that are likely to contain significant biodiversity but have not been well surveyed and so should be a priority for research.

Wherever suitable data allows, an assessment of the immediate survey priority (next five years) has been indicated for taxonomic, thematic and spatial gaps.

4.1 Taxonomic Data Gaps

4.1.1 Freshwater Biodiversity

No comprehensive surveys of freshwater fauna and flora have been completed in Samoa yet, although a significant body of work is available for American Samoa. The first freshwater biodiversity surveys for Samoa were conducted in July 2008 with assistance of Wetlands International – Oceania, IUCN Oceania and the Paris Museum of Natural History. The report from this work was not yet available at the time of preparation of this report so could not be reviewed by the authors. The survey was only a preliminary survey lasting 2 weeks and needs to be followed up with more comprehensive assessments.

Given the threat to wetlands from pollution and infrastructure and other development, more comprehensive surveys of the population, distribution and conservation status of wetland fauna and flora are urgently needed.

4.1.2 Land Snails and Slugs

No comprehensive land snail surveys have been done in Samoa, although a lot of work has been done in American Samoa. The most recent snail survey work in Samoa was done by Tony Robinson of the MNRE in 1993 and 1994 but has not been followed up with more recent surveys.

Since the introduction of the Giant African Snail into Samoa in the late 1990's (and its biocontrol flatworm agent *Platydemus manokwari*) it is very likely that snails are under greater threat in Samoa than ever before.

A comprehensive survey of the population, distribution and conservation status of land snails and slugs of Samoa is therefore a high priority.

4.1.3 Insects

A checklist of the insects of Samoa was prepared by the Bishop Museum (Kami and Miller 1998) but did not include information on the residency (eg native versus introduced) nor the conservation status of the species.

Insects were partially covered during the Upland Ecological Survey of 1996 at least to family level. However apart from this work and some limited collections done on other surveys (eg the Lake Lanoto'o Ramsar surveys) there is little up to date information on the status of the insects of Samoa, especially threatened native insects. A comprehensive insect survey is therefore considered to be a high survey priority.

4.1.4 Flying Foxes and the Sheath-Tailed bat

Apart from *ad hoc* observations of flying foxes and bats during surveys of other taxonomic groups, there is very little information on the current status of these mammals. This is particularly true for the sheath-tailed

bat or tagiti (*Emballonura semicaudata*)-which is classified on the 2006 IUCN Redlist as Endangered and has not been seen in Samoa for many years and may be extinct.

Thus a national survey of the bats and flying foxes of Samoa is a high priority.

4.1.5 Plants of concern

The vegetation of Samoa has been quite well surveyed and studied. However, a list of plants of concern needs to be produced, along with notes on the current distribution and conservation status of these plants. It is hoped that Dr Art Whistler will be contracted to conduct this study.

4.1.6 Seabirds and the Samoan Moorhen (Puna'e)

The land birds of Samoa have been well surveyed and studied. However, further work should be done on the seabird fauna which is not well known. In addition further surveys to locate the Samoan Moorhen or Puna'e (*Gallinula pacifica*) which has not been confirmed seen since 1873 but may persist in remote areas of upland Savaii should also be conducted.

4.2 Thematic Data Gaps

The main thematic gap is that our understanding of the ecology of the vast majority of species in Samoa is very poor. Without a good knowledge of the population, distribution, habitat, threats, breeding and feeding habits of species (especially the fauna) it is hard to manage or conserve them adequately.

For all threatened species, the following types of information are needed in particular:

- Current Distribution and Population Size
- Habitat Requirements (eg ecosystem type, soil, climate, geology, topography etc)
- Threats
- Use (if any)

For fauna specifically the following extra information is needed:

- Feeding habits (eg what they feed on, seasonality of feeding on different foods etc)
- Breeding habits (eg territoriality, frequency of breeding, timing, seasonality of breeding, gestation periods, number of young etc)
- Important species

For plants the specifically the following extra information is also needed:

- Phenology (flowering and fruiting times)
- Dispersal mode (pollinators, how fruits spread etc)
- Age class distribution
- Successional stage

While it will not be possible to get a detailed ecological knowledge of all threatened species in Samoa, much greater effort must be placed on getting general ecological information on the most threatened species and those that play a key ecological role (ie keystone species).

4.3 Spatial Data Gaps

It is obvious when looking at the survey maps that survey work has concentrated on lowland areas and along or close to the road network. This is understandable as such sites are the most accessible. However, the result of this is that there are a number of geographic areas that have not been well surveyed.

The following two areas are considered the key areas where further survey work is considered to be most needed (refer to map 4.3.1).

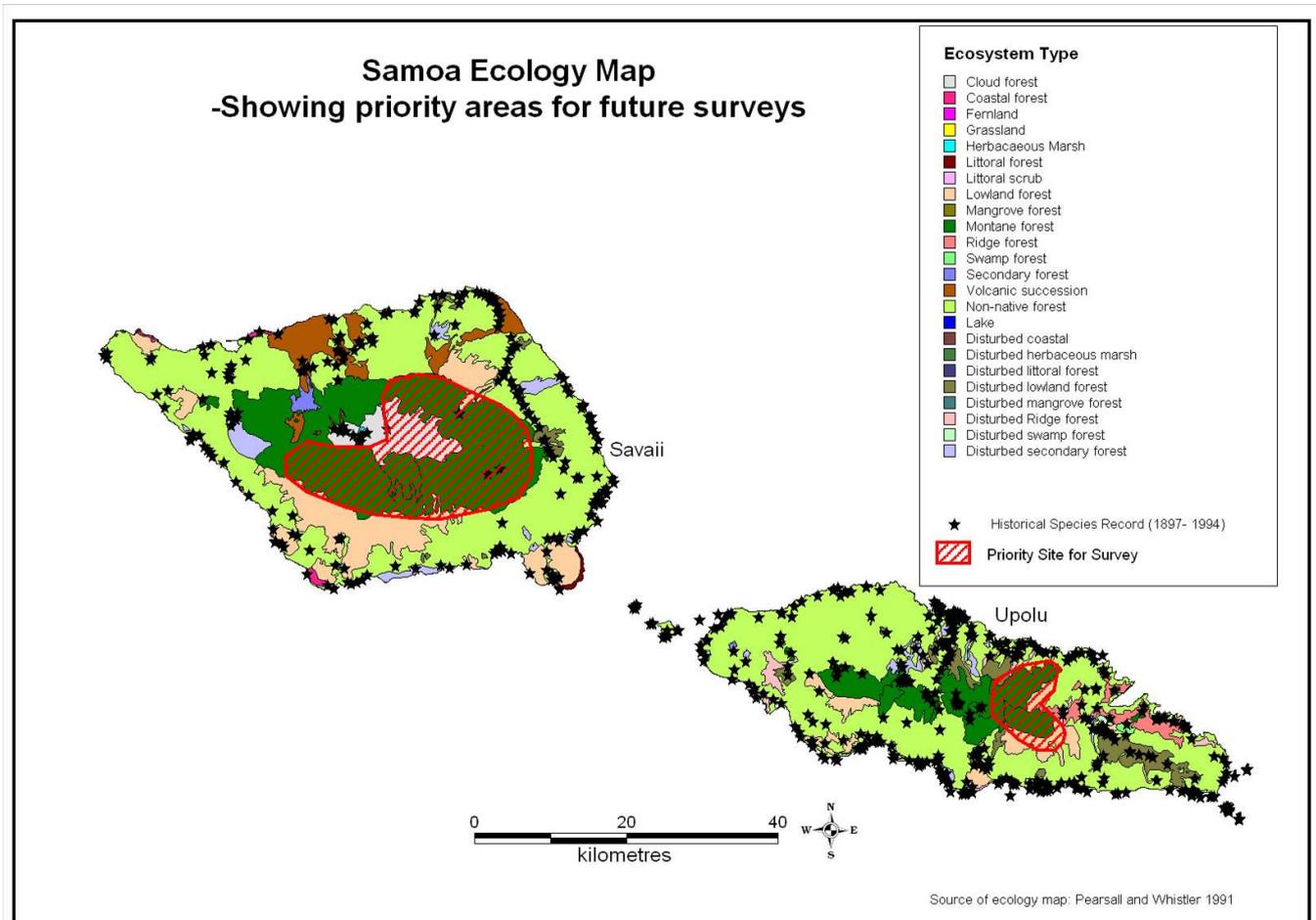
1. East-central Savaii

The central part of Savaii to the east of Mt Silisili, and the southern slopes of the central mountain plateaux have never been surveyed. This forest contains 10 globally threatened species including 2 threatened site endemics (the Savaii white eye and the Samoan moorhen) and should therefore be a priority area for future survey.

2. East-central Upolu

Similarly the east-central part of Upolu from Mt Fito to the east towards Mauga Sa and north towards Mauga Tele has not been surveyed. This area of intact forest may contain significant populations of threatened species such as the manumea and so should be a target for future surveys.

4.3.1 Map of priority areas for future ecological surveys



5. Summary

This review has summarized available terrestrial biological information for Samoa. While incomplete (not all survey reports were available to the authors) the review has nevertheless identified a number of survey and knowledge gaps. Filling these survey gaps becomes a research priority for the future and is needed for Samoa to manage its threatened biodiversity effectively and to strategically expand its PA network to capture the areas of highest biological value and threat.

The main future survey priorities are: taxonomic, thematic and spatial.

5.1 Taxonomic Survey Priorities

1. Freshwater biodiversity
2. Land snails
3. Flying foxes and the sheath tailed bat
4. Insects
5. Seabirds
6. List of plants of concern

5.2 Thematic Survey Priorities

The main thematic priority is to improve our knowledge of the ecology of native Samoan species. This includes research on the current population, distribution, habitat, threats and breeding and feeding habits of species. In particular it is important to identify and conduct ecological research on threatened species and species that play key roles in maintaining ecosystem structure and integrity (sometimes called keystone species).

5.3 Spatial Survey Priorities

There are two main spatial priorities- one on Upolu and one on Savaii. On Savaii the key priority is to survey the central and eastern parts of the central mountain plateau, while on Upolu the main priority is to survey the eastern part of the central mountain ridge up to Mauga Tele.

References

- BANACK, S.A.** (1996) *Flying foxes, genus Pteropus, in the Samoan Islands: Interactions with forest communities*. PhD Dissertation, University of California, Berkeley, USA.
- BEICHLER, U.** (1997) Studies on the avifauna: Report on a proposed Conservation Area at Uafato, Upolu, Samoa. *Unpublished report*. SPREP.
- BELLINGHAM, M. AND DAVIS, A.** (1988) Forest Bird Communities in Western Samoa. *Notornis* **35**:117-128.
- BROOK, A.** (1995) *Trip report for Western Samoa Pteropus samoensis survey*. Unpublished report.
- BRYAN, E. H., JR.** (1935) *Samoan and Scientific Names of Plants found in Samoa*. Unpublished typescript. Pacific Science Center, B. P. Bishop Museum, Honolulu, Hawaii. 38 pp.
- BUXTON, P.A.** (1935). *Insects of Samoa*. University of Hawaii Press, Honolulu, Hawaii.
- CHRISTOPHERSEN, E.** (1935). Flowering Plants of Samoa. *Bulletin of the B. P. Bishop Museum* **128**:1-221.
- COWIE, R.H.** (1998) Catalogue of the non-marine snails and slugs of the Samoan Islands. *Bishop Museum Bulletin in Zoology* **3**. Bishop Museum Press, Honolulu, Hawaii.
- COX, P. A.** (1984) Flying fox nearly extinct in Samoa. *Bats* **1**:1-2.
- CRIBB, P. AND WHISTLER, W.A.** (1996). *Orchids of Samoa*. Royal Botanic Gardens, Kew, England.
- ELMQVIST, T., RAINEY, W.E., PIERSON, E.D., AND COX, P.A.** (1994) Effects of the tropical cyclones Ofa and Val on the structure of a Samoan lowland rain forest. *Biotropica*
- FAO.** (2005) *Strengthening the institutional capacity of the Samoa forestry division to effectively plan and manage forest resources. Final project report*. Report written for the Government of Samoa by FAO. Apia, Samoa.
- INTERNATIONAL FOREST ENVIRONMENT RESEARCH & MANAGEMENT** (1991). *Western Samoa: Ecological survey and resource conservation review*. Unpublished report.
- KAMI, K.S., AND MILLER, S.E.** (1998). Samoan Insects and Related Arthropods: Checklist and Bibliography. *Bishop Museum Technical Report No.13*. Honolulu, Hawaii.
- LLOYD, C. G. AND W. H. AIKEN.** (1934) Flora of Samoa. *Bulletin of the Lloyd Library and Museum of Botany, Pharmacy, and Materia Medica. Bulletin. Botany Series* **33(4)**:1- 115.
- LOVEGROVE, T., BELL, B. AND HAY, R.** (1992) *The indigenous Wildlife of Western Samoa: The Impacts of Cyclone Val and a Recovery and Management Strategy*. NZ Ministry of Conservation
- MARTEL, F. AND ATHERTON, J.** (1997). *Timber inventory of the Ifilele Resource: Uafato Conservation Area Project*: Unpub. Report produced for O le Siosiomaga Society. Apia, Samoa.
- MAYR, E. AND JACQUES, F. L.** (1978) *Birds of the Southwest Pacific: A Field Guide to the Birds of the Area Between Samoa, New Caledonia, and Micronesia (new edition)*. Tuttle, Rutland, Vermont. 316 pp.

- MERLIN, M. D. AND JUVIK, J. O.** (1985). Bird Protection in Western Samoa. *Oryx: Journal of the Flora and Fauna Society* Vol 19:97-103.
- MICKLEBURGH, P., HUTSON, A. M. AND RACEY, P. A.** (1992). *Old World Fruit Bats: An Action Plan for their Conservation*. I.U.C.N., Gland Switzerland.
- MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT.** (2006a) *Recovery plan for Manumea or Tooth-Billed Pigeon (Didunculus strigirostris) 2006-2016*. Apia, Samoa.
- MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT.** (2006b). *Recovery plan for the Ma'oma'o or Mao (Gymnomyza samoensis) Samoa's Large Forest Honeyeater 2006-2016*. Apia, Samoa.
- MUSE, C. AND MUSE, S.** (1982). *The Birds and Birdlore of Samoa = O Manu Ma Talaaga O Manu O Samoa*. Pioneer Press, Wala Wala, Washington, for the National Audubon Society. 156 pp. illus. Printers.
- PARHAM, B. E. V.** (1972). Plants of Samoa: a guide to their local and scientific names with authority; with notes on their uses, domestic, tradition and economic. *New Zealand Department of Scientific and Industrial Research; no 85:1-162*. DSIR Information Wellington, New Zealand.
- PARK, G. HAY, J. WHISTLER, A. LOVEGROVE, T. AND RYAN, P.** (1992). *The Ecological Survey of Western Samoa: The Conservation of Biological Diversity in the Coastal Lowlands of Western Samoa*. Report by the NZ Department of Conservation for the Ministry of External Relations and Trade.
- PEARSALL, S.H.** (1993). *A geographical-ecological model for landscape conservation development in Western Samoa*. PhD Dissertation, University of Hawaii.
- PEARSALL, S. H. AND WHISTLER, W. A.** (1991). *Terrestrial Ecosystem Mapping for Western Samoa*. A report prepared for the Government of Western Samoa. South Pacific Regional Environment Programme, Noumea, New Caledonia and East-West Center and Policy Institute, Honolulu, Hawaii, U.S.A.
- PILSBURY, H.A., COOKE, C.M., AND NEALE, M.C.** (1971) *Land snails from Hawaii, Christmas Island and Samoa*. Unpublished.
- ROBINSON, A.C** (1994). *Ecology of Samoa: an annotated bibliography*. SPREP, Apia, Samoa.
- SCHUSTER, C.; WHISTLER, A.; TAPULOLOU, S.T. AND BUTLER, D.** (ed). *The conservation of biological diversity in upland ecosystems of Samoa*. Apia, Samoa
- SCHUSTER, C., AND BUTLER, D** (2001). *Samoa's Biodiversity Strategy & Action Plan*. Government of Samoa, Samoa.
- UHE, G.** (1974). *Medicinal plants of Samoa; a preliminary survey of the use of plants for medicinal purposes in the Samoa Islands*. New York Botanical Garden, New York, USA.
- UHE, G.** (1974). *Wayside of plants of the South Pacific: [a guide to some common and interesting herbs, shrubs, and trees found in Hawaii, Tahiti, Marqueses, Samoa, Tonga, Niue, Rarotonga, Fiji and New Caledonia]*. Stockton House, Auckland.
- WATLING, R. AND TALBOT-KELLY, C.** (1982) *Birds of Fiji, Tonga, and Samoa*. Milwood Press, Wellington, New Zealand. 176 pp.
- WILSON, D. AND ENGBRING, J.** (1991) *Pteropus samoensis and Pteropus tonganus: Status in Fiji and Samoa*. *US Fish and Wildlife Service Report* 90:74-101.

- WISHART, F.** (1989). Western Samoa: a rainforest reprieved. *Habitat Australia* (1989) **Vol 17** (no.4): 20-23
- WHISTLER, W. A.** (1978). Vegetation of the Montane Region of Savai'i, Western Samoa. *Pacific Science* **32**:79-94.
- WHISTLER, W. A.** (1984). Annotated List of Samoan Plant Names. *Economic Botany* **38**:364-489.
- WHISTLER, W. A.** (1992) *Flowers of the Pacific Island Seashore: A Guide to the Littoral Plants of Hawaii, Tahiti, Samoa, Tonga, Cook Islands, Fiji and Micronesia*. Everbest Printing Co, Hong Kong.
- WHISTLER, W. A.** (1992) National Biodiversity Review of Western Samoa. In: Giuven, D. R. (compiler) *An overview of the Terrestrial Biodiversity of the Pacific Islands*. Global Environment Facility and South Pacific Biodiversity Conservation Programme.
- WHISTLER, W.A** (1995). *Wayside plants of the islands: a guide to the lowland flora of the Pacific Islands: including Hawaii, Samoa, Tonga, Tahiti, Fiji, Guam and Belau*. Isle Botanica, Honolulu, Hawaii.
- WHISTLER, W.A** (1996a). *Samoaan herbal medicine*. Report produced for O le Siosiomaga Society of Samoa. Apia, Samoa. Isle Botanica, Honolulu Hawaii.
- WHISTLER, W.A** (1996b). *Samoaan traditional medicine*. Report prepared for Vaka Moana Project of UNESCO, Apia, Samoa.
- WHISTLER, W. A.** (1997). *Botanical Survey of the Uafata Conservation Area*. Unpub. Report produced for O le Siosiomaga Society. Apia, Samoa.
- WHISTLER, W. A.** (2000). *Plants in Samoan Culture: The Ethnobotany of Samoa*. Isle Botanica, Hawaii.

Annex 1. List of Terrestrial Protected Areas in Samoa

Site	Site Type	Area (Ha)
Falealupo Conservation Area	Community Conservation Area	722
Uafato Conservation Area	Community Conservation Area	1161
O le Pupu Pue National Park (OLPP NP)	National Park/Reserve	4999
Mt Vaea Reserve	National Park/Reserve	89
Saanapu-Sataoa Conservation Area	Community Conservation Area	53
Asau-Falelima National Park	National Park/Reserve	1888
Lata National Park	National Park/Reserve	3732
Mauga Salafai National Park	National Park/Reserve	5974
Lake Lanotoo National Park	National Park/Reserve	470
Laulii Conservation Area	Community Conservation Area	400
Land Portion of Aleipata Marine Protected Area	Community Conservation Area	156
<i>Proposed extension to OLPP NP</i>	<i>National Park/Reserve</i>	<i>10700</i>
Total Land Area currently under protection		19644
<i>Total Land Area under protection with O Le Pupu Pue extension</i>		<i>30344</i>
Percent of land area currently protected in Samoa		6.9%

NB: this list does not include the two marine sites (Safata MPA and Palolo Deep Marine reserve) that do not have terrestrial components

Annex 2. Globally Threatened Terrestrial Species in Samoa

#	Scientific Name	Family	Order	Class	Phylum	Kingdom	Common Name(s)	Red List	Trend
1	<i>Chelonia mydas</i>	CHELONIIDAE	TESTUDINES	REPTILIA	CHORDATA	ANIMALIA	GREEN TURTLE	EN A2bd ver 3.1 (2001)	↓
2	<i>Didunculus strigirostris</i>	COLUMBIDAE	COLUMBIFORMES	AVES	CHORDATA	ANIMALIA	TOOTH-BILLED PIGEON	EN A2bcd; B1ab(ii,iii,v); C1+2a(i) ver 3.1 (2001)	↓
3	<i>Emballonura semicaudata</i>	EMBALLONURIDAE	CHIROPTERA	MAMMALIA	CHORDATA	ANIMALIA	PACIFIC SHEATH-TAILED BAT	EN A1ac ver 2.3 (1994)	↓
4	<i>Eretmochelys imbricata</i>	CHELONIIDAE	TESTUDINES	REPTILIA	CHORDATA	ANIMALIA	HAWKSBILL TURTLE	CR A1bd ver 2.3 (1994)	
5	<i>Gallinula pacifica</i>	RALLIDAE	GRUIFORMES	AVES	CHORDATA	ANIMALIA	SAMOAN MOORHEN	CR D ver 3.1 (2001)	?
6	<i>Gymnomyza samoensis</i>	MELIPHAGIDAE	PASSERIFORMES	AVES	CHORDATA	ANIMALIA	MAO	EN B1ab(ii,iii,v) ver 3.1 (2001)	↓
7	<i>Lalage sharpei</i>	CAMPEPHAGIDAE	PASSERIFORMES	AVES	CHORDATA	ANIMALIA	SAMOAN TRILLER	NT ver 3.1 (2001)	
8	<i>Myiagra albiventris</i>	MONARCHIDAE	PASSERIFORMES	AVES	CHORDATA	ANIMALIA	SAMOAN FLYCATCHER	VU A2e+3c ver 3.1 (2001)	↓
9	<i>Numenius tahitiensis</i>	SCOLOPACIDAE	CHARADRIIFORMES	AVES	CHORDATA	ANIMALIA	BRISTLE-THIGHED CURLEW	VU C2a(ii) ver 3.1 (2001)	↓
10	<i>Pteropus samoensis</i>	PTEROPODIDAE	CHIROPTERA	MAMMALIA	CHORDATA	ANIMALIA	SAMOAN FLYING-FOX	VU A1d+2d ver 2.3 (1994)	↓
11	<i>Thaumatodon hystricelloides</i>	ENDODONTIDAE	STYLOMMATOPHORA	GASTROPODA	MOLLUSCA	ANIMALIA		EN A2ce ver 2.3 (1994)	
12	<i>Zosterops samoensis</i>	ZOSTEROPIDAE	PASSERIFORMES	AVES	CHORDATA	ANIMALIA	SAMOAN WHITE-EYE	VU D2 ver 3.1 (2001)	?
13	<i>Clinostigma samoense</i>	PALMAE	ARECALES	LILIOPSIDA	TRACHEOPHYTA	PLANTAE		EN A1c ver 2.3 (1994)	
14	<i>Drymophloeus samoensis</i>	PALMAE	ARECALES	LILIOPSIDA	TRACHEOPHYTA	PLANTAE		CR D ver 2.3 (1994)	
15	<i>Nesofregatta fuliginosa</i>	HYDROBATIDAE	PROCELLARIIFORMES	AVES	CHORDATA	ANIMALIA	POLYNESIAN STORM-PETREL	VU A2bce+3bce; B2ab(i,ii,iii,iv,v); C1 ver 3.1 (2001)	↓
16	<i>Gallinolumba stairi</i>	COLUMBIDAE	COLUMBIFORMES	AVES	CHORDATA	ANIMALIA	SHY GROUND-DOVE	VU C2a(i) ver 3.1 (2001)	↓
	<i>Pterodroma brevipes</i>	PROCELLARIIDAE	PROCELLARIIFORMES	AVES	CHORDATA	ANIMALIA	COLLARED PETREL	NT ver 3.1 (2001)	↓
	<i>Aglaia samoensis</i>	MELIACEAE	SAPINDALES	MAGNOLIOPSIDA	TRACHEOPHYTA	PLANTAE		LR/nt ver 2.3 (1994)	

The last two species in italics are not classified as threatened, but could become threatened in future so are included here.

Key to Redlist categories: CR = Critically Endangered; EN= Endangered; VU = Vulnerable; NT = Near Threatened; LR =Least Risk.

Annex 3. List of Terrestrial Key Biodiversity Areas in Samoa

Site Number	Site name	Size of Site (Ha)	Land Tenure	Current Status	Year of Creation	Threatened species in site
1	Aleipata Marine Protected Area	5,084 (marine); 156 (land)	Customary	in process - active	1999	<i>Chelonia mydas</i> ; <i>Eretmochelys imbricata</i> ; <i>Gallicolumba stairi</i> ; <i>Numenius tahitiensis</i>
2	Lake Lanoto'o National Park	469.95	Government	in process - active		<i>Clinostigma samoense</i> ; <i>Didunculus strigirostris</i> ; <i>Drymophloeus samoensis</i> ; <i>Pteropus samoensis</i> ; <i>Thaumatodon hystricelloides</i>
3	O le Pupu Pue NP	4230.62	Government	in process - active		<i>Clinostigma samoense</i> ; <i>Didunculus strigirostris</i> ; <i>Drymophloeus samoensis</i> ; <i>Gymnomyza samoensis</i> ; <i>Thaumatodon hystricelloides</i>
4	Sa'anapu-Sataoa Conservation Area	100.99	Customary	Uncertain	1994	<i>Chelonia mydas</i> ; <i>Eretmochelys imbricata</i> ; <i>Myiagra albiventris</i>
5	Savaii Lowland and Upland Forest	71587.7	Customary	Not declared yet	-	<i>Clinostigma samoense</i> ; <i>Didunculus strigirostris</i> ; <i>Drymophloeus samoensis</i> ; <i>Gallinula pacifica</i> ; <i>Gymnomyza samoensis</i> ; <i>Intsia bijuga</i> ; <i>Myiagra albiventris</i> ; <i>Pteropus samoensis</i> ; <i>Zosterops samoensis</i>
6	Uafato-Tiavea Coastal Forest	1144.37	Customary	Uncertain	1994	<i>Clinostigma samoense</i> ; <i>Didunculus strigirostris</i> ; <i>Gallicolumba stairi</i> ; <i>Gymnomyza samoensis</i> ; <i>Intsia bijuga</i> ; <i>Myiagra albiventris</i> ; <i>Pteropus samoensis</i>
Total Land Area of KBAs		77689.63	(27% of land area)			

Annex 4. Terrestrial Survey Reports Reviewed

Table 1: The National Survey of Western Samoa. The Conservation of Biological Diversity in the Coastal Lowlands of Samoa

Title: The National Survey of Western Samoa. The Conservation of Biological Diversity in the Coastal Lowlands of Western Samoa Authors: Geoff Park, Rod Hay, Art Whistler, and Tim Lovegrove Year published: 12 March 1992				
Taxonomic Group	Survey Area	Methodology	Survey Year	Recommendation
Vegetation	Uafato, Ti'avea Coastal Forest.	100m x 10m plot	After Cyclone Ofa February 1990, completed two months before Cyclone Val December 1991	Areas recommended for long-term monitoring are: le Pupu Pu'e – Streambed above Pe'a Pe'a Cave. Lake Lanoto'o – Track from lake to south. Tafua Forest Reserve. Falealupo Forest Reserve. A'opo – track to coast. A'opo – high altitude forest. Aliepata Islands
Birds	A'opo, Letui, Sasina Coastal Forest. Sataoa, Sa'anapu Mangrove Wetlands. Va'oto Lowland Forests. Aleipata Islands. Taga, Lata, Sala'ilua Lowland Forest. Si'uvao Point Coastal Lowland Forests. Mulinu'u, Tufutafoe Coastal Wetlands. Samalaelulu, Mauga Lava	5minute bird count		
Mammals – Bats	Flow Succession and Forest Islands. Apolimafofou Coastal Wetlands. Mali'oli'o River Forest. Salaepaga, Lalomanu Coastal Forest Vaie'e, Tafitoala Peninsula. Vaipu Swamp Forest. Sala'iula Upper Lowland Forests. Falelima Upper Lowland. Pu'apu'a, Lesoto Coastal Lowland Forest.	Bats noted when spotted		

Title: The National Survey of Western Samoa. The Conservation of Biological Diversity in the Coastal Lowlands of Western Samoa				
Authors: Geoff Park, Rod Hay, Art Whistler, and Tim Lovegrove				
Year published: 12 March 1992				
Taxonomic Group	Survey Area	Methodology	Survey Year	Recommendation
	Vailoa Upper Lowland Forest (Bird count only) Lake Lanoto'o (Bird count only) Punataemo'o Swamp Forest. Salani, Utulaelae Coastal Wetlands. Malaemalu Coastal Wetland. Vaovai Coastal Wetland Mulivai Coastal Wetland. Lefaga, Matautu Coastal Forest.			programmes should these prove necessary in the wake of Cyclone Val.

Table 2: The Conservation of Biological Diversity in upland ecosystems of Samoa

Title: The Conservation of Biological Diversity in upland ecosystems of Samoa.				
Authors: Cedric Schuster, Arthur Whistler and Tapulolou Siuli Tuailmafua				
Year published:				
Taxonomic Group	Survey Area	Methodology	Survey Year	Recommendation
Vegetation	Le Pupu Pue National Park Lepue Vaivai-Fito Togitogiga Gagaifomauga III Aopo Asau Mauga Mu Mata o le Afi Silisili Palauli West Salailua Anoamaa	<i>3 methods used</i> 1. Vegetation highly damaged – checklist used. 2. Vegetation damaged but some large trees present – a diameter at breast height (dbh) of all trees over 5cm diameter was measured. 3. Good vegetation (not damaged) 100m x 10m plot – recorded all trees.	13 May 1996 to 1 June 1996. 29 July to 9 August 1996.	Areas for Conservation: Gagaifomauga III Palauli West Anoamaa Eastern Upolu Islands Lefaga/Aleisa Fogasavaii, Ologogo Mt Tafauupolu Further Surveys Do more upland survey areas in areas missed, particularly the

Title: The Conservation of Biological Diversity in upland ecosystems of Samoa.

Authors: Cedric Schuster, Arthur Whistler and Tapulolou Siuli Tuaillemafua

Year published:

Taxonomic Group	Survey Area	Methodology	Survey Year	Recommendation
	Sauniatu Solosolo Eastern Upolu Vaipu Afulilo Olomaga Lanoto Uafato Lefaga/Aleisa Lefaga Taitoelau Fogasavaii Ologogo Mt Tafuaupolu			western parts of Savaii Undertake wetland surveys Detailed entomological surveys Management Threatened species Invasive species – need to develop a national plan for eradication of invasive species
Birds	Le Pupu Pue National Park Mt Fito Gagaifomauga III Maugaloa Aopo Palauli West Anoamaa Sauniatu Solosolo Eastern Upolu Lefaga/Aleisa Fogasavaii Ologogo Mt Tafuaupolu	5 minute bird count		
Insects	Le Pupu Pue National Park Togitogaia Gagaifomauga III	<u>3 methods used</u> 1. Malaise trap – a trap was placed for 24 hours at each site		

Title: The Conservation of Biological Diversity in upland ecosystems of Samoa.

Authors: Cedric Schuster, Arthur Whistler and Tapulolou Siuli Tuaillemafua

Year published:

Taxonomic Group	Survey Area	Methodology	Survey Year	Recommendation
	Aopo Mata o le Afi Silisili Palauli West Salailua Eastern Upolu Afulilo Fogasavaai Mt Tafuaupolu	surveyed 2. Light trap – the light trap used a coleman spirit lamp placed in the centre of a white sheet (2m x 1.8m) on the ground, lit at 8-9pm and run for about an hour. Insects were collected as they settled on the sheet. 3. Sweeping – ten sweeps with a net were conducted every 10m until 100 sweeps were achieved. Insects were collected and placed in a container after 10 sweeps.		
Bats	Le Pupu Pue National Park Gagaifomauga III Palauli West Eastern Upolu	When ever a bat of seen it was noted down.		

Table 3: Recovery plan for the Ma'oma'o or Mao (*Gymnomyza samoensis*) Samoa's Large Forest Honeyeater 2006-2016. And Recovery plan for Manumea or Tooth-Billed Pigeon (*Didunculus strigirostris*) 2006-2016

Title: Recovery plan for the Ma'oma'o or Mao (<i>Gymnomyza samoensis</i>) Samoa's Large Forest Honeyeater 2006-2016. And Recovery plan for Manumea or Tooth-Billed Pigeon (<i>Didunculus strigirostris</i>) Authors: Ministry of Natural Resources & Environment (MNRE) Year published: October 2006				
Taxonomic Group	Survey Area	Methodology	Survey Year	Recommendation
Birds	Malololelei Aopo Tafua Mt Tafua Matafa'a Tiavi O le Pupu Pue National Park Lake Lanoto'o Tapatapao Fagafua Plantation Falelime Forest Plantation Salailua Taga/Mt Olomanu Masamasa plantation forest Fagatele bay coastal trail Patamea Forest Lemafa Cattle farm Nuutele Island Palauli Lalomanu Falelatai Sili Gataivai Vaiaata	5minute bird count	October 2005 and November 2006	Survey the uplands of Savaii and south eastern side of Upolu Do more research into the ecology of the Maomao and Manumea

Table 4: Strengthening the Institutional Capacity of the Samoa Forestry Division to effectively plan and manage Forest Resources. GIS Design and Development 3rd Mission Final Report

<p>Title: Strengthening the Institutional Capacity of the Samoa Forestry Division to effectively plan and manage Forest Resources. GIS Design and Development. 3rd Mission Final Report. Authors: James Atherton for FAO Year published: December 2004</p>				
Taxonomic Group	Survey Area	Methodology	Survey Year	Recommendation
Vegetation - land cover/forest classification	The whole of Samoa Apolima Fanuatapu Manono Namua Nuulua Nuutele Savaii Upolu	Aerial photo interpretation Ground truthing	5 July 2004 to 27 November 2004	Continue with SamFRIS GIS development – keep updating information. Continue with forest surveys

Table 5: Terrestrial Ecosystem Mapping For Western Samoa

<p>Title: Terrestrial Ecosystem Mapping For Western Samoa Authors: Sam H. Pearsall and W. Arthur Whistler Year published: March 1991</p>				
Ecosystems of Samoa	Survey Area	Methodology	Survey Year	Recommendation
Mixed upland species swamp forest xylocarpus mangrove pandanus turritus swamp forest freshwater lake mixed lowland species swamp forest herbaceous marsh rhizophora mangrove metrosiderous marsh grassland (native) coastal rain forest ridge rain forest bruguiera mangrove littoral forest	Central Upolu uplands Eastern Upolu uplands Western Upolu Montane Lakes Mt Taitoelau Mt Fao Rainforests le Pupu Lowland Forests Highlands of Savaii	Aerial photo interpretation Ground truthing	1989	Sites, listed in order of priority conservation Lona – Punataem’o forests Sala’ilua lowland forest Fusiluaga forest Aleipata islands Falealupo lowland forests Taga lowland forests Saanaapu-Sataoa Mangrove and coastal rain forest Highlands of Savaii Central Upolu Uplands Eastern Upolu Uplands Gagaifoolevao and Matautu lowland forest Mt. Talitoelau

Title: Terrestrial Ecosystem Mapping For Western Samoa				
Authors: Sam H. Pearsall and W. Arthur Whistler				
Year published: March 1991				
Ecosystems of Samoa	Survey Area	Methodology	Survey Year	Recommendation
cloud forest				Western Upolu Montane Lakes Aopo Lowland ecosystems and lava flows Apolima coastal rain forest Tafua Peninsula lowland forest O Le Pupu Lowland forest Mulivai Coastal Ecosystem Musugale Point Herbaceous Marsh Apolimafou Herbaceous marsh Cape Mulinuu Herbaceous Marshes Malaemalu Marsh Mt Fao Rain forest Falelatai mangrove Vaovai mangrove Siupapa Lata Cliffs Lowland Rain forest

Table 6: Summary of Taxonomic Groups

Taxonomic Group	Survey Area	Methodology	Survey Year
Vegetation	Afulilo Asau A'opo, Letui, Sasina Coastal Forest. Aleipata Islands. Apolimafou Coastal Wetlands. Falelima Upper Lowland. Fogasavaii Lefaga, Matautu Coastal Forest. Lefaga Lanoto Le Pupu Pue National Park Lepue Lefaga/Aleisa	<u>3methods used</u> 1. Vegetation highly damaged – checklist used. 2. Vegetation damaged but some large trees present – a diameter at breast height (dbh) of all trees over 5cm diameter was measured. 3. Good vegetation (not damaged) 100m x 10m plot – recorded all trees	1990 1991 1996

Taxonomic Group	Survey Area	Methodology	Survey Year
	Mulivai Coastal Wetland. Mali'oli'o River Forest. Mulinu'u, Tufutafoe Coastal Wetlands. Malaemalu Coastal Wetland. Mt Tafuaupolu Mauga Mu Mata o le Afi Ologogo Olomaga Pu'apu'a, Lesoto Coastal Lowland Forest. Punataemo'o Swamp Forest. Sala'iula Upper Lowland Forests Salani, Si'uvao Point Coastal Lowland Forests. Sataoa, Sa'anapu Mangrove Wetlands. Samaelulu, Mauga Lava Flow Succession and Forest Islands. Salaepaga, Lalomanu Coastal Forest Salailua Sauniatu Solosolo Silisili Taga, Lata, Sala'ilua Lowland Forest. Taitoelau Togitogiga Utulaelae Coastal Wetlands Uafato, Ti'avea Coastal Forest. Vaovai Coastal Wetland Vaie'e, Tafitoala Peninsula. Vaipu Swamp Forest. Va'oto Lowland Forests. Vaivai-Fito		
Birds	Aopo Aleipata Islands. Apolima fou Coastal Wetlands Falelima Upper Lowland. Falelima Forest Plantation Fagafua Plantation	5 minute bird count	1990 1991 1996 2005 2006

Taxonomic Group	Survey Area	Methodology	Survey Year
	Fagatele bay coastal trail Falelatai Fogasavaii Gataivai Lake Lanoto'o Letui Coastal Forest Lata Lowland Forest Lefaga, Matautu Coastal Forest. Lemafa Cattle farm Lalomanu Lefaga/Aleisa Mali'oli'o River Forest. Mulivai Coastal Wetland. Mulinu'u, Tufutafoe Coastal Wetlands Malaemalu Coastal Wetland. Mt Tafuaupolu Malololelei Mt Fito Mt Tafua Matafa'a Masamasa plantation forest Maugaloa Nuutele Island Ologogo le Pupu Pue National Park Punataemo'o Swamp Forest Pu'apu'a, Lesoto Coastal Lowland Forest Patamea Forest Palauli Salani, Utulaelae Coastal Wetlands Sala'iula Upper Lowland Forests. Salaepaga, Lalomanu Coastal Forest Samaelulu, Mauga Lava Flow Succession and Forest Islands. Si'uvao Point Coastal Lowland Forests Sala'ilua Lowland Forest. Sataoa, Sa'anapu Mangrove Wetlands. Sasina Coastal Forest.		

Taxonomic Group	Survey Area	Methodology	Survey Year
	Salailua Sili Sauniatu Solosolo Taga Lowland Forest Tafua Tiavi Tapatapao Taga/Mt Olomanu Ti'avea Uafato, Coastal Forest. Vaovai Coastal Wetland Vailoa Upper Lowland Forest Vaie'e, Tafitoala Peninsula. Vaipu Swamp Forest. Va'oto Lowland Forests. Vaiaata		
Mammals – Bats	Apolima fou Coastal Wetlands. Aleipata Islands. A'opo, Letui, Sasina Coastal Forest. Falelima Upper Lowland. Lefaga, Matautu Coastal Forest. Le Pupu Pue National Park Mulivai Coastal Wetland. Malaemalu Coastal Wetland Mali'oli'o River Forest. Mulinu'u, Tufutafoe Coastal Wetlands. Pu'apu'a, Lesoto Coastal Lowland Forest. Punataemo'o Swamp Forest. Salani, Utulaelae Coastal Wetlands. Salaepaga, Lalomanu Coastal Forest Sala'iula Upper Lowland Forests. Si'uvao Point Coastal Lowland Forests. Samaelulu, Mauga Lava Flow Succession and Forest Islands. Sataoa, Sa'anapu Mangrove Wetlands Taga, Lata, Sala'ilua Lowland Forest. Uafato, Ti'avea Coastal Forest.	Noted when sighted during other surveys	1990 1991 1996

Taxonomic Group	Survey Area	Methodology	Survey Year
	Vaovai Coastal Wetland Vaie'e, Tafitoala Peninsula. Vaipu Swamp Forest. Va'oto Lowland Forests.		
Insects	Afulilo Aopo Fogasavaii Le Pupu Pue National Park Mata o le Afi Mt Tafuaupolu Palauli West Silisili Salailua	<i>3 methods used</i> 1. Malaise trap – a trap was placed for 24 hours at each site surveyed 2. Light trap – the light trap used a coleman spirit lamp placed in the centre of a white sheet (2m x 1.8m) on the ground, lit at 8-9pm and run for about an hour. Insects were collected as they settled on the sheet. 3. Sweeping – ten sweeps with a net were conducted every 10m until 100 sweeps were achieved. Insects were collected and placed in a container after 10 sweeps.	1996

Table 7 : Other Ecological Survey Reports

Taxonomic Group	Author	Title	Year	Survey Area	Comments/Recommendations
Flying Foxes	Banack, S.A	Flying foxes, genus <i>Pteropus</i> , in the Samoan Islands: Interactions with forest communities	1996	National - Samoa	No recent surveys.
	Brooke, A.	Trip report for Western Samoa <i>Pteropus samoensis</i> survey (Unpub. report)	1995		
	Wilson, D.E. & Engbring, J	Status of the Fruit Bat, <i>Pteropus samoensis</i> , in Samoa	1993		
	Mickleburgh, S.P., Hutson, A.M. & Racey, P.A	Old world fruit bats: An action plan for their conservation	1992		
	Wilson, D.E	The flying foxes <i>Pteropus samoensis</i> and	1992		

Taxonomic Group	Author	Title	Year	Survey Area	Comments/Recommendations
		<i>Pteropus tonganus</i> : Status in Fiji and Samoa			
	Cox, P.A	Flying fox nearly extinct in Samoa	1984		
Birds	DEC - MNRE	Recovery plan for the Ma'oma'o or Mao (<i>Gymnomyza samoensis</i>) Samoa's Large Forest Honeyeater 2006-2016	2006	National - Samoa	Most recent surveys – 2006 during the Manumea and Maomao Project
	DEC - MNRE	Recovery plan for the Manumea or Tooth Billed Pigeon (<i>Didunculus strigirostris</i>) 2006-2016	2006		Future Survey Sites – Savaii uplands, Upolu: south-eastern corner and uplands.
	Beichle, U	Studies on the avifauna: Report on a proposed Conservation Area at Sataoa-Sa'anapu Mangrove Wetland, Upolu, Samoa	1997	Sataoa-Sa'anapu	Seabirds not well surveyed.
	Bellingham, M & Davis, A	Forest bird communities in Western Samoa	1988	National - Samoa	
	Muse, C. & Muse, S.	The birds and birdlore of Samoa / O manu ma tala'aga o manu o Samoa	1982		
	Watling, D.	Birds of Fiji, Tonga & Samoa	1982		
	Mayr, E	Birds of the Southwest Pacific: a field guide to the birds of the area between Samoa, New Caledonia & Micronesia	1978		
	Bellingham, M & Davis, A	Forest bird communities in Western Samoa.	1988		
	Merlin, M.D. & Juvik, J.O	Bird protection in Western Samoa	1985		
Insects	Karin S. Kami and Scott E. Miller	Samoan Insects and Related Arthropods checklist and Bibliography	1998		No recent surveys
	Buxton, P.A	Insects of Samoa	1935		
	British Museum (Natural History) Department of Entomology	Insects of Samoa and other Samoan Terrestrial Arthropoda	1927-1935		
	Whistler, W.A	Plants in Samoan culture: the ethnobotany of Samoa	2000	National - Samoa	No recent assessment of threatened plants
	Elmqvist, T., Cox, P.A., Rainey, W.E. & Pierson, E.D	The rain forest and the flying foxes: an introduction to the rain forest preserves on Savaii, Western Samoa.	1998 (3 rd ed)	Savaii	

Taxonomic Group	Author	Title	Year	Survey Area	Comments/Recommendations
Vegetation	Martel, F. & Atherton J.	Timber inventory of the Ifilele Resource: Uafato Conservation Area Project: Draft Report	1997	Uafato	Llyod, C.G. & Aiken, W.H
	Whistler, W.A	Botanical survey of the Uafato Conservation Area	1997	Uafato	
	Cribb, P. & Whistler, W.A	Orchids of Samoa	1996	National - Samoa	
	Whistler, W.A	Samoaan herbal medicines	1996		
	Whistler, W.A	Samoaan traditional medicines	1996		
	Whistler, W.A	Wayside plants of the islands: a guide to the lowland flora of the Pacific Islands: including Hawaii, Samoa, Tonga, Tahiti, Fiji, Guam, Belau	1995c		
	Elmqvist, T., Cox, P.A., Rainey, W.E. & Pierson, E.D	Effects of tropical cyclones Ofa and Val on the structure of a Samoaan lowland forest	1994		
	Whistler, W. A	Flowers of the Pacific Island seashore: A guide to the littoral plants of Hawaii, Tahiti, Samoa, Tonga, Cook Islands, Fiji and Micronesia.	1992		
	Wishart, F.	Western Samoa: A rainforest reprieved	1989		
	Whistler, W. A	Checklist of the weed flora of Western Polynesia: an annotated list of the weed species of Samoa, Tonga, Niue and Wallis and Fatuna, along with the earliest dates of collection and the local names	1988		
	Whistler, W.A	Annotated list of Samoaan plant names	1984		
	Whistler, W.A	Vegetation of the montane region of Savaii	1978		
	Uhe, G	Medicinal plants of Samoa; a preliminary survey of the use of plants for medicinal purposes in the Samoaan Islands	1974	National - Samoa	
	Uhe, G	Wayside plants of the South Pacific: [a guide to some common and interesting herbs, shrubs, and trees found in Hawaii, Tahiti, Marquesas, Samoa, Tonga, Niue, Rarotonga, Fiji and New Caledonia]	1974		
Parham, B.E.V	Plants of Samoa: a guide to their local and	1972			

Taxonomic Group	Author	Title	Year	Survey Area	Comments/Recommendations
		scientific names with authorities; with notes on their uses, domestic, traditional and economic			
	Bryan, E.H	Samoa and scientific Names of plants found in Samoa	1935		
	Christopherson, E	Flowering plants of Samoa	1935-1938		
	Llyod, C.G. & Aiken, W.H	Flora of Samoa	1934		
Snails and Slugs	Cowie, R.H	Catalogue of the non-marine snails and slugs of the Samoan Islands	1998		No recent surveys
	Pilsbury, H.A., Cooke, C.M. & Neale, M.C	Land snails from Hawaii, Christmas Island and Samoa	1971	National - Samoa	Future survey sites – Upolu and Savaii (whole of Samoa)
Other – Ecology	Schuster, C., Whistler, A. & Tuailmafau, T.S.	The conservation of biological diversity in upland ecosystems of Samoa	1997	Uplands of Savaii and Upolu	Very limited ecological data available- especially of threatened species
	Robinson, A.C	Ecology of Samoa: an annotated bibliography	1994	National - Samoa	
	Pearsall, S.H	A geographical-ecological model for landscape conservation development in Western Samoa	1993	National - Samoa	
	Lovegrove, T., Bell, B. & Hay, R	The indigenous wildlife of Western Samoa: impacts of cyclone Val and a recovery and management strategy	1992	National - Samoa	
	Parks, G., Hay, R., Whistler, A. & Lovegrove, T.	The National Ecological Survey of Western Samoa: The conservation of Biological Diversity in the Coastal Lowlands of Western Samoa	1992	Coastal Lowlands of Upolu and Savaii	
	Whistler, W.A	National Biodiversity review of Western Samoa	1992	National - Samoa	
	Pearsall, S.H. & Whistler, W.A	Ecosystem mapping for Western Samoa	1991	National - Samoa	
	Pearsall, S.H. & Whistler, W.A	Terrestrial ecosystem mapping for Western Samoa: Summary, project, report, and proposed national parks and reserves plan.	1991	National - Samoa	
International Forest	Western Samoa: Ecological Survey and	1991	National -		

Taxonomic Group	Author	Title	Year	Survey Area	Comments/Recommendations
	Environment Research & Management	resource conservation review		Samoa	