PLANNING NEW CONSERVATION AREAS IN WESTERN SAMOA: A CASE STUDY

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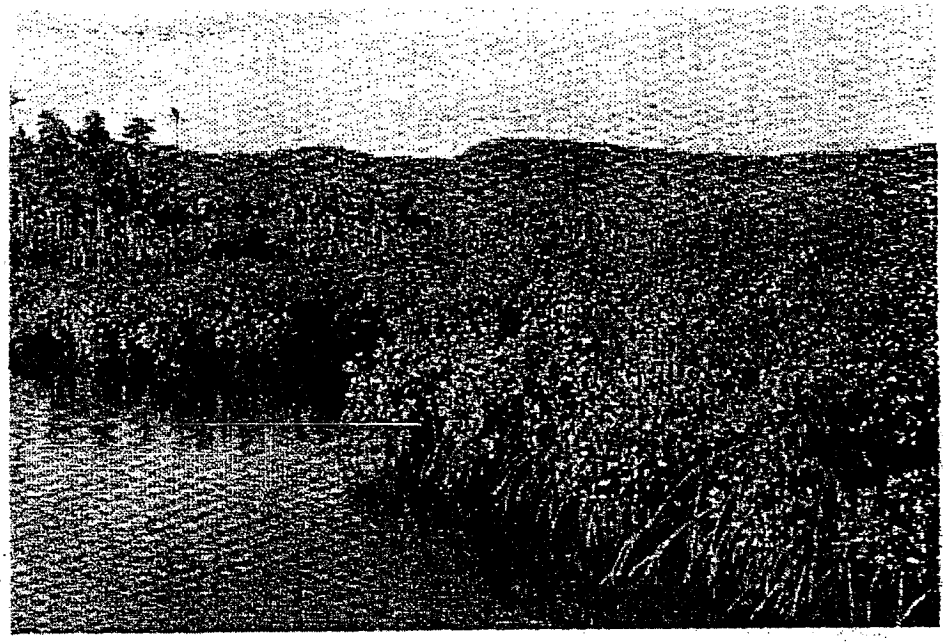

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ABSTRACT

This thesis is a case study of a new initiative of environmental conservation currently being planned in Western Samoa. The initiative is based on what are termed 'Conservation Area Projects' whose primary goal is to help rural people achieve sustainable development without degrading biological diversity. The research focuses on the first Conservation Area Project proposed for Western Samoa- the Sataoa-Saanapu Conservation Area and in particular the 75 ha Sataoa-Saanapu mangrove forest. This forest is one of Samoa's priority ecosystems requiring protection. Data on conservation area ecology, geography, sociology and economics are all presented. Threats to the conservation area are outlined and ways of dealing with them discussed. Survey results showed that the mangrove forest provides food, firewood, medicines, materials for house and boat construction, cultural handicrafts and opportunities for recreation. Both subsistence and cash needs are provided by the forest. Although the forest is valued highly by local people and is still in relatively good condition, overharvesting of resources and the use of inappropriate and destructive harvesting techniques such as the use of dynamite and fish poisons are threatening the forest ecosystem. A decline in fish and crab catches appears to be occurring. Population growth and increasing commercialisation of the economy may further increase these threats in future unless they are dealt with soon. To deal with these threats it is recommended that more sustainable resource harvesting regimes be encouraged and new income generating opportunities such as aquaculture, ecotourism and agricultural diversification be developed. It is also recommended that local people be involved in every stage of the planning and later implementation of all conservation area management prescriptions.

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1.1 The Biophysical Setting

1.1.1 Location and Map

Western Samoa is an independent South Pacific nation situated between 13° and 15° south latitude and 171° and 173° west longitude (figure 1). The country makes up the western part of the Samoan archipelago, the eastern part being the United States' dependency of American Samoa.

Western Samoa consists of four inhabited islands: Upolu (1,123 square kilometres) and Savaii (1,708 square kilometres), and the smaller islands of Apolima and Manono, which lie between Upolu and Savaii (ANZDEC 1990). In addition there are a number of uninhabited off-shore islets. Apia, the capital of the country, is located on the north coast of Upolu. The total land area is 2,929 square kilometres (Wright 1963).

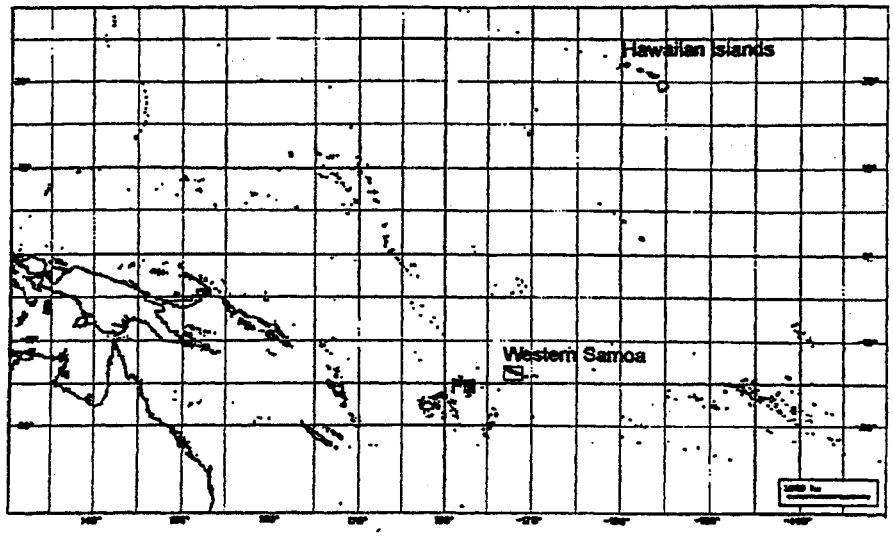
1.1.2 Topography, Geology and Hydrology

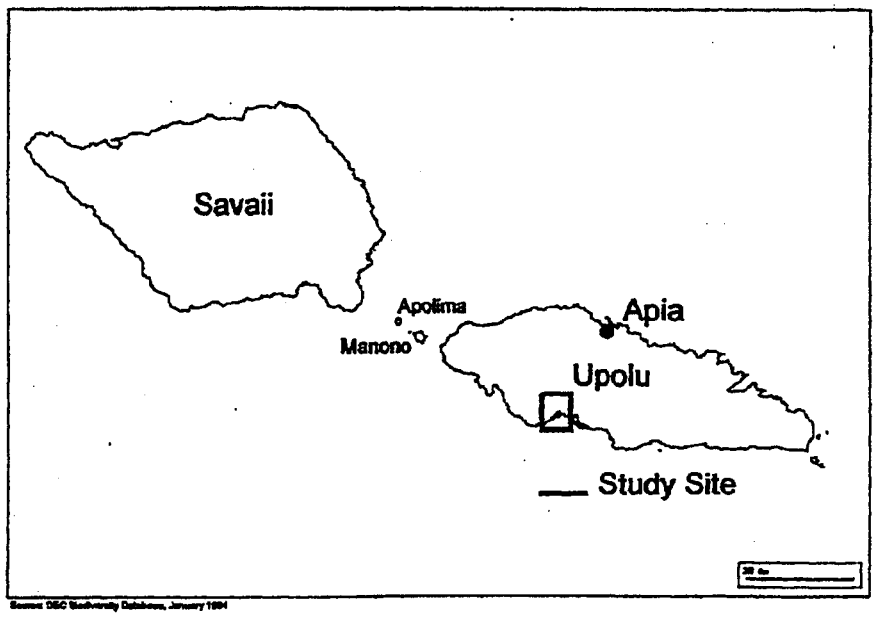
The Samoan islands are volcanic in origin, all major volcanic flows being olivine basalt (Wright 1963). Both Upolu and Savaii have a central ridge of volcanic cones running from northwest to southeast. The highest point in the group, Mt Silisili, on Savaii (1,857m), is one such cone.

The land usually slopes gently from the central ridge down towards the coast. However, rivers have cut deep gorges in some parts of the islands and weathering of the oldest rocks has resulted in some very rugged landscapes (Curry 1955).

There are thought to be six major volcanic formations in Samoa (Kear and Wood 1962). The oldest formation, the Fagaloa volcanics, which are found predominantly in the north-eastern and central part of Upolu, are thought to date from the Pliocene or early Pleistocene. These volcanics however are flanked and largely buried by late Pleistocene and more recent lava flows. The youngest formation, the Aopo volcanics is less than 200 years old and is confined to the north-western part of Savaii (ibid). At least 2 cones in the western highlands of Savaii are still considered active (Bier 1990).

Figure 1: Western Samoa Location Map





Surface streams are concentrated in areas covered by the oldest volcanic formations, and are uncommon on the younger formations, which are often highly porous (Curry 1955). Some streams run through lava tubes but these tend to be just as ephemeral as surface-flowing streams on similar basalts and are no more dependable for water supply purposes (Kear and Wood 1962). Springs are frequent along the coast and are often used to supply village water needs (ibid).

1.1.3 Soils

Wright (1963) mapped the soils of Western Samoa into 90 soil series, 55 of which developed from olivine basalt alone. ANZDEC (1990) have simplified Wright's classification to 86 soil series, and have reclassified the soils according to Soil Taxonomy, but have retained most of Wright's mapping units.

Inceptisols are the most common soil type in Western Samoa, and the particular abundance of Humitropepts and Dystropepts is thought to reflect the strongly leached status of the soil (ANZDEC 1990). The basic basaltic parent material gives rise, at least initially, to fertile soils. However, under the warm, wet climate, the soils progressively lose their bases and become more acidic. Consequently, the most fertile soils are the youngest, but these tend to be shallow and rocky, while the more weathered, deeper soils are usually less fertile (Wright 1963).

In addition to age and climate, other factors contributing to soil characteristics in Samoa are the type of basalt parent material (eg pahoehoe, scoria, a'a or volcanic tuff) and the man-induced changes in plant cover (Wright 1963). Deforestation and changes in agricultural practices like cropping cycles, are resulting in a decrease in soil fertility (Wright 1963, Paulson 1992b).

1.1.4 Climate

Western Samoa's climate is tropical, without any marked seasonal variation in temperature, but with a moderate seasonality in rainfall (ADB 1985). The `wet' season runs from November to April, the `dry' season from May to October.

In Apia, the daily mean temperature varies little from the annual average of 26.6°C. The daily range is from 23°C to 30°C (ADB 1985). There is however, a strong temperature lapse rate with altitude,

estimated at 0.66°C per 100m (Scattarella 1977, cited in ANZDEC 1990). The minimal variation in daily mean temperature through the year is accompanied by a minimal variation in humidity, which averages over 80% throughout the year.

Rainfall in Western Samoa varies both seasonally and spatially (Paulson 1992b). Winds blow predominantly from the southeast giving rise to rainshadows in the northwest portion of both main islands and the southeast portion of Savaii. These areas receive only about 2,500mm of rain per year compared with an average of approximately 6,000mm in upland areas (ANZDEC 1990). Seventy five percent of the precipitation is from November to January (ADB 1985).

Despite two recent devastating cyclones (Ofa in 1990 and Val in 1991), serious cyclonic events are not common, averaging less than one per decade (Whistler 1992).

1.1.5 Ecology

While not particularly species rich by world standards, Western Samoa has considerable regional conservation importance because of the large number of native ecosystems, the high proportion of endemic plants and animals and the growing threat to native species and ecosystems. These threats are not always man-made, the effects of cyclones Ofa and Val on native ecosystems show how damaging natural events can be.

Major gaps in the knowledge of Western Samoan ecology still exist (DEC 1993a).

(i) Flora and vegetation

Samoa has the second most diverse flora in tropical Polynesia, after Hawaii (Park *et al* 1992). It is estimated that Western Samoa supports more than 720 species of native vascular plants, about 30% of which are thought to be endemic (Whistler 1992). There are 280 genera of native angiosperms and 71 genera of native ferns. As many as 136 plant species are considered under threat, although at present no plant species are designated as endangered or threatened (ibid).

Today, as many as half the plants in the country have been introduced by humans (DEC 1993a). Many of

these, such as **fue-saina**, the mile-a-minute vine (*Micrania micrantha*), have become destructive weeds.

Western Samoa has been placed in South Pacific biogeographic province IX, along with American Samoa, Wallis and Futuna (Dahl 1980). Pearsall and Whistler (1991) have classified Western Samoan terrestrial ecosystems into 19 different types, based on the predominant vegetation formation, and mapped the country into ecosystem units. Five broad ecosystem categories have been distinguished: littoral vegetation, wetland vegetation, rainforest, volcanic scrub and disturbed vegetation (ibid).

The lowland ecosystems are currently under the greatest pressure from disturbance and development, because this is where the majority of the Samoan population lives. Consequently, Park *et al* (1992) carried out their National Ecological Survey on the lowland zone. They identified 27 important sites for biological conservation, including 14 key sites. One of the key sites, the Sataoa-Saanapu mangrove forest provides the case study in this thesis.

The mangrove forests are of particular interest and importance. They are not found anywhere in the South Pacific east of Samoa. However, more importantly, they are Samoa's most economically valuable native ecosystem as a major fish breeding and nursery site (Park *et al* 1992). Unfortunately they are not valued accordingly and are being extensively damaged or degraded (Zann 1991).

(ii) Fauna

a) reptiles

Of the reptiles, there is one species of snake, the indigenous Pacific boa (*Candoia bibroni*), five geckos, eight skinks and two species of marine turtle, the hawksbill (*Eretmochelys imbricata*) and the green turtle (*Chelonia mydas*). The Pacific boa, though not often seen, is common, especially on Savaii (Whistler 1992). All of the lizards, except the Micronesian skink (*Emoia adspersa*) are common and widespread and only one is endemic to the Samoan archipelago, namely the Samoan skink (*Emoia samoensis*).

Of the marine turtles only the hawksbill actually breeds in Western Samoa. Both turtles are globally endangered and have been given complete protection under the Convention for International Trade in Endangered Species (IUCN 1990).

b) birds

The DEC (1993a) note 35 species of landbird with 8 endemic at the species level and 6 endemic subspecies. Only 5 introduced bird species are now naturalised, including two species of mynah. Sixteen sea birds breed in Western Samoa and 5 species are migratory, overwintering in the islands (Whistler 1992).

Compared with other archipelagoes in Polynesia, Samoa is rich in native birds. It now has about the same number of native land bird species as Hawaii (which has suffered many extinctions), a country noted for its avifauna (Whistler 1992). Three endemic Western Samoan birds are particularly significant. The Samoan wood rail or **punae** (*Pareudiastes pacificus*) was last officially recorded in 1908 and may now be extinct (Muse and Muse 1982). The tooth-billed pigeon or **manumea** (*Didunculus strigirostris*) and the **ma'oma'o** (*Gymnomyza samoensis*) are both important in Samoan culture and folklore (Park *et al* 1992).

The conservation value of native Samoan birds is substantial because of their high rate of endemicity (c30% for landbirds), their cultural significance in Samoan legend and their role in the pollination and seed dispersal of indigenous forest plants (Steadman, 1988 cited in Park *et al* 1992). Local declines in many bird species have been observed following cyclone Ofa (Park *et al* 1992) and cyclone Val (Lovegrove *et al* 1992). It is not known what effect this will have on forest regeneration.

c) mammals

The only terrestrial mammals indigenous to Western Samoa are bats of which there are 3 species: the insectivorous, sheath tailed bat (*Emballonura semicaudata*) and two fruit bats (*Pteropus samoensis* and *Pteropus tonganus*). The fruit bats, like some birds, are major pollinators and seed dispersers of native trees (Cox 1984) and are important in Samoan legend being regarded as 'guardians of the rainforest' (Cox and Elmqvist 1991).

Fruit bat populations in Western Samoa have declined rapidly in recent years due to commercial hunting, habitat loss through deforestation and the effects of the two recent cyclones (Cox and Elmqvist 1991). In 1989, both fruit bat species were cited in Appendix I of CITES. Although this effectively curtailed the lucrative export trade to Guam, the population of both species remains very low (Park *et al* 1992).

A number of mammals have been introduced into Western Samoa such as pigs, dogs, goats, cattle and horses. Some, such as cats, rats and mice, may have had a significant effect on populations of indigenous species, especially birds.

d) fish

Little is known about the freshwater fish of Western Samoa. The information available however, points to a sparse native fauna (Waugh *et al* 1991). Much more is known about the marine fish fauna. Wass (1984, cited in DEC 1993a) carried out the most recent survey of the Samoan archipelago and recorded 991 species including 890 inhabiting shallow water or reefs, 56 living in deeper water and 45 pelagic species. Recent declines have been recorded in some of the harvested fish species and this is thought to be linked to overfishing, pollution of the lagoon, the use of destructive and non-selective fishing techniques (like dynamiting) and damage to fish nursery sites like mangrove forests (Zann 1991).

e) invertebrates

Few data are available on the terrestrial invertebrates of Western Samoa, other than insects and landsnails. In the Samoan archipelago, 1603 insect species have been described of which about 49% are endemic (Buxton 1935).

There are more than 20 species of landsnail, including 4 introductions since European settlement (DEC 1993a). Introduced ants have extinguished some species and many endemic snails are now limited to high altitudes (Whistler 1992).

The marine environment supports many threatened invertebrates, including the coconut crab (*Birgus latro*) and several corals and clams (Whistler 1992). A particularly important marine invertebrate is the palolo worm (*Eunice viridis*). The reproductive organs of this annelid are considered a great delicacy amongst Samoans and the annual spawning of the palolo in October or November is a very important event in the cultural calendar. Unfortunately, palolo risings are becoming increasingly sporadic and have now ceased along the northwest coast of Upolu (UNDAT 1975).

1.2 The Human Setting

1.2.1 Population and Settlement

Archaeological evidence suggests that the Samoan islands were first settled by proto-Polynesian people around 1000 B.C. (Bellwood 1980). It is from Samoa (and Tonga) that migrations are thought to have taken place to the rest of the Polynesian region including Hawaii to the north, New Zealand to the southwest and Easter island to the southeast (ibid).

When Europeans first settled in Samoa in 1830, the population stood at about 50,000 (GOWS 1990). Introduced diseases such as measles and influenza then appear to have caused a substantial population decline to about 30,000 in the mid nineteenth century. It was not until the 1920's following the introduction of health measures by the New Zealand administration that the population began a steady increase (Thomas 1986).

Since the 1920's the population of Western Samoa has increased five-fold. In 1991 the population had reached 161,298 and the population growth rate was 0.5% per annum (GOWS 1993a). The growth rate has slowed considerably since 1961 when it was 3.3% per annum, the decline being due to a fall in the total fertility rate and a high rate of emigration (GOWS 1992). However, the underlying, natural growth rate is still high at about 2.5% per annum (KRTA 1988). There are signs that more stringent immigration controls in destination countries, notably Australia and New Zealand, will lead to an increase in population growth rates to 1% per annum (GOWS 1992).

The population of Western Samoa is not evenly distributed. Seventy two percent of the population lives on Upolu, the smaller of the two main islands, and most of these people live in and around the capital Apia (1991 population= 34,126) and in the peri-urban area of northwest Upolu (GOWS 1993a). The vast majority of the population still lives along the coast, much as they did when the first missionaries arrived (Thomas 1986). Consequently, the modest overall population density of 57 people per square kilometre is misleading. Population densities substantially exceed this along the coastal zone, especially on Upolu, resulting in significant population pressure on certain lowland and marine resources.

Western Samoa, like many developing countries, still has a very young population. However, the

proportion of young dependants has been decreasing while the proportion of old dependants has been rising (GOWS 1992). Consequently, the dependency ratio, defined as the number of persons below 15 and above 60 for every 100 persons in the age group 15 to 60, still remains high at 87% (1986 figures in GOWS 1992).

1.2.2 The Social System

'Tradition dies hard in Samoa' (Farrell and Ward 1962).

Traditional Western Samoan society has remained stronger and more intact than any other in Polynesia (ADB 1985). Rooted in the social system is the `Samoan Way' or **FaaSamoa** which places greater emphasis on group activities and achievements than those of individual members (GOWS 1990).

The social unit of Samoan life remains the **`aiga** or extended family. Each **`aiga** is headed by at least one **matai** or chief who is appointed by the consensus of the **`aiga** members. There are two distinct types of **matai** title, the **alii** or chiefly **matai** and the **tulafale** or orator chief. Although men or women may be awarded **matai** titles, in practice women are rarely titled (Paulson 1992b).

Traditionally, the **matai** has responsibility for directing the use of family land and other assets belonging to the **`aiga**, such as their labour. However, this is now changing with some **matai** delegating responsibilities and allowing **`aiga** members more independence (Alailima and Alailima 1968, cited in Paulson 1992b).

The village **matai** make up the village council or **fono** which has substantial power to regulate life and mediate disputes in the village. There is also an established Western style legal system but this is in addition to, rather than in place of, the village system of justice. Within the **fono**, the **matai's** actions are controlled by the relative rank of the title and according to whether the **matai** is an **alii** or **a tulafale**. The **fono** is headed by the **pulenuu** or village mayor, a government appointment on recommendation from the village council and usually rotated within a group of influential **matai** (GOWS 1990).

In 1990, the government passed the 'Village Fono Act' which legitimised the power of the **fono** to exercise control over a number of different village affairs, including the right to punish villagers for

misconduct and to make rules governing the use of village land. Recent abuse of this act by some village councils has, however, led to calls for its abolishment (Samoa Observer 1993).

In addition to the fono, each village has a number of other social institutions or organisations, such as the church, the Women's Committee and the untitled men's group (Paulson 1992b). Christianity exerts a particularly strong influence on Samoan life, with the vast majority of the population attending church. The church remains the focus of many social and economic activities in the village (ibid).

1.2.3 The Economic System

Western Samoans are still primarily subsistence agriculturalists. However, the economy is becoming increasingly commercialised. Paralleling this commercialisation has been an increasing dependency on aid, remittances, and imports, leading to a situation whereby 'the local economy is sustained but only at the cost of a mounting external debt' (Wilson 1986).

The primary sector remains the dominant economic sector despite the destructive effects of cyclones Ofa and Val on agricultural crops, forests and fishing fleets. It is estimated that as many as 70% of Samoan households are still involved in agriculture and 50% engage in fishing (GOWS 1990). Production is primarily for home consumption. However, almost half of the total income received by agriculturally active households is derived from agricultural activities (GOWS 1990) and agricultural exports make up the bulk of all exports (GOWS 1992). Consequently, agricultural development has traditionally been, and still is, one of the major elements of government economic policy (ibid).

Traditionally, one of the major crops in Western Samoa, and Polynesia in general, has been taro (*Colocasia esculenta*). The corms are a good source of starch and the leaves are nutritious and used in traditional dishes. However, in mid 1993 a serious disease of taro occurred in Western Samoa. By late 1993, taro leaf blight, caused by the fungus *Phytopthera colocasiae*, had infected about 90% of Samoa's taro crop (Frank Fong pers.comm. 1993). Infected plants grow very slowly, producing much smaller corms, and infected leaves cannot be eaten. The disease is a particular problem because taro is not only a traditional staple crop, but in recent years it had become the country's major agricultural export. Although research efforts are currently underway to find taro varieties resistant to the blight, the long term effects of the blight on the economy in general and on agriculture in particular are likely to be severe.

Even before taro blight and cyclones Ofa and Val, overall agricultural production in Western Samoa was stagnant or in decline (ADB 1985). With continued population growth agricultural production per capita is falling. In terms of commercial production, the most dramatic recent declines have occurred in the production of copra and cocoa, the traditionally dominant export commodities. In 1991, taro and coconut cream exports together exceeded copra and cocoa combined and total agricultural exports were still in decline (GOWS 1992).

Many explanations have been given for the long term stagnation in Western Samoa's agricultural performance. Perhaps the single most important factor, at least as far as commercial production is concerned, has been the depressed state of world commodity markets (GOWS 1992). O'Meara (1983) believes that it is the low economic returns to agriculture in Western Samoa, rather than the oft quoted 'inhibitory nature of Samoan social institutions and cultural values', which is the cause of agricultural stagnation.

Coinciding with Western Samoa's poor export performance has been a dramatic increase in imports. Imports grew at 4.5% per annum between 1984 and 1990, resulting in a substantial balance of trade deficit, equivalent to 62% of GDP in 1991 (GOWS 1992). Only significant remittance payments and development assistance have, in recent years, kept the country's balance of payments positive (ibid). The seventh and latest development plan (1992-1994) however, predicts a pending balance of payments deficit, due in part to a stagnation in remittance receipts from emigrants (GOWS 1992).

1.2.4 Land Use

Land use in Western Samoa follows a distinct pattern, related to distance from a village, most of which are situated along or near the coast. There are three zones of village land use: firstly, a coconut zone, much of it old and poorly-managed, located immediately behind the village and extending inland; secondly, inland from the coconut zone, a mixed crop zone of cocoa, banana, taro, minor crops and fallow land and thirdly a zone of taro plots and fallow extending from the mixed crop zone up to the forest boundary (Farrell and Ward 1962, Paulson 1992a).

Traditionally, `aiga holdings are scattered throughout the village lands giving every `aiga access to each of the three major land use zones (ADB 1985). This is still the case although there is some evidence that

population pressure is leading to unequal land distribution in some villages and a shortage of taro land in particular (Paulson 1992b).

There have been changes in each of the three land use zones over recent decades. Perhaps the most profound change however has been in the mixed crop zone (Paulson 1992a). This zone used to be the focus of agricultural activity but until very recently this had shifted to the taro zone due to a change in commercial production from bananas and cocoa in the 1950's to taro in the 1980's (ibid).

Since there is always a preference to plant taro on newly cleared forest, where the soil fertility is thought to be highest, the expansion of taro production in recent years has been associated with rapid deforestation (Paulson 1992b). In 1954 forests covered 74% of Western Samoa's surface area, in 1987 the coverage was 55%, by 1990 it was down to 40% (Ward unpubl.). The rate of forest loss in the late 1980's was estimated to be three times faster than that in Indonesia (GOWS 1993b). One can only speculate at this stage what effect taro blight will have on this process, but perhaps a positive outcome will be a slowdown in deforestation.

There is conflicting evidence as to whether taro farming on steep slopes promotes soil erosion. According to the FAO (1991), soil erosion from this system may be significant. Research carried out at the University of the South Pacific however, indicates that soil erosion from this system is insignificant, even on steep slopes (Steve Rogers pers.comm. 1993). The heavy ground cover and minimal soil disturbance of this type of farming appear to protect the soil from erosion. More data are needed to confirm this.

Although agriculture in Western Samoa still follows a shifting cultivation pattern, there have been recent changes associated with population growth, new cash crop opportunities and changes in land tenure (Paulson 1992b). In the traditional agricultural system, forest lands were cleared and then planted with food crops, especially taro and taamu (*Alocasia macrorrhiza*), for two or three seasons. This was followed by a long fallow period, long enough for secondary forest to establish itself, before the land was cleared and cropped again (FAO 1991). Nowadays perennial crops like coconut are often planted soon after the food crops, leading to much shorter or even non-existent fallow periods (Paulson 1992b).

The new form of shifting cultivation has been described as `terminal shifting cultivation' because although crops are shifted periodically to new land cleared from the forest, the area left behind is not allowed to

return to bush fallow, but is planted to coconut (Paulson 1992b). This practice may help explain both the rapid increase in cleared land per capita in some Samoan villages and the rapid expansion in land area under coconut in recent decades (Paulson 1992a).

1.2.5 Land and Marine Tenure

Samoan life and culture are intimately bound up with the use and ownership of land and lagoon. After all, the livelihoods of the vast majority of Samoans still depend on the productivity of these resources.

Samoan village lands are unsurveyed. However, in effect each village owns a strip of land stretching from the coast out to the adjacent reef and inland up to the mountain ridge in the centre of the island. Beyond the reef, the ocean was considered a common property resource. Villages maintain rights of use and access to both the adjacent land and the lagoon resources. In fact, the lagoon must be thought of as a logical extension of the village land territory (Farrell and Ward 1962). There are however, important differences between land and marine tenure, so these two systems will be considered separately.

(i) Land tenure

There are currently three types of land tenure in Western Samoa: customary (or village) land, public (or government) land and freehold land. Customary land makes up the majority of the country at 77% of the land surface (Cole 1986). Public land makes up 15% and the rest (about 8%) is freehold (ibid).

There are laws designed to protect customary land from alienation with the provision that this land can be leased and can be taken for public purposes (Cole 1986). Other laws regulate the alienation of freehold and public lands. These laws are enforced by the Lands and Titles court, the state agency set up to regulate disputes over land tenure, especially those involving **matai** titles and **pule** (control) over land. Public and freehold land has long been registered on cadastral maps, only recently however has the court begun to register customary land itself and not just the **matai** title to which the land belongs (Tiavolo 1984, cited in Pearsall and Whistler 1991).

Land tenure in Western Samoa is not static, it is evolving with changing circumstances (O'Meara 1987). Indeed, in the South Pacific, even where the original principles of land tenure apply, they operate now in

such a totally different social, economic and political context that the outcome is completely different (Crocombe 1989). One of the biggest changes in Samoa is that the majority of village lands are now held by individuals or nuclear families and are inherited directly rather than by acquiring **matai** titles (O'Meara 1987). Traditionally, land was cleared and worked for the **`aiga** in the name of the family **matai** and his particular **matai** title. The land went with the title and could only be obtained by acquisition of the title. When a **matai** died, the title, and all the land that went with it, could be passed on to anybody the **`aiga** deemed suitable, not necessarily a blood descendant of the original titleholder. Nowadays, land may be cleared and worked by an individual for himself, not for his **matai**, and the control over this land may be passed on to any children, and not by acquisition of the title (ibid).

The change in land tenure is a response to modern social and economic conditions, such as cash cropping, where individual effort and return are more desirable than they were in traditional society (O'Meara 1987). An advantage of the new system is that security of tenure to those who clear and work the land is improved (ibid). A disadvantage is that the new system appears to encourage accelerated clearance of forest in order to establish individual land claims (GOWS 1993b).

(ii) Marine tenure

There is little information on marine tenure in Western Samoa. However, it seems that marine tenure, unlike land tenure, is not based around ownership of the resource by individuals or **`aiga**. Instead it is based around communal ownership by the village as a whole.

In the past, the highest ranking chief, the village **fono** or the village's principal fisherman regulated the use of the village fishing grounds and were thus responsible for marine tenure. Neighbouring villagers were generally permitted to use the fishery but were expected to give a portion of their catch to the village that owned the fishery (Bell 1989). Some villages however, had exclusive fishing and distribution rights to their fishery. No part of the catch was supposed to be taken out in any form (ibid).

While colonial, and later national governments did not recognise marine tenure, it has survived in traditional law (Zann 1992). According to national law, all 'land' below high tide mark is vested in the state and is therefore public land (cited in Bell 1989). However, many villagers still feel that the fishing grounds adjacent to their village belong to their village. Consequently, some village **fonos** have banned

certain fishing methods and even outsiders from fishing in 'their' fishing grounds (ibid). The passage of the Fono Act in 1990 has provided some legal basis to these actions (Zann 1992).

CHAPTER 2: CONSERVATION IN WESTERN SAMOA

2.1 Resource Conservation

2.1.1 Traditional resource conservation

> 'Care must be taken in judging to what extent indigenous communities actually "managed" their environment' (Baines 1984).

Little is known about the pre-European interactions between Samoans and their environment (Park *et al* 1992). However, it is known that in the South Pacific in general there was a high degree of communal control over the exploitation of natural resources (SPREP 1985). Control took the form of rules and procedures over hunting, fishing and agricultural activities (ibid). Fishing was particularly highly regulated: there were closed seasons, closed areas, size restrictions on fish, gear restrictions and also restricted entry to fisheries (Johannes 1982). Perhaps most important was the imposition of taboos (**tapu** in Samoan) or bans on resource harvesting activities. Some taboos were applied seasonally or to specific species, others to a specific social group or groups (Baines 1984).

Taboos are associated with animistic beliefs and are invested with supernatural powers (SPREP 1985). While many taboos were used to protect agricultural crops from theft (Turner 1861), and sacred areas, such as burial sites, from damage, they were also used to protect wildlife and its habitats (SPREP 1985). An example of the latter is the widespread South Pacific practice of banning fishing following the death of a high chief (Baines 1984), a practice that continues in Samoa to this day. The ban allows the buildup of fish stocks in preparation for a big memorial feast (ibid).

While there is evidence that certain traditional practices, like some taboos, had the effect of conserving resources, it is uncertain to what extent these practices constituted 'management'. Restrictions on resource harvesting activities probably evolved as a means of minimising conflicts and distributing resources effectively (Johannes 1982). It is wrong to assume that such controls are evidence of a fundamental conservation ethic in South Pacific countries (Baines 1984). Resource shortages, which may have made Pacific island communities aware of resource limits, have in most cases, only recently been reached (ibid). Nevertheless, there is substantial evidence that Pre-European Pacific island societies, and Samoa is no exception, lived in much closer harmony with their natural environment than today's society.

2.1.2 Contemporary resource conservation

'Beware of appeals to ancient custom- it no longer exists' (Crocombe 1989).

Following the arrival of Europeans in Samoa there have been tremendous changes, not the least of which have been in the interactions between people and their environment. The strong bond between land and people, fundamental to traditional, animistic, South Pacific cultures, has been weakened by the Christian ethic of man's domination over the environment (Baines 1984). The bond has been further altered by demographic and sociological changes.

It has already been mentioned that it is uncertain whether resources were ever consciously 'managed' by traditional Samoan society (see previous section). Population pressure on resources is thought to have been generally low and therefore most resources didn't require careful management. Nevertheless, a number of traditional controls on resource exploitation probably had the effect of conserving resources. Nowadays however, traditional practices are dying out (Johannes 1982), population has grown significantly and material aspirations are high and rising. Resources now have to satisfy demands for subsistence and for cash.

From the perspective of resource conservation, all these changes have had one major effect. The current levels of resource use and practices of resource harvest are no longer sustainable. The list of environmental degradation is long. The inshore fishery for example is said by the government to be in an 'advanced state of ecological collapse' (GOWS 1992). Fish catches are in decline. Reasons given for the decline include overfishing, the use of non-traditional and destructive fishing methods (like dynamiting), and damage to fish breeding sites like mangrove forests and coral reefs (Zann 1991).

The forest resource is also degraded. Forest clearance is occurring so fast that merchantable forest resources will disappear within 6 or 7 years (GOWS 1993b). Until very recently, the cleared forest was often replaced with taro monocropped under a short fallow system. This system relies on heavy applications of herbicides which are easily leached in the high rainfall and porous soil. Downstream, these herbicides may pollute water supplies and degrade reefs and inshore lagoons (Zann 1991).

2.2 Environmental Legislation

There is a wide range of legislation relating to environmental protection and planning in Western Samoa. However, enforcement is often difficult in a country where the government has limited control over rural activities. A summary of the major legislation, in chronological order, is given in table 1.

Table 1. Western Samoa environmental legislation (Sources: SPREP 1985, KRTA 1988, GOWS 1993b, David Butler pers.comm. 1993)

Legislation	Principal Function of legislation
1.Agriculture, Forests and Fisheries Ordinance 1959	Constitutes the Department of Agriculture, Forests and Fisheries (DAFF). Promotes the conservation, protection and development of Western Samoan natural resources, especially soil, water and forest
2.The Water Act 1967	Consolidates the law relating to water conservation, supply and use
3.Forests Act 1967	Constitutes the Forestry Division within DAFF. Further consolidates the law relating to conservation, protection and development of natural resources
4.Fisheries Protection Act 1972	Controls fishing by foreign vessels
5.Fisheries Dynamiting Act 1972	Bans the use of dynamite or other explosives for fishing
6.National Parks and Reserves Act 1974	Provides for the establishment, preservation and administration of national parks and reserves on public land
7.Wild Birds Regulation 1981	Gives absolute protection to 15 bird species and partial protection to 3 species
8.The Lands, Surveys and Environment Act 1989	Constitutes the Division of Environment and Conservation (DEC) within the Department of Lands, Surveys and Environment. Allows for conservation agreements to be made with customary landholders
9.The Village Fono Act 1990	Legalises the right of village **fonos** (councils) to exercise authority in a number of areas, including management of local natural resources
10.Watershed Protection and Management Regulations 1992	Establishes a National Watershed Management Committee and also a Management Planning process for individual watersheds
11.The Protection and Conservation of Wild Animals Regulation 1993	Imposes a 5 year hunting ban on both flying fox species and 3 pigeon species and absolute protection to 30 birds and the Sheath-tailed bat

2.3 The Development of a Protected Area System

The first reserves to be set aside in Western Samoa were the Mt Vaea Scenic and Stevenson Memorial reserves in 1958 (IUCN 1991). However, it was not until after the passage of the seminal 'National Parks and Reserves Act' in 1974 that the country's protected area system really began to develop. This legislation enables the Head of State to declare any public (government) land a protected area, provided it is not set aside for any other public purpose and it is not less than 607.5 ha (1500 acres), unless an island (ibid).

A major United Nations survey was carried out in 1974 to coincide with the passage of the National Parks and Reserves Act. This survey recommended a protected area system consisting of 6 National Parks, 24 Nature Reserves, 18 Historical Sites, 5 Coral Sanctuaries and 6 Recreational Beaches (UNDAT 1975). Of these 59 sites only 3 have been gazetted under the 1974 legislation. These are O le Pupu Puë National Park, Palolo Deep Marine Reserve and the Mount Vaea Scenic Reserve (IUCN 1991). Other sites not mentioned in the UNDAT survey which have been gazetted are the Vailima Botanical Garden, the Stevenson Memorial Reserve and the Togitogiga Recreation Reserve. Thus Western Samoa's protected area system currently consists of one National Park and 5 reserves. Approximately 1% of the land area is protected (ibid).

In addition to the official protected area system on public land, there are 2 rainforest preserves on customary land. These preserves, both in Savaii, cover significant areas of lowland forest that had been under threat from logging. Overseas conservation organisations sponsored village development so as to remove the pressure on villagers to sell their forest to loggers. In exchange, covenant agreements were signed whereby villagers agreed to conserve the rainforest for 50 years and only use traditional resource harvesting practices (Cox and Elmqvist 1991).

Since the rainforest agreements in Savaii are on customary land they have no legal basis under the 1974 Act. Indeed, since about 80% of land in Western Samoa is customary land, the restriction of protected areas to public land is a major drawback of the legislation. Theoretically, customary land can be bought by the government for conservation purposes but in reality the government is unwilling to do this. The 1989 Lands and Environment Act appears to solve this problem. This Act legalises conservation area agreements on customary land. Not only does this legitimise the rainforest agreements in Savaii, it also allows the Division of Environment and Conservation (DEC) to establish conservation areas on customary

land in partnership with customary landholders.

2.4 Conservation Area Projects: A new approach to conservation

> 'If you want to protect the Samoan environment you must rely on villages to do the job' (Park 1992b).

There is now a consensus in Western Samoa that any major additions to the protected area system must be made on customary land. After all, the priority ecosystems needing protection are all on customary land. There is also a consensus that new protected areas must involve a high degree of local participation in the planning and management process.

There have been many problems with the established protected area system, such as boundary disputes and encroachment by local people into the protected areas. These problems arose because there was little negotiation with local people and resource users over the designation and management of these areas.

In Western Samoa, people rely heavily on natural resources. In addition, the government has limited control over land use and management even on government land (eg FAO 1990a). The combination of these two factors means that the established protected area system, where the government attempts to alienate land and resources from local people, does not translate well in Samoa, nor indeed in many other Pacific countries.

The need for a more appropriate way of conserving biological resources, where local people can continue to use their natural environment, has prompted the development of a major new conservation programme in the South Pacific. The Global Environment Facility, under the United Nations Development Fund, is sponsoring a US$10 million programme called the 'South Pacific Biodiversity Conservation Programme'(SPBCP). The programme will be administered by the South Pacific Regional Environment Programme (SPREP), a multilateral environmental agency established in 1982.

The primary goal of the SPBCP is the 'conservation of biodiversity' (SPREP 1993). However, a major focus of the programme is the 'improvement in social well-being of local communities through sustainable development' because 'the problem of conserving biological diversity cannot be separated from the wider issue of social and economic development'. Sustainable development is defined as:

> `management or use of this biodiversity inheritance...for the sustainable provision of both the subsistence and commercial needs of Pacific Island Countries...while at the same time enhancing rare, endangered and culturally and economically valuable ecosystems...for the benefit of future generations' (SPREP 1993).

The SPBCP intends to achieve its goals by facilitating the establishment of large and diverse Conservation Area Projects (CAPs) in which there are agreed criteria for development based on long term ecological sustainability. These projects will be established by environmental agencies, either government departments or NGOs. Participation, commitment and co-operation of local communities are considered pre-requisites for the success of the programme. Consequently, emphasis will be placed on involving local communities in the planning, establishment and later management of the CAPs (SPREP 1993).

The Division of Environment and Conservation is hoping to establish 3 Conservation Area Projects in Western Samoa (DEC 1993a). It is hoped that one will be funded by the SPBCP, and two from other funding sources. The next chapter is a case study of one of these sites- the proposed Sataoa-Saanapu Conservation Area.

CHAPTER 3: A CASE STUDY OF THE PROPOSED SATAOA-SAANAPU CONSERVATION AREA

3.1 Background to the Research Project

When searching for a dissertation topic I approached the Western Samoa Division of Environment and Conservation within the Government Department of Lands, Surveys and Environment. It was suggested that I assist the DEC by gathering data for a proposed conservation area, the Sataoa-Saanapu Conservation Area. The data would then be used in an application for funds from SPBCP. I agreed to the proposal, was awarded a small grant from SPREP, and began gathering data in July 1993.

The DEC decided that the core of the conservation area would be the Sataoa-Saanapu mangrove forest. This 75 ha site had been identified in the National Ecological Survey as one of the five best remaining lowland ecosystems in Western Samoa. Perhaps more importantly however, is the key role that mangroves play in sustaining the health of local fisheries as the chief fish-spawning, nursery and feeding ecosystem (Park *et al* 1992). Extensive damage to other Samoan mangroves means that this forest is now a nationally valuable resource.

In keeping with the SPBCP philosophy (SPREP 1993, see section 2.4), the primary goal of the conservation area is to manage biodiversity for sustainable social and economic development. Although initially only covering the mangrove forest, it is hoped that the conservation area will extend to include all the customary lands of both Sataoa and Saanapu villages and perhaps later to the whole of Safata district (DEC 1993b). It would then form a more discrete ecological unit including the catchments of all the rivers flowing into Safata Bay (see figure 2, p 24).

The aim of this case study was to gather and compile a wide range of basic background data on the site of the proposed conservation area to assist in the planning and management of the site. An associated aim was to determine what new research, if any, is required for a full management plan to be drawn up and implemented.

Data were gathered on geography, ecology, sociology and economics. An important element was determining local uses made of the natural resources in the proposed conservation area and attitudes of villagers towards conservation of these resources. Most of the data were gathered from secondary sources between July and

September 1993. A list of people interviewed is shown in appendix 1. A two week village survey of resource use and conservation was carried out in October 1993.

3.2 The Biophysical Setting

3.2.1 Location and Map

The proposed Conservation Area is located on the south coast of the main island of Upolu within the district of Safata (figure 2). It includes the villages of Sataoa and Saanapu.

The exact boundaries of the conservation area have not yet been finalised by the DEC so the boundary shown is assumed. In this study, I have assumed that the conservation area will include all the village lands of Sataoa and Saanapu, so the area shown approximates this. It is only approximate because village boundaries in Samoa are unsurveyed. However, in effect, both villages own a strip of land stretching from the reef right up to forested highlands in the centre of the island. The land area of this proposed conservation area is approximately 70 square kilometres.

Four settlements are included in the proposed conservation area since Sataoa and Saanapu are each split into two settlement units, one along the coast and one inland. The coastal settlements are given the suffix tai (ie Saanapu-tai and Sataoa-tai) and the inland settlements are given the suffix uta (ie Saanapu-uta and Sataoa-uta).

3.2.2 Topography, Geology and Hydrology

The topography and hydrology of the area are shown in figure 3 (Source: DEC Biodiversity Database, from maps originally digitised by ANZDEC 1990).

Saanapu village land slopes gently upwards from the coast to the centre of Upolu, at an altitude of 790m (2,600 feet). Most of this land is underlain by the relatively young Lefaga volcanics (early Holocene) which are characterised by a lack of surface flowing streams and a lack of dissection (Wright 1963). One lava tube (the Seuao cave) is known to exist in the area, just to the west of Saanapu. Some springs are found near the coast and these provide the village water supply (Kear and Wood 1959).

Figure 2: Proposed Sataoa-Saanapu Conservation Area

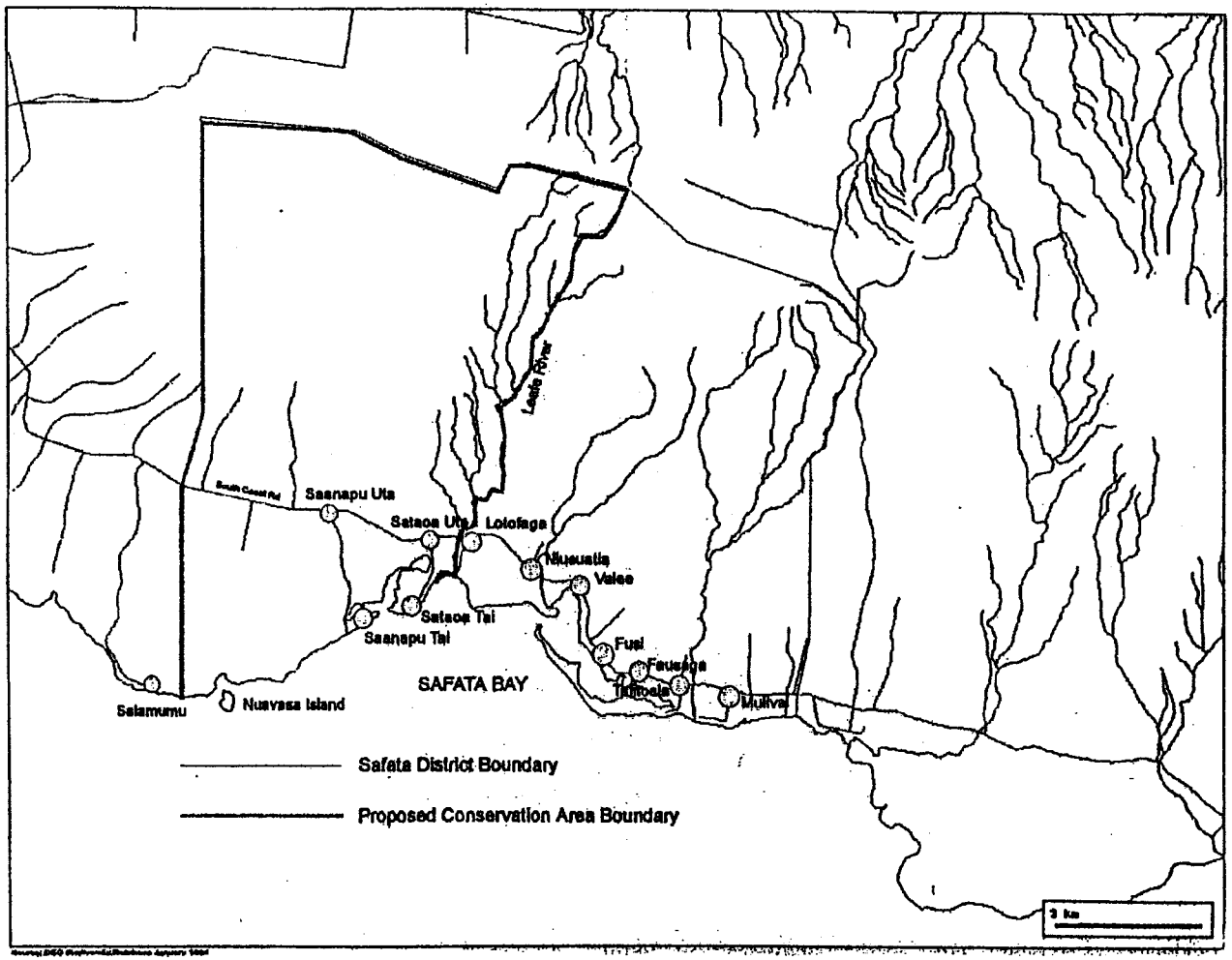
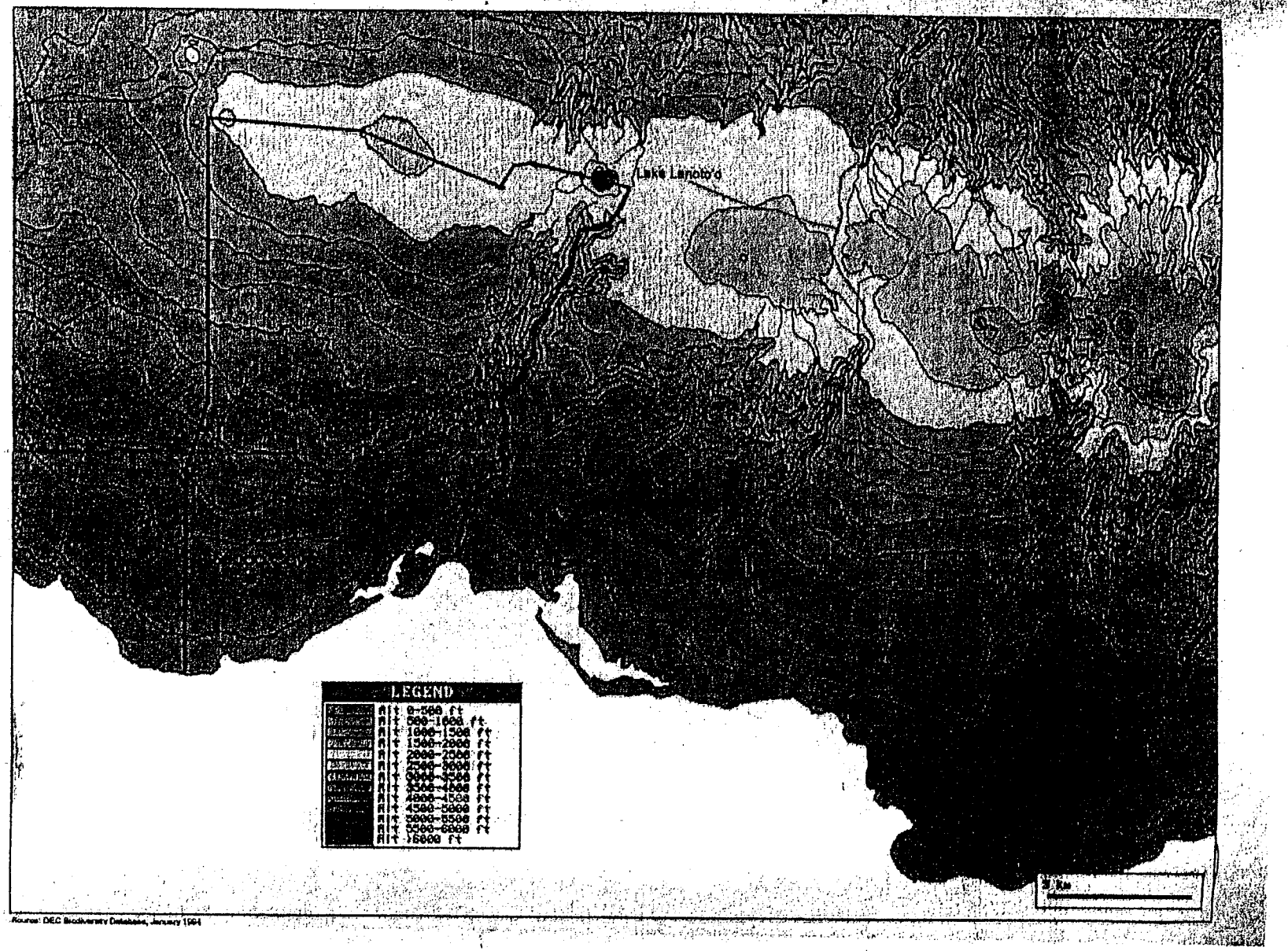


Figure 3:Topography and Hydrology of Sataoa-Saanapu Conservation Area



Sataoa village land, also rising to the centre of Upolu, is steeply dissected by the Leafe river and the Sataoa stream (not shown on map, but situated 1 km to the west of the Leafe river). This land is underlain by the relatively old Salani volcanics of early Pleistocene origin. In places, the Leafe river has cut through the Salani volcanic flow to expose the underlying, and older, Fagaloa volcanics. Both these volcanic formations are characterised by moderate to strong dissection by surface flowing streams. The village water supply is tapped from these surface streams, rather than from springs.

3.2.3 Soils and Land Capability

Like Western Samoa as a whole, most soils in the Sataoa-Saanapu area are Inceptisols (ANZDEC 1990). The predominant soil texture is clays and loams (Wright 1963). Entisols however, especially sands, are found along the coast, and on the steep slopes, Andisols, especially Typic Hapludands are common (ANZDEC 1990).

Most of the soils on Sataoa and Saanapu village land have low to medium natural fertility levels and more than 50% stones or boulders at the surface. However, these soils have only moderate limitations to agriculture and few limitations to forestry and so are placed in land capability class 2. Only the soils in the steeply dissected Leafe river catchment and in the volcanic craters along the northern boundary of Safata district are considered unsuitable for agriculture. This is largely due to a severe risk of erosion upon cultivation.

Interestingly, the only soils on Sataoa and Saanapu village land placed in the best land capability class (class 1), with few limitations to agriculture, are the organic rich Lithic Tropaquept soils of the mangrove forest (ANZDEC 1990).

3.2.4 Climatic Features

The climate in the proposed conservation area is typical of the south coast of Upolu. This, the windward side of the island, receives 50 percent more rain at the coast than the northern coast of Upolu (Wright 1963). At the coast, the annual average rainfall is approximately 3,500mm and this rises quite rapidly with altitude reaching 5000mm or more in the central highlands. Most of this rain falls between November and April, although the rain is more evenly distributed throughout the year than it is on the northern side of the island. There is only a very weak dry season with on average only 1.5 months per year having less than 100mm of

rain.

The mean annual temperature at the coast is approximately the same as in Apia at 26°C, with little seasonal variation. However, the temperature drops strongly with altitude, the mean annual temperature in the highest part of the conservation area being 21°C and with a bigger daily temperature range than at the coast (Wright 1963).

3.2.5 Ecological Features

There is a severe shortage of data on the ecology of the proposed conservation area, especially the fauna. The only ecosystem that has been surveyed adequately is the Sataoa-Saanapu mangrove forest. Consequently, only a brief outline of the major ecosystems will be given, concentrating on the core area, the mangrove forest.

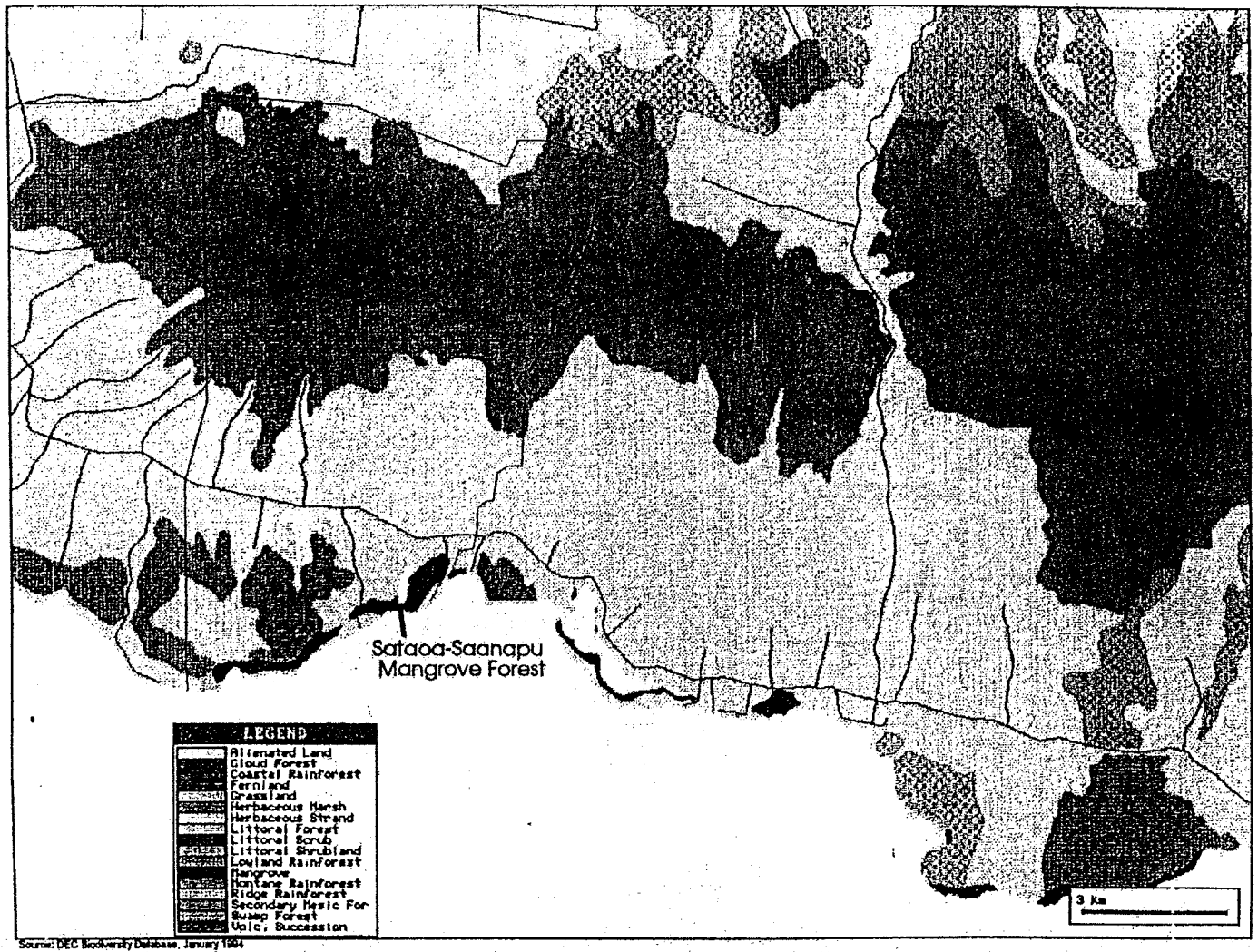
Figure 4 is a map of the terrestrial ecosystems found in the proposed conservation area (Source: DEC Biodiversity Database, from maps drawn by Pearsall and Whistler 1991). The boundaries should not be relied on absolutely as this map was drawn from aerial photographs taken before cyclones Ofa and Val. The map can however, be used as a general guide to the extent of these ecosystems. The following ecosystems are described in geographical sequence from the highest elevation in the conservation area, moving downwards towards the coast.

(i) Montane Rainforest

This ecosystem is the richest plant community (by number of species) in Western Samoa and covers the largest area of any native ecosystem in the proposed conservation area. In the conservation area it is found from about 300m up to the central island ridge at 790m. Montane rainforest is essentially a non-stratified forest and supports many climbers and epiphytic plants including most of Samoa's fern and orchid species (Pearsall and Whistler 1991). Ground cover is thick. Dominant tree species include *Calophyllum neo-ebudicum* (**Tamanu**), *Dysoxylum huntii* (**Maota mea**) and *Syzygium samoense* (**Fena vao**) (ibid).

Very little is known of the wildlife found in this particular montane rainforest, however it is likely to contain important refuge populations of birds and bats. The only bird surveys carried out in this rainforest, at Lake Lanoto'o, have shown significant declines in some species following cyclone Ofa such as Crimson-crowned

Figure 4: Terrestrial ecosystems in proposed Conservation Area



fruit dove (*Ptilinopus porphyraceus faciatus*), Samoan triller (*Lalage sharpei*), Blue-crowned lory (*Vini australis*) and White-rumped swiftlet (*Collocalia spodiopygia spodiopygia*) (Park *et al* 1992).

(ii) Lowland Rainforest

There are two main patches of lowland rainforest in the proposed conservation area. The larger area merges into montane rainforest to the north of the south coast road and the other area is found between the coast road and the coast itself, just to the west of Saanapu. Both these areas have been significantly disturbed, especially the latter which has been partially replaced with exotic trees in a government sponsored forestry project.

Lowland rainforest is generally found under 350m (1100 feet) and is a stratified forest with moderate ground cover and many epiphytes, lianas and climbers (Pearsall and Whistler 1991). Dominant tree species include *Dysoxylum maota* (**Maota**), *Dysoxylum samoense* (**Maota?**), *Planchonella torricellensis* (**Mamalava**) and *Calophyllum inophyllum* (**Fetau**). There are no data available on the wildlife found in either patch of lowland rainforest, however, following the cyclones and continued deforestation, both patches are likely to be important refugia for birds and bats.

(iii) Mangrove Forest

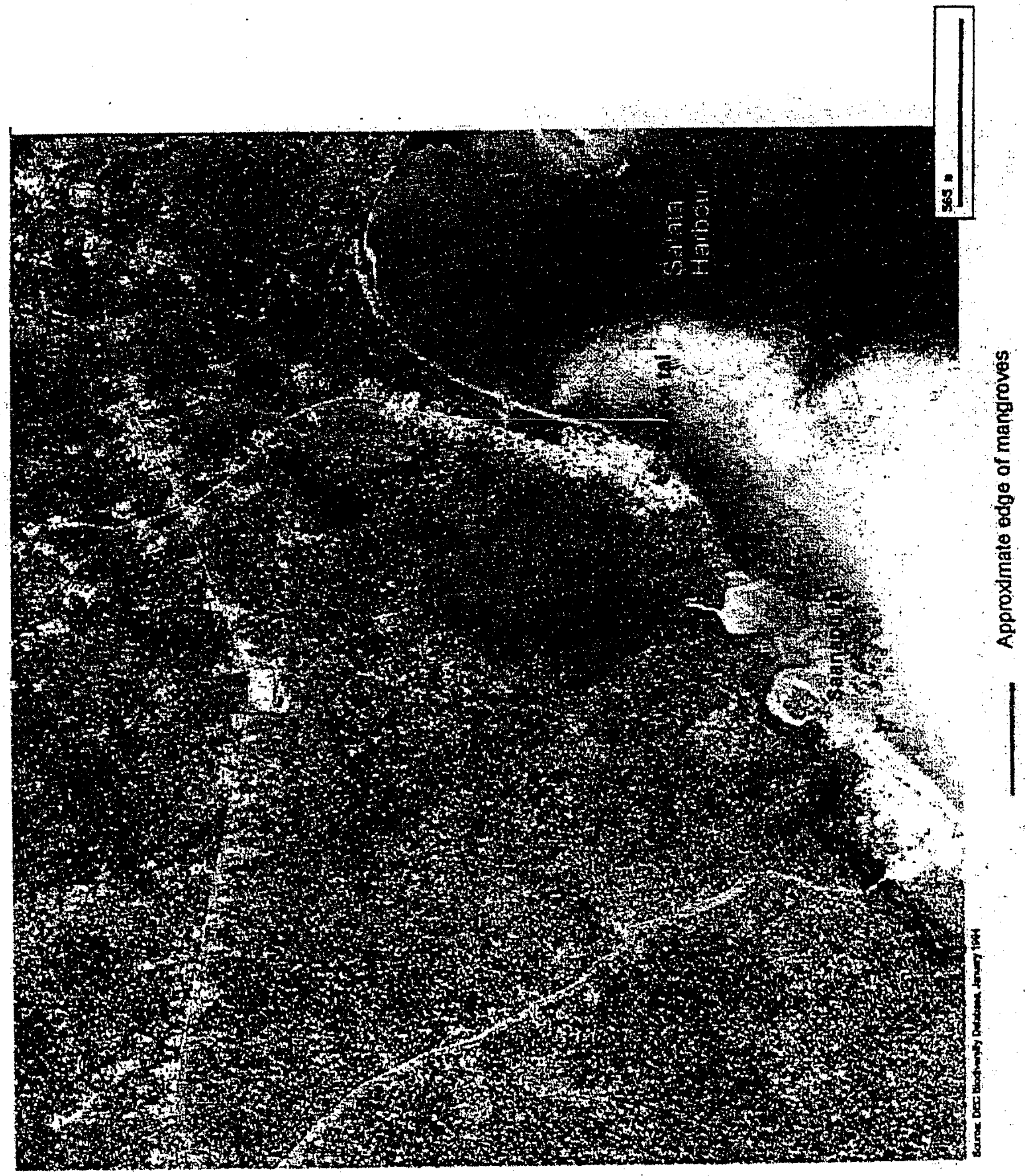
Figure 4 shows two mangrove forests in the proposed conservation area. Of these, only the Sataoa-Saanapu mangrove forest will be described, as the other forest (situated along the coast just to the west of the Sataoa-Saanapu mangrove forest), is in reality only a very narrow and patchy strip of mangrove vegetation. It is not significant enough to be described here.

Figure 5 is an aerial photograph of the Sataoa-Saanapu mangrove forest, and its environs, showing some of the main features. A full species list of flora and fauna recorded in the mangrove forest by Park *et al* (1992) is given in appendix 2.

a) flora and vegetation

The 75 ha mangrove forest is dominated by two tree species: *Rhizophora mangle* (**Togo fafine**) and *Bruguiera gymnorrhiza* (**Togo**). *Rhizophora*, with its distinctive spreading prop roots, often forms pure associations on

Figure 5: Aerial photograph of Saanapu-Sataoa Mangroves



the edges of the mangrove forest, where it reaches a height of about 8m. *Bruguiera*, with its knobby breathing

roots, dominates the interior of the forest, where it reaches a height of 15m or more (Park *et al* 1992). Cyclones Ofa and Val appear not to have caused significant damage to this forest and it has therefore retained its conservation importance (Lovegrove *et al* 1992).

Ground cover other than *Rhizophora* and *Bruguiera* seedlings is virtually absent due to the saline conditions. There is however, a rich epiphytic flora especially on the mature *Bruguiera* trees. Park *et al* (1992) recorded 27 epiphytes, the most common of which were ferns and orchids including some rare endemics.

On the periphery of the mangrove forest littoral shrubs and trees are found including *Hibiscus tiliaceous* (**Fau**), *Thespesia populnea* (**Milo**), *Dendrolobium umbellatum* (**Lala**), *Clerodendrum inerme* (**Aloalo tai**) and *Inocarpus fagifer* (**Ifi**). On the western edge of the mangrove forest there is a narrow littoral forest dominated by *Barringtonia asiatica* (**Futu**) (Park *et al* 1992).

b) birds and bats

Fourteen species of landbird have been recorded in the mangrove forest which is more than in any other surveyed Samoan mangrove forest (Park *et al* 1992). The most significant species that have been recorded are Samoan broadbill (*Myiagra albiventris*), Crimson-crowned fruit dove (*Ptilinopus porphyraceus faciatus*), Samoan whistler (*Pachycephala flavifrons*) and Cardinal honeyeater (*Myzomela cardinalis*). The Reef heron (*Egretta sacra sacra*), Wandering tattler (*Heteroscelus incanus*) and Australian grey duck (*Anas superciliosa*) have also been recorded. Cyclone Val caused significant declines in numbers of most bird species and also in species richness (Lovegrove *et al* 1992). The current bat status in the mangrove forest is unknown, although roosts of the Tongan fruit bat *Pteropus tonganus* were recorded in the area before cyclone Val.

C) fish

Thollot (1993) carried out a fish survey of the mangrove forest in 1992 using gill nets and rotenone poisoning. He recorded 20 fish species, the most common of which were the mullet *Valamugil engeli* (**Aua, Anae**), and the crescent perch *Therapon jarbua* (**Avaava**), both of which are caught for food. He noted that the Sataoa-Saanapu mangrove forest has a much more stable and more diverse fish community than the polluted Vaiusu Bay mangrove forest adjacent to Apia. In addition to the 35 fish species actually recorded in Western Samoan mangroves, an additional 216 species have been recorded in other South Pacific

mangrove forests and may also be present in Samoan mangroves (ibid).

(iv) Herbaceous Marsh

On the eastern boundary of the Sataoa-Saanapu mangrove forest is a herbaceous marsh (refer to figure 5) consisting almost entirely of the salt tolerant marsh fern *Acrostichum aureum* (**Sa'ato**). Although omitted from Pearsall and Whistler's ecosystem map (figure 4), this marsh is probably the largest *Acrostichum* coastal marsh in Western Samoa (Park *et al* 1992). The marsh is mono-dominant because of the water-logged and saline soil and the shade produced by the *Acrostichum*. No trees exist on the site.

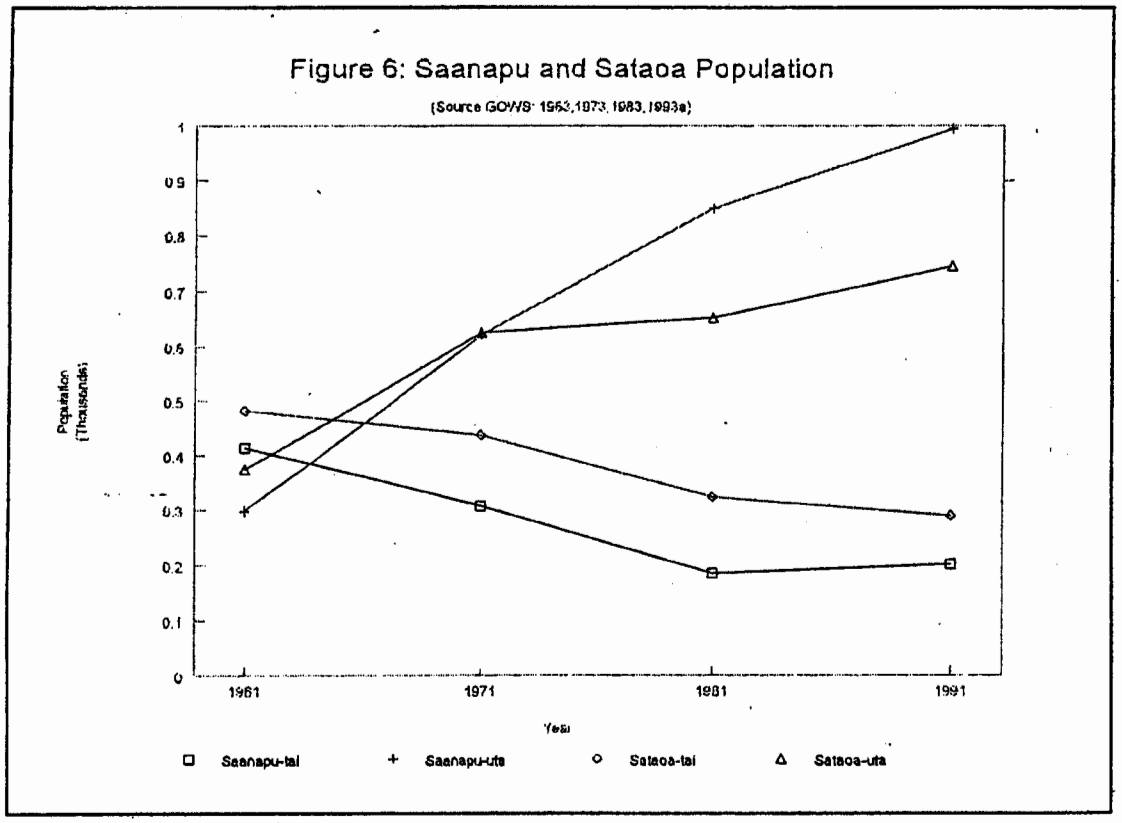
(v) Coral Reef

A fringing coral reef (10 to 100m wide) extends from the west into the proposed Conservation area as far as Nuavasa island. This reef continues but becomes a barrier reef, up to 2.5 km off-shore as far as Safata Harbour in Safata Bay at the eastern edge of the proposed conservation area (see figure 5). The reef has been studied by Zann (1991) as part of his fisheries resource study. He found that live coral cover was high at the southern section of the barrier reef but lower adjoining Safata harbour in the east and also near Nuavasa island in the west due to recent crown-of-thorns starfish outbreaks. The most common types of coral recorded on the reef were *Acropora*, *Montipora*, *Pocillopora* and *Porites*, although much of the coral was dead. Cyclone Ofa caused slight damage to the reef but the effect of cyclone Val is not known.

3.3 The Human Setting

3.3.1 Population and Settlement

In 1991 the population of Saanapu (tai and uta) was 1196 while Sataoa (tai and uta) had a population of 1033 (GOWS 1993a). The average population of a village in Western Samoa is only between 300 and 600 (ADB 1985) so these are large villages, partly because they each consist of two settlement units. Figure 6 shows the population of Sataoa and Saanapu villages, split into each settlement unit, between 1961 and 1991.



The graph clearly shows the depopulation of the coastal (tai) settlements and the development of the inland (uta) settlements over this period. Until the Second World War, both Sataoa and Saanapu existed entirely on the coast, so the development of the inland settlements is relatively recent. The migration inland appears to have followed the construction of the main south coast road (see figure 2) in the 1950's which provided improved access to land hitherto difficult to reach (Fox 1962). This migration appears to have slowed

In 1991, the vast majority (85%) of the employed population of Sataoa and Saanapu were working in agriculture, hunting, forestry and fishing (GOWS 1993a) and were thus directly dependent on natural resources, especially biological resources, for survival. Most of these people work primarily for subsistence, with only 25% of the employed population working primarily to earn money (ibid).

(i) Agriculture

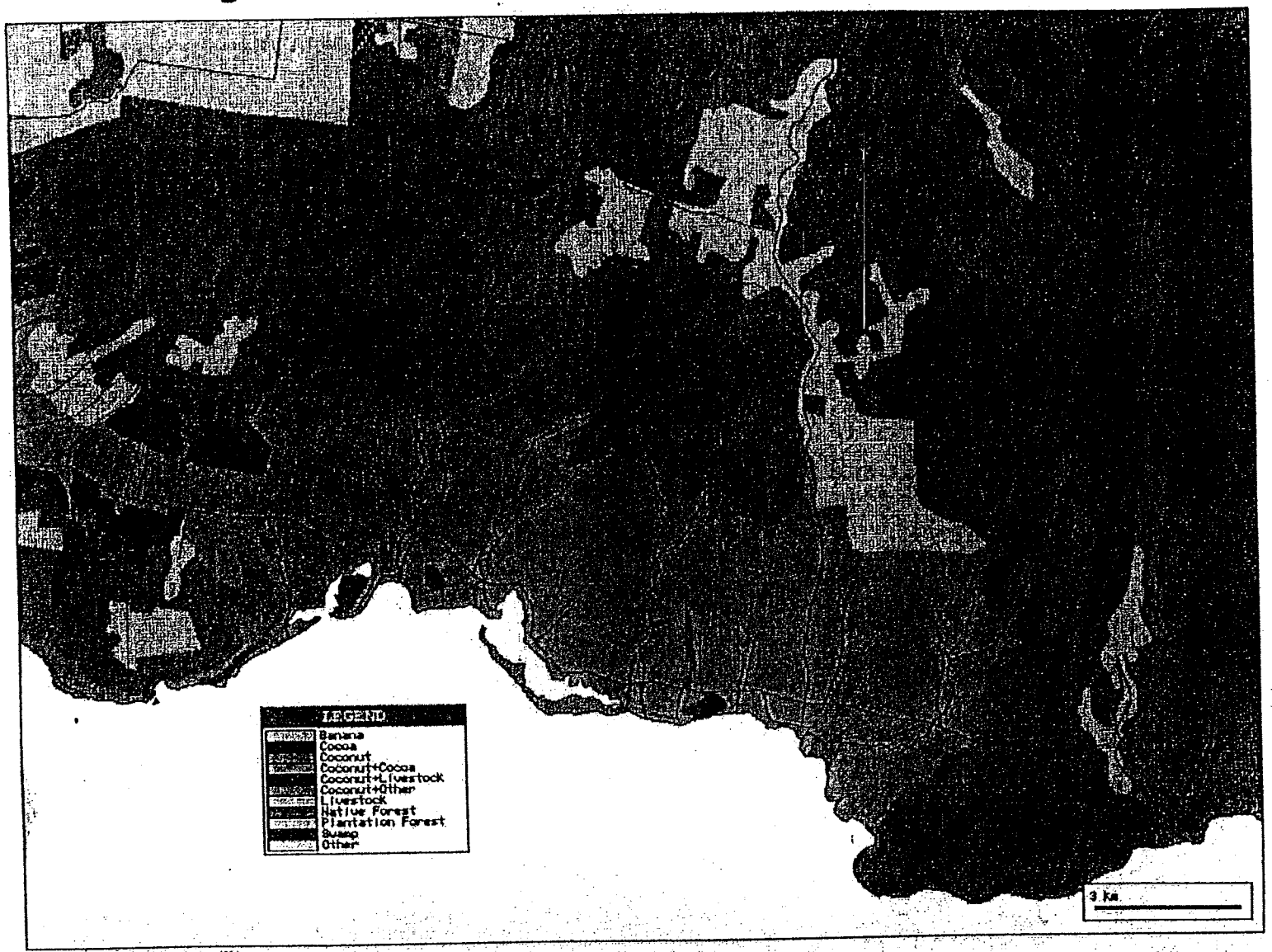
The 1989 census of agriculture (GOWS 1990) provides a general assessment of agricultural activities in Safata district as a whole. Ninety four percent of households in the district were defined as agriculturally active. The most important crops grown were taro, coconut, cocoa, banana and taamu. These and other crops were grown mainly for home consumption, although, considerable proportions of some crops were grown for sale, especially taro, coconut, cocoa and kava. In fact, 55% of all households in Safata got most of their income from agriculture (ibid).

Figure 7 shows the current agricultural land use in Sataoa and Saanapu (Source: DEC Biodiversity Database, originally digitised by ANZDEC 1990). The boundaries on this map should not be relied on absolutely as it was drawn from aerial photographs taken before cyclones Ofa and Val. The forest edge for example, is now at a higher elevation. The map does however, give a general guide to the extent of various land uses in the proposed conservation area.

Although not shown on the map, land use in the area still follows the typical Samoan 3 zone pattern described by Farrell and Ward (1962, see section 1.2.4). These agricultural zones are all found within the coconut and cocoa belt on the map (light blue area). Over recent decades the 3 zone pattern has undergone many changes associated with population growth, new cash crop opportunities and changes in land tenure (Paulson 1992b). Taro blight will probably continue this process of change (see section 1.2.3).

In early 1993, the major source of agricultural income in both villages was taro (village survey results). The taro zone is an indistinct zone situated adjacent to the forest boundary at about 370m (1200 feet). This zone has, for many years been steadily moving inland, pushing back the forest boundary as it does so (Paulson 1992a). However, in about July 1993 taro leaf blight began spreading in Western Samoa. It now infects 80 to 90% of all taro plantations in Safata district (Frank Fong pers.comm. 1993) and many of these plots have

Figure 7: Land use in proposed Conservation Area



Source: DEC Biodiversity Database, January 1994

been abandoned. The impact of taro blight on agriculture and livelihoods in the project area is likely to be severe.

Much of the agricultural land in the proposed conservation area is now under coconuts, in Saanapu for example, 63% of the cropped area was in coconuts in 1988 (Paulson 1992a). In fact, the coconut zone has expanded into the mixed crop zone, which is now predominantly in little-managed coconut or ageing cocoa intercropped with coconut. Previously the mixed crop zone had been the focus of agricultural activity with the major export crops of cocoa and bananas grown alone or intercropped. Much of the coconut zone is now poorly managed and unproductive (ibid).

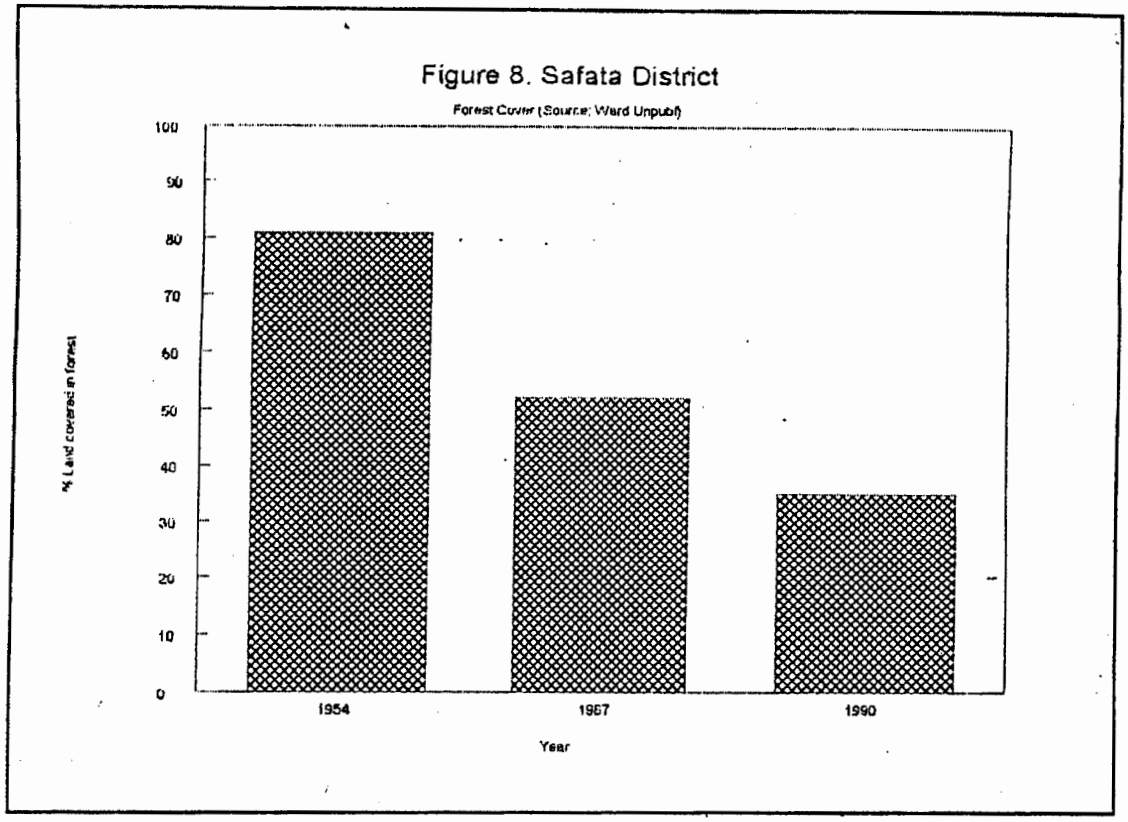
(ii) Hunting

No data are available on hunting in the proposed conservation area. However, recent research in other parts of Western Samoa show hunting to be of insignificant importance (Paulson 1992b). In any case, the very rarity of some forest birds may have reduced hunting pressure (Park *et al* 1992).

(iii) Forestry

There is a 280 ha plantation forest 2 kilometres to the west of Saanapu. It is a silvipastoral system and is actually shown on figure 7 as a livestock area, straddling the south-western boundary of the conservation area. The forest is run by the Forestry Division within the Government Department of Agriculture, Forests and Fisheries. The main tree grown is an introduced species- mahogany (*Swietania macrophylla*). Most of the forest was written off by cyclones Ofa and Val before the trees had reached maturity.

From a forestry perspective, the most important recent development in the proposed conservation area and in Western Samoa in general has been the rapid clearance of forest for agriculture. Much of this clearance has been associated with the expansion of taro farming (see section on Agriculture above). Data on changes in forest coverage are available for Safata district as a whole and these are shown in figure 8 (after Ward unpubl.).



In Safata, forest cover declined by an average 2.2% per year between 1954 and 1990. The rate has accelerated in recent years with an average annual rate of decline in forest cover of 13% between 1987 and 1990 (both figures assume a linear relationship between forest loss and year in each reference period). Population growth alone cannot explain this deforestation; in Saanapu while the population has doubled since 1956, the area of land cleared has more than trebled (Ward 1992). There is a negligible volume of merchantable timber now left in Upolu's native rainforest so productive forestry is no longer a viable enterprise (GOWS 1993b).

Much of the recent clearance of forest for agriculture has occurred above the zone described by Wright (1963) and ANZDEC (1990) as suitable for sustained agriculture. In fact clearance has now progressed into the steeply dissected Leafe river catchment (see figure 7) where actual or potential erosion may be severe (ANZDEC 1990).

(iv) Fishing

Zann's (1991) survey of inshore fish resources provides an assessment of the marine resources of the

Saanapu-Sataoa area. It concluded that the inshore fisheries of this area are of considerable importance but under stress. In the seven settlements surveyed, from Salamumu and along the coast to Lotofaga (see figure 2), 77% of all households fished at least once per week. The main fish caught were mullet, surgeonfish, rockcod, sweetlip and soldierfish in that order. The fish catch was high at 130kg/ha/yr and consumption was moderately high at 31kg/person/yr. Over half the fishermen interviewed however, indicated that the fish catch had declined over the past decade.

(v) Others:

a) tourism

There is one small tourist development in the proposed conservation area, consisting of two small **fales** (houses). It is located on the beach 1/2 a kilometre to the west of Saanapu-tai and is currently undergoing expansion.

b) sand mining

Sand has been observed to be mined from the beach about 3 kilometres to the west of Saanapu-tai and is probably taken from other beaches in the area. It is used as a roading material, for grounds around **fales** and to make the concrete used in **fale** construction. There is no control over this activity in terms of volume of sand mined or method of extraction used and it is not known what environmental damage this practice is causing.

3.3.4 Cultural Features

Only one cultural feature has so far been recorded in the proposed conservation area. The Seuao cave, situated about 2 kilometres to the west of Saanapu, between the coast road and the sea (see figure 3), features in a local legend.

3.4 The Village Survey

3.4.1 Methodology of data collection and analysis

A questionnaire based survey of resource use and conservation in Saanapu and Sataoa villages was carried out between 18 October and 27 October 1993. Some of this time was spent living in each village. The focus of the survey was the mangrove forest, a resource shared by both villages. Samoan language questionnaires were given to each village **pulenuu** (mayor) who then distributed them to households within their own village. An English translation of the questionnaire is shown in Appendix 3.

The survey concentrated on the seaward settlements of Saanapu-tai and Sataoa-tai since these settlements were assumed to have a greater impact on the mangrove forest than the more distant inland settlements of Saanapu-uta and Sataoa-uta. Most households in the coastal settlements were sampled, but due to a time constraint only 3 households in Saanapu-uta were given questionnaires while 20 households in Sataoa-uta were given questionnaires.

From the questionnaire results, a number of villagers (n= 14 in each of the coastal settlements, n= 3 in each of the inland settlements) were chosen for detailed interview. It has been shown by other researchers in Samoa (eg Paulson 1992b) that the semi-structured interview approach works best so this method was used. The interviews explored resource use and attitudes towards conservation in depth and were generally carried out with the head of household or another senior member of the household. Most interviews were carried out in Samoan with the assistance of Cedric Schuster from the Division of Environment and Conservation.

While interviews targeted people who actually used the mangrove forest, interviews were also carried out with non-mangrove forest users and a number of influential groups and individuals in each village. These included the Women's Committee, the village pastor, the local school headmaster and the village **pulenuu.**

3.4.2 Results of Village Survey

The major points are summarised as follows.

(i) Uses of the Sataoa-Saanapu mangrove forest and adjacent littoral forest.

a) overall.

The vast majority of people in both Saanapu-tai and Sataoa-tai regularly (every week) used the mangrove forest or the adjacent littoral forest for one or more purpose. The results are shown in Table 2.

Table 2. Uses of the mangrove forest and adjacent littoral forest.

Use	Species used	Comments
1.Food supply (i) Fish	eg *Sphyraena* spp (**Sapatu**) *Caranx* spp (**Malauli**) *Valamugil* spp (**Anae**) *Chrysiptera* spp (**Mutu**)	The fish are mainly caught with nets (**tili** and **upega**) and with spears. Most of the catch is for home consumption.
(ii) Crab	*Scylla* spp (**Paa**) *Sesarma erythrodactyla* (**U'a**)	In Saanapu-tai crabs are caught with traps and in Sataoa-tai they are caught by hand. Most of the catch is sold.
(iii) Shellfish	eg *Gafrarium tumidum* (**Tugane**) *Cypraeidae* spp? (**Sisi**) *Assathis* spp (**Pipi**)	These are dug up for home consumption.
(iv) Snackfoods	*Adenthera pavonia* (**Lopa**) *Inocarpus fagifer* (**Ifi**)	The seeds are eaten.
2.Firewood	eg *Hibiscus tiliaceus* (**Fau**) *Barringtonia asiatica* (**Futu**) *Bruguiera gymnorrhiza* (**Togo**)	Most of the firewood collected is dead wood although some is live wood which is dried before burning.
3.Medicine	eg *Davallia epiphylla* (**Laugasese**), *Morinda citrifolia* (**Nonu**) *Hoya australis* (**Fueselela**) *Vigna marina* (**Fuesina**) *Phymatosorus scolopendria* (**Lau'auta**)	Most of these plants are vines or ferns.

Continued on following page

Table 2. (Cont'd) Uses of the mangrove forest and adjacent littoral forest.

Use	Species	Comments
4.Construction materials: (i) **Fale** rafters	*Hibiscus tiliaceous* (**Fau**) *Rhizophora mangle* (**Togo**)	Other construction materials are obtained from the rainforest.
(ii) **Fale** posts	*Terminalia catappa* (**Talie**) *Bruguiera gymnorrhiza* (**Togo**)	
(iii) **Fale** thatch	*Acrostichum aureum* (**Sa'ato**) *Metroxylon vitiense* (Sago palm)	
(iv) Canoes	*Albizia chinensis* (**Tamalini**) *Calophyllum samoensis* (**Tamanu**)	
5.Handicraft materials: (i) Mats	3 spp *Pandanus* (eg **Lautotolo**)	**Siapo** is rarely made now due to a shortage of **ua** (*Broussonetia papyrifera*) - the paper mulberry tree.
(ii) **Siapo** cloth	Dye is from *Bruguiera* bark	
6.House decoration	*Davallia epiphylla* (**Laugasese**) *Hoya australis* (**Fueselela**) *Acrostichum aureum* (**Sa'ato**)	These plants are used to decorate houses for special occasions.
7.Others: -Fish poison	*Barringtonia asiatica* (**Futu**)	The fruit of **Futu** is grated and used as a fish poison.
-Washing		In Saanapu- tai a spring arises in the mangrove forest and this is used for
-Cricket bats	*Hibiscus tiliaceous* (**Fau**)	washing clothes.
-Recreation		
-Shore protection		

b) differences in resource use between Saanapu-tai and Sataoa-tai.

Sataoa-tai people appear to rely less on the mangrove forest than Saanapu-tai people, with fewer people using the area to catch fish and crabs. In addition, different methods of harvest are used. In Saanapu-tai canoes are used to set crab traps, in Sataoa-tai, access to the mangrove forest by canoe is more difficult and therefore crabs are dug up or collected from trees at high tide.

c) differences in resource use between coastal and inland settlements.

The survey results appear to confirm the hypothesis that villagers in the inland settlements rely less on the mangrove forest than villagers living on the coast. Presumably this is linked to the distance of these settlements from the mangrove forest.

(ii) Changes in the mangrove forest in the recent past.

- Fish/crab stocks: Many respondents in both Saanapu and Sataoa noted a decline in fish and crab stocks over the past 20 years- about 4 times as many who said these stocks had remained stable or increased.
- Vegetation: Many respondents said that there were fewer large trees due to cyclone damage, but much recent regeneration.
- Others: Some respondents noted a decline in bird numbers and others noted that some organic-rich mangrove mud had eroded away.

(iii) Attitudes towards conservation of the mangrove forest.

All the respondents in both villages supported the concept of conserving the mangrove forest. The main reasons given for conservation were, in descending order of priority:

- To protect or improve fish and crab stocks.
- To improve income earning opportunities.
- To protect the shore from erosion.
- To preserve firewood supplies.
- Others, like to increase bird stocks and to increase tourist potential.

(iv) Attitudes towards tourists.

All the respondents in both villages gave a positive response when asked if they wanted tourists in their village. Many however wanted tourism carefully controlled so as not to disrupt village life. It was generally felt that: tourists should be educated about Samoan cultural values; tourism should be particularly carefully regulated on Sundays and tourists should not be allowed to stay more than a few days.

(v) Development needs.

Villagers were asked in the interviews to give the physical development needs required by their village. They

gave the following in order of priority:

a) breakwater

Many respondents in Sataoa-tai and some in Saanapu-tai identified the need for some form of protection against shoreline erosion. This was critical enough in Sataoa-tai for one respondent to suggest that reclamation of the mangrove forest for housing would be needed unless the problem could be rectified soon.

b) water supply

The water supply to both coastal settlements is unreliable, with frequent stoppages due to burst pipes. Money is needed to replace the existing pipes with more reliable ones.

c) roads

Villagers in both coastal settlements sought improvements in their access road to the main south coast road as the present access roads are unsurfaced and pot-holed. Some people also wanted improved access roads to their inland plantations.

3.5 Conservation Area Management Issues

3.5.1 Management Goals and Objectives

(i) Goals

The primary goal of the SPBCP has already been described as the conservation of biodiversity for sustainable social and economic development (see section 2.4). Since funding for the Sataoa-Saanapu Conservation Area will be sought from SPBCP, this is also the primary goal of this conservation area.

(ii) Objectives

End of project objectives for the proposed conservation area are listed below. To achieve these broad objectives, more immediate objectives will be needed, but these can only be identified when more data are available and after further consultation with villagers.

- Objective A: Improved community awareness among Sataoa and Saanapu villagers of the importance of biodiversity conservation.

- Objective B: Active involvement of local people in conservation area planning and management and ongoing commitment to it.

- Objective C: Conservation area zoned into management units according to ecological sensitivity and management required.

- Objective D: Sustainable resource exploitation levels and practices identified and advice provided for implementation.

- Objective E: New income generating opportunities identified and help given for implementation.

- Objective F: Strengthened local co-operation between government agencies and non-governmental organisations involved in or influencing environmental management.
- Objective G: Improved resource management practices spread to the rest of Safata district.

3.5.2 Threats to the Proposed Conservation Area.

The major threats to the environmental quality of the proposed conservation area are human-induced and typical for Western Samoa in general. Natural impacts, like cyclones, are also important but tend to be infrequent.

Fundamentally, environmental impacts are increasing due to the combined effect of three interlinked causative agents: population growth, commercialisation and the use of unsustainable resource harvesting regimes.

(i) Population growth.

The population of the proposed conservation area has increased by 40% over the past 30 years with an average growth rate of 1.2% per year. The current growth rate is about 1% per year (source GOWS 1993a). While not a spectacular rate of population growth by world standards, the limited resource base available and the methods of resource extraction currently being used mean that even this modest rate is cause for concern.

While population pressure may not have been a significant issue in the conservation area in the past, there is growing evidence that population density is now exceeding the carrying capacity of some natural resources. Most of the land has already been cleared for agriculture. Only c35% of Safata district is still forested, and much of this is on steep land of low agricultural potential and high erosion risk. There is thus little suitable land left for agricultural expansion. Likewise, few coastal marine resources have not already been exploited. In fact, according to the survey results, the extent and nature of current exploitation appear to be degrading the fish resource.

Almost as important as population growth *per se* is the distribution of population. Most people living in the proposed conservation area live on the coastal lowlands. However, perhaps fortunately for the survival of the mangrove forest, a declining population has been a feature of the two settlements actually on the coast (see figure 6). Population pressure has instead shifted to the natural resources a short way inland. Recent evidence that the migration of people away from the coast may have ceased is worrying because it may mean that the threats to the adjacent mangrove forest will rise. For example, a shortage of land may increase pressure to reclaim land from the mangrove wetland.

(ii) Commercialisation.

The commercialisation of the Samoan economy has promoted many changes in Samoan life. From an environmental perspective, commercialisation has resulted in increased environmental impact because the level of resource extraction has increased to satisfy demands for subsistence and for cash.

A number of respondents in the village survey noted that crab fishing effort had increased in recent years in order to satisfy cash demands. Increased crabbing effort may be responsible for an apparent decline in crab stocks seen over recent years. Another example of increased resource exploitation to satisfy cash demands is the accelerated clearance of forest in the late 1980's to plant taro, formerly the most lucrative Samoan cash crop.

It is not likely that material aspirations will diminish in the foreseeable future, if anything they are likely to grow. If at the same time, the predicted fall in remittance receipts occurs, there is likely to be even greater pressure on natural resources.

(iii) The use of unsustainable resource harvesting regimes

Neither population growth nor commercialisation need necessarily cause environmental damage, as long as resource extraction activities occur at a level and using techniques that the available resources can sustain. Not only must the natural resources be able to sustain the level of exploitation, they must also be able to absorb the byproducts of this exploitation in terms of pollution. It appears that the current level and nature of resource harvest is causing environmental damage in the proposed conservation area. This is true of both terrestrial and marine resources.

On land, the practice of clearing forest on steep slopes to monocrop taro under short fallow systems is thought to cause problems. It is said that this process promotes substantial soil erosion (FAO 1991), although this claim is contested (see section 1.2.4). In addition, taro farming relies on heavy application of herbicides which are easily leached in the high rainfall and porous soil. The downstream effects of the sediment and chemicals may be significant including the pollution of human water supplies and the degradation of reefs and inshore lagoons (Zann 1991).

In the sea, the practice of using introduced and non-selective fishing techniques (such as wire fish fences and

gill nets), and the use of destructive fishing techniques (such as dynamiting and fish poisoning) has probably contributed to a decline in fish stocks in Western Samoa (Zann 1991). The village survey confirmed that all these fishing techniques are currently being used in the proposed conservation area. Fish poisoning and dynamiting, although banned by both Sataoa and Saanapu **fonos**, continue in both the lagoon and the mangrove forest.

Fish poisoning and dynamiting are particularly destructive fishing techniques because they are not only extremely effective at killing large numbers of fish, but also kill many non-harvested aquatic organisms. In addition, dynamiting on the reef can destroy the coral ecosystem and thereby reduce fish populations, increase siltation and sedimentation (which further damages coral) and increase the exposure of the lagoon to destructive waves (Sandford 1993).

3.5.3 Who owns the Mangrove Forest?

The mangrove forest is a shared resource, both Sataoa and Saanapu villages currently harvest from it. However, during recent village discussions concerning the conservation area, Saanapu people claimed that the mangrove forest belonged entirely to them. Sataoa people on the other hand claim that half of it belongs to them. It is possible that this dispute is simply an attempt by each village to maximise their own share of the benefits obtained from the project. Consequently, great care will be needed to get the two villages to work together on conservation area management. There must be an attempt to share project benefits equally between the two villages.

3.6 Recommendations for Management of the Conservation Area

Before detailed management recommendations can be made and a management plan implemented, there is a need for further liaison with villagers. However, a number of general recommendations can be made at this stage.

3.6.1 Gather more data

The most critical need is for more data. These data are needed to establish broad controls on resource extraction activities, in terms of level and nature of harvest and method used. In addition, such data may be used to establish a baseline against which future changes in environmental quality can be measured. Data are most urgently needed in the following areas:

(i) Ecology

- Harvested marine resources. More detailed information on the current status of the harvested fish, crab and turtle resources is needed before management prescriptions can be suggested. Zann's (1991) assessment of inshore resources could be used as a model for this data gathering exercise.

- Terrestrial fauna. There is little information on terrestrial fauna other than birds and bats, and that which exists is largely pre-cyclone Val and limited to the mangrove forest ecosystem.

- Upland flora. The montane rainforest in the proposed conservation area is unsurveyed. Data on the status of these forests, species found, their current uses including any threats, their value to local people and any management regimes employed, are needed. The DEC is planning an upland ecological survey in 1994 and this will provide some of the required data.

(ii) Sociology

- Traditional knowledge. Traditional knowledge of harvested species and their biology and traditional harvesting practices and controls should be recorded. These data will be invaluable when drawing up management regimes at a later stage.

■ Sataoa-uta and Saanapu-uta. The village survey work already completed concentrated on the two coastal settlements of Sataoa-tai and Saanapu-tai and their use of the adjacent mangrove forest. More sociological data from the inland settlements are needed, concentrating on land use practices occurring in the watershed. These data will complement those collected on rainforest ecology described above.

■ Lotofaga. Data from the village of Lotofaga should also be collected as the customary lands of this village include much of the Leafe river catchment, the major watershed in the conservation area (see figure 2).

(iii) Hydrology

■ Water quality and quantity. Basic monitoring of the water quality and quantity of the two major rivers in the conservation area, the Leafe river and Sataoa stream, should be carried out. The technology and skills to carry out simple pH measurements, conductivity, temperature and total dissolved solids already exists in Western Samoa, at DAFF's Apia Observatory (FAO 1990b). Such hydrological data are lacking in Western Samoa, and would complement concurrent research on land use activities in the watershed to help predict the effects of these activities.

3.6.2 Get local people involved

For the conservation area to be a success, local people must identify with management aims and objectives and be committed to their achievement. After all it is the local people who will implement management regimes and be influenced by their outcome. Saanapu people have already expressed their commitment to the conservation area project in a meeting in June 1992 to follow- up the National Ecological Survey (Park 1992a). However, Sataoa people must also be fully committed to the project and commitment from both villages must be active and not just verbal.

To get people interested, a series of informal workshops and discussions will be needed. A wide cross-section of the community, not just the village **matai** and pastor, should be involved. This includes the Women's Committee, untitled men's groups and schoolchildren. It is recommended that some of these meetings be joint village meetings and these must have equal representation from both Sataoa and Saanapu.

In village discussions, the costs of current destructive environmental practices should be discussed, as should the benefits of improved management techniques and new income earning opportunities. Links between

biodiversity conservation and income generation should be explored, such as the provision of income from ecotourists visiting the mangrove forest. Throughout, attempts should be made to develop ideas put forward by local people themselves, as these are more likely to be sustainable in the long term.

3.6.3 Encourage more sustainable resource harvesting regimes

Current destructive and/or wasteful resource harvesting regimes need to be discouraged and more sustainable systems encouraged. Much data are needed on the biology of harvested species and the effect of current levels and techniques of harvesting, before any detailed recommendations can be made regarding sustainable regimes (see 3.6.1 'Gather more data' above). However, enough evidence already exists on the destructive nature of certain resource exploitation techniques to make some immediate recommendations.

Of particular concern is the apparently declining state of the inshore and mangrove fishery. There is little doubt that stricter controls on dynamiting and fish poisoning are required. Controls on net sizes, minimum sizes of fish and crabs, closed areas and closed seasons may also be needed. The Fisheries Division in DAFF are planning to work with coastal villages on such regimes and should be asked for assistance in the proposed conservation area. Any implemented regimes must be monitored carefully to determine their effectiveness.

Improvements can also be made in agricultural systems. Agroforestry based farming systems should be encouraged. In cropping trials with taro, leguminous trees such as *Erythrina*, *Gliricidia* and *Calliandra* have been found to help maintain soil fertility and reduce weed growth while providing firewood and a favourable work environment (IRETA 1993). The University of the South Pacific and the recently formed Watershed Management Unit in DAFF should be enlisted to give advice.

3.6.4 Help develop new income generating opportunities

Possible new income generating opportunities in the project area arise from ecotourism, aquaculture and agricultural diversification. Only income generating opportunities which promote sustainable exploitation of resources should be supported. Thus all new developments must be subject to some form of environmental impact assessment.

(i) Ecotourism

The rationale for developing tourism in the conservation area arises from two sources: firstly, the site has significant ecotourist potential and secondly, in the village survey, unanimous support was given by villagers to the concept of developing limited ecotourism. However, since ecotourism is so small scale, it is not likely to generate large amounts of income, but it does provide an economic rationale for conservation and environmental management (Sandford 1993). In addition to the moneys received directly from tourists visiting ecological sites, tourism could promote ancillary industries such as handicraft production. In the village survey, many expresses an interest in selling handicrafts to tourists. Advice was sought on how to market these products.

The following is a list of potential ecotourist sites in the proposed conservation area

■ Mangrove forest. The Sataoa-Saanapu mangrove forest has the greatest ecotourist potential of any site. In his Visitor Services Plan, Sandford (1993) recommended that a nature trail and boardwalk be built from Sataoa into the mangrove forest. **Paopao** (canoe) rides through the forest could depart from a landing on the board walk. A few ecotourists have already canoed through the mangrove forest and have enjoyed the experience. However, there needs to be further discussion between the DEC, the Visitor's Bureau and villagers on the nature of this tourist development.

■ Lake Lanoto'o. This is Western Samoa's largest lake and has long been recommended for conservation status, but so far little has been done. The development of picnic facilities and walking trails at the lake, which is situated at the northern end of the conservation area (see figure 3), would encourage tourist visits. Walking trails could be constructed down through forested gorges to link up with other features.

■ Seuao lava cave. This cave (see figure 3) could provide an interesting tourist excursion if trail access from the main south coast road were improved.

■ Turtle nesting beach. Hawksbill turtles (*Eretmochelys imbricata*) are known to have nested on the beach adjacent to Nuavasa island up until the early 1980's. Considerable numbers of Hawksbills are still found in the lagoon. If they could be encouraged to resume nesting, this could provide a seasonal tourist focus.

There is already one tourist venture in the conservation area, and this is currently undergoing expansion. There should be collaboration between the DEC, the Visitor's Bureau and the owner of this establishment over the nature of expansion.

(ii) Aquaculture

The village survey found there was interest in the aquaculture of fish and shrimps, but it was indicated that both funding and expertise were needed. Zann (1991) noted that the area was suited to aquaculture such as seaweed culture in the lagoon and pond construction along the coast. However, he noted that if aquaculture is to be developed, great care must be taken not to damage the mangrove forest. The Fisheries Division of DAFF should be enlisted for advice.

(iii) Agricultural diversification

The destruction of taro in the project area puts extra emphasis on the need for new agricultural crops, especially cash crops. In the survey, many people identified this as a serious problem. The development of vegetable gardens was mentioned, but is not likely to provide a substantial source of income. However, ginger and asparagus in particular may have export potential. A number of agencies and institutions could provide advice, such as DAFF, the University of the South Pacific and the Australian funded 'Western Samoa Farming Systems Project'.

3.6.5 Extend the Conservation Area to Lotofaga

Some of the Leafe river catchment, the major watershed in the proposed conservation area, is on Lotofaga village land. Thus, if the conservation area is to satisfy the requirement that complete river catchments be included (SPREP 1993) Lotofaga must be brought into the conservation area. It is recommended that Lotofaga be included in the conservation area before any watershed management regimes are implemented. In this way plans for the whole Leafe river catchment can be implemented at once.

CHAPTER 4: DISCUSSION

This chapter is divided into two sections. First, issues related specifically to the proposed Sataoa-Saanapu conservation area will be discussed. Next, more general issues related to conservation area projects in Western Samoa will be considered.

4.1 Issues related to the Sataoa-Saanapu Conservation Area

4.1.1 Do villagers value the mangrove forest?

The Sataoa-Saanapu mangrove forest is relatively undamaged. Compared with most other Samoan mangrove forests it is in an almost pristine state. Anthropogenic damage to the forest is slight, although recent cyclone damage has been more significant. Is this forest in good condition because it is valued highly by villagers in Sataoa and Saanapu, or for some other reason?

The village survey indicated that the mangrove forest is extensively used by most villagers in Sataoa-tai and Saanapu-tai. The forest (including the surrounding littoral vegetation) is used for food, firewood, medicine, construction materials, handicraft materials, house decoration and other uses. Both subsistence and cash needs are provided by the forest and its products. All interviewed villagers wanted to see the forest conserved because they could see the direct benefits of conservation to their families and to their village. Villagers considered that managing the forest carefully would increase the benefits obtained from the forest. Thus, it would appear that villagers do value the forest highly and would like to see it conserved to maintain or even improve its value.

Is this evidence that Sataoa and Saanapu people have a conservation ethic, an ethic that appears lacking in other Samoan villagers which have degraded their mangrove forests? This question cannot be answered with any certainty. However, responses by some villagers gives clues to the answer. One respondent noted that the only reason that the mangrove forest is relatively unspoilt is because current population pressure in the coastal settlements adjacent to the forest is low. The respondent felt that as soon as population pressure begins to rise that more trees would be cut down for firewood. Another respondent noted that parts of the mangrove forest would need to be reclaimed for house sites if shortage of land became a problem. While not currently a problem, land shortage may become a problem if coastal population begins to rise and the coast continues to erode away (see section 3.5.2).

Other respondents noted that crabbing effort in the mangrove forest had risen. Since most crabs are caught for sale, this increased effort was occurring in order to satisfy demands for cash. Many respondents noted that it was getting more difficult to catch crabs, this indicates that crab stocks had begun to decline. Some people linked this decline directly to overharvesting of the resource.

It appears that while Sataoa and Saanapu villagers do value their mangrove forest and do wish to conserve it, they are not currently 'managing' it for conservation purposes. Current pressure on the forest ecosystem is relatively low, with perhaps the exception of the fish and crab resource. However, if population and demands for cash rise, as is probable, the forest and its products will inevitably be used more intensively. Unless management regimes are then in operation, the resource may well degrade like so many other Samoan mangrove forests.

The goal of the conservation area project is to help people to achieve social and economic development while conserving biological diversity. While this will undoubtedly be a complicated exercise, the commitment to conservation expressed by the villagers provides a strong base upon which the project can build. Fortunately for the Sataoa-Saanapu mangrove forest it is not too late, there is every chance that the forest can successfully be conserved for future generations to use and to enjoy.

4.1.2 Can traditional resource harvesting controls and practices be incorporated into management of the Conservation Area?

Few data have been gathered on traditional resource harvesting practices and controls in the proposed conservation area. However, the village survey seems to indicate that in recent years at least, few, if any, resource harvesting controls have been used. As one chief put it 'There was always plenty of fish in the sea, so we didn't need to regulate the harvest'.

Although there may have been few recent controls on the harvesting of resources, many resource harvesting practices are known to have existed. Most of these practices were associated with the harvesting of specific marine species and some may have had the effect of conserving these species. Mud crabs (*Scylla* spp) for example, were only caught during the first 1/4 of the moon, because they were thought to taste best then. Nowadays, Mud crabs are caught on most days, which may explain an apparent decline in crab stocks. Other special practices were associated with catching turtles and fish. The **atule**, or Big-eyed scad (*Selar crumenopthalmus*) for example, was only caught at night. Few of these traditional practices appear to be still

in operation today.

While it may not be possible nor relevant to try and resuscitate long-dead resource harvesting controls or practices, they must not be ignored. Traditional practices evolved over millennia to suit local conditions. Some may still be valid and appropriate today. An attempt should be made to integrate relevant traditional practices with modern resource management techniques. Likewise, traditional knowledge of species and their biology may be useful in devising management regimes. Gathering and compiling this knowledge should be a priority in the early stages of the project.

4.2 Issues related to Conservation Area Projects (CAPs) in Western Samoa

4.2.1 What lessons have been learnt from the Falealupo and Tafua Rainforest Agreements?

The Falealupo and Tafua Rainforest Preserves in Savaii are the only established examples of conservation areas set up on customary land in Western Samoa. Consequently, a brief analysis of the lessons learnt from these projects is useful when planning new Conservation Area Projects in Western Samoa.

Both rainforest preserves rely on the Agreement approach to conservation (see section 2.3). Covenant agreements between a donor and a village were signed whereby the donor agreed to finance village development in exchange for village agreement to protect their rainforest for 50 years. Most of the villages involved had been under pressure to sell their lowland rainforest to loggers in order to finance new school buildings. Consequently, much of the development assistance provided by the donors was used to build new schools and to thereby remove the immediate pressure to sell the forest.

While the Agreement approach may have been justified in order to save the rainforests from the immediate threat of logging, there has been much debate as to whether this approach is really appropriate or sustainable in the long term. An independent assessment of the Tafua rainforest project found that the villagers did not feel that they owned the project (Olsson 1992). It has been said that the donors 'took their starting point in conservation but for **matai's**, money was the motivating factor' (ibid). This feeling of lack of ownership arose for a number of reasons, but especially the following two: firstly, the initiative to conserve the forest came from outsiders and not the villagers themselves, and secondly there was poor liaison between donors and villagers over the aims of the project and how to achieve them.

The Agreement approach to conservation is said to face the same criticisms that have been levelled at conventional aid: it produces a dependency mentality, stifles self-help and local initiative and may create needs which did not previously exist and which cannot be provided for once the assistance ends (Peteru 1993). But perhaps it is not the Agreement approach itself which is at fault, just the way Agreements have been implemented.

What lessons have been learnt from the Savaii Agreements? It appears that first and foremost, before a conservation area is developed, there should be a perception by local people that conservation of natural resources would be beneficial. If this perception does not already exist there will be no commitment to conserve resources. Consequently, it is far better if the initiative to conserve comes from local people themselves. Of course some villagers may not realise the true value of specific resources or that their natural resources are being degraded. Natural resource degradation usually occurs slowly and the effects are often only felt after serious damage has been done. Consequently, villagers may not perceive the dangers of biodiversity loss until it is too late to reverse the damage. There is thus a strong role here for environmental education.

Linked to a perception by villagers that resources need conserving, is the need for a consensus about how to achieve resource conservation. Close liaison between the implementing agency and the village is necessary. Villagers may have their own ideas about how to conserve biodiversity; these should be discussed in village meetings. Ultimately, villagers themselves must choose the management prescriptions, after all it is the villagers who will have to implement these controls. The role of the outside agency is to provide information and advice and to assist in decision making, not to make decisions for villagers.
Another lesson is that simply throwing money at the problem is not likely to be a long term solution. Money must be targeted very carefully, if it is to be useful. In other words there should be clear criteria for utilisation of funds. The money given to villages in Savaii to build new schools may have removed an immediate threat to the rainforests, but are these forests any safer now that the schools have been built? Ideally, any money spent should be linked to improved management of a resource and should promote local self-reliance not diminish it. The aim should be to further the link between natural resource conservation and provision of benefits from the resource. Some form of cost-benefit analysis, including perhaps an environmental impact assessment, may be necessary to ensure that new developments are appropriate and sustainable.

Unfortunately, the wide publicity given to the Tafua and Falealupo Agreements has engendered a perception by many in Samoa that natural resources can be sold to the highest bidder. O le Sio'sio'maga Society, the

local environmental NGO now responsible for managing the Tafua rainforest, has been approached for financial assistance by a number of villages. This misunderstanding needs to be corrected before village discussions on conservation issues can begin (Peteru 1993). To achieve this, agencies implementing CAPs must have defined aims and must state them carefully, clearly and consistently.

4.2.2 How can CAPs best promote *sustainable development*?

The goal of Conservation Area Projects is the conservation of biodiversity via sustainable social and economic development (section 2.4). In the South Pacific context, sustainable development has already been defined as the management of biodiversity to satisfy both the current and the future needs of Pacific Islanders (SPREP 1993). But how can biodiversity be managed to ensure that the provision of current needs doesn't compromise the ability of future generations to meet their needs? A first step is to understand what those needs are. Only when needs are adequately defined can ways of satisfying those needs, ways which limit environmental damage, be developed.

The basic, and timeless, 'needs' for human survival are food, water and shelter. In a traditional and predominantly rural society like Western Samoa, these needs are provided directly by the environment. In Western Samoa, most people are still directly dependent on natural resources to supply their basic needs for survival.

While the basic human needs for food, water and shelter are timeless, new needs are arising with the modernisation of the Samoan economy. Cash is a new 'need' and an unavoidable aspect of modern life, where people become increasingly remote, geographically, economically and psychologically, from nature. In many modern societies, where the link between people and the environment has been broken, cash is needed to buy basic human needs. It is thus needed for survival. As Western Samoa 'modernises', the need for cash will inevitably increase. Since it is urban areas which modernise fastest, the need for cash is strongest in the Apia urban area. However, even in rural Samoan society where the basic physical needs can still be obtained from nature, cash is also needed. It is needed, amongst other things, to buy clothes and imported foodstuffs, to pay children's schoolfees, to contribute to family, church or village gatherings and projects. But perhaps most importantly, it is needed to satisfy rising consumerist aspirations.

Continued population growth multiplies the volume of resources the environment must provide to satisfy basic needs for survival. Consequently, in order to accommodate rising populations, new and more efficient

ways of exploiting resources need to be developed. This is not an easy task in a small, isolated and resource-poor country like Western Samoa. However, there is considerable potential for developing new sources of income such as ecotourism, aquaculture and new export crops. There is also a potential for improvements in current resource harvesting technologies, especially the destructive and/or inefficient fishing and agricultural practices.

The key to the success of Samoan conservation areas must therefore be `natural resource management'- the management of the exploitation of natural resources to satisfy the current and future needs of a growing and increasingly consumerist population. Sustainable development however, involves much more than just the provision of human needs. It also involves the provision of what have become human `rights', `rights' to a certain quality of life: the right to health care and education, the right to self-determination and political freedom, amongst other things. It is now accepted that true sustainability can only be achieved if human needs and human rights are satisfied (eg WCED 1987). Most of these aspects of development are outside the remit of a Conservation Area Project. Nevertheless, if sustainable development is to be a goal of CAPs, then these issues must not be ignored in planning conservation areas.

4.2.3 What role will local village institutions play in CAPs?

In Western Samoa, traditional village **fonos** (councils), consisting of the village **matai**, have much influence on village life. Village **fonos** usually meet once a month and have the power to pass and enforce local laws. The legal mandate for this has been recognised in the 1990 Village Fono Act. Thus the machinery for enforcing management prescriptions in Samoan conservation areas already exists. If any restrictions on resource harvesting practices are needed, the village **fono** is the institution which will inform villagers of these new rules and then enforce them. Most people will respect these rules as the penalties for breaking them can be very severe.

The **fono** should play a vital role in CAP planning and management. The details of how this will work may vary from project to project according to local conditions. In any case, the local village **fono(s)** must be represented in any committee established to manage specific CAPs. **Fono** representatives will probably then report back to **fono** meetings, discuss the issue(s) of concern with other **matai** and come up with a consensus decision on how to proceed. Ideally, a regular two-way dialogue between the management committee and the village **fono**, will be established.

One **tulafale** (orator chief) representing the implementing agency will be needed in this process. This person will be the chief spokesperson for the implementing agency in any formal discussions with village **fono**. This is a key role and must be played by someone very well informed of project aims and objectives and also very skilled at giving speeches in the traditional Samoan manner. To avoid the possibilities of confusion and conflict it is advisable that in each CAP there is only one **tulafale** who has a clearly stated and consistent negotiating position.

There are other village groups and institutions which need to be involved in conservation area management in addition to the **fono**. One of these institutions is the church. The church plays a strong role in Samoan life. The village pastors, as the representatives of the church in the village, have considerable influence on village activities. The effectiveness of management prescriptions is likely to be enhanced if such prescriptions have been given the sanction of the church. Consequently, the pastors must be closely involved in planning and management of CAPs.

The actions of young, untitled people are becoming more independent of family **matai,** and hence the village **fono**. One of the effects of this change is the increase in individual as opposed to **`aiga** landholding. In addition, young people are the most active users of natural resources so they will be the main executors of improved resource management practices. It is therefore important to involve young untitled people, both male and female, in conservation area planning and management.

Since the long-term success of CAPs is obviously dependent on the interest and commitment to biodiversity conservation expressed by the youth of today, schoolchildren should be involved in CAPs. There are currently no classes in environmental awareness on the school curriculum in Western Samoa, perhaps CAPs could organise these classes, emphasising the role that local natural resources play in sustaining village life. This could set a precedent for the inclusion of environmental education classes in other Samoan schools.

Last, but not least, is the need to involve Women's Committees in CAP planning and management. Women in Samoa have been described as 'the voice behind the throne'. They are much more influential in Samoan life than is publically recognised (especially by men). Although Women's Committees are largely concerned with women's and children's health and village cleanliness, these committees are likely to have a considerable influence on the effectiveness of CAPs.

4.2.4 Towards an integrated approach to Conservation Area planning and management

It has already been stated that true sustainable development involves the provision of human 'needs' and 'rights' (see section 4.2.2 above). Many different agencies, both government and NGO, are involved in promoting the provision of these 'needs' and 'rights'. To achieve sustainable development, CAPs must foster an integrated approach between these agencies. Such agencies include the Health Department, the Education Department, the Public Works Department and the Department of Agriculture, Forests and Fisheries. The Environmental NGO - O le Sio'sio'maga Society could play a particularly valuable role here as it is currently managing the Tafua Rainforest Preserve and therefore has valuable experience in managing conservation areas in the Samoan context.

An integrated approach to conservation area planning recognises the complex nature of sustainable development, it takes into account the multifarious linkages between the environment and development, it minimises the duplication of effort and the possibilities of contradictory policies being implemented by competing agencies. While there is inherent conflict in many government policies, such as the encouragement of agricultural expansion while at the same time attempting to conserve forest resources, an integrated approach will hopefully allow sensible compromises to be made and will lead to more co-ordinated management.

To be fully effective, an integrated approach to conservation area planning should begin at the earliest research stages of a CAP and continue right through the project cycle. Basic background data should be gathered on a wide range of relevant topics, at both a national level, and a local level. Such data includes geography, ecology, cultural features, socio-economics and demography. The effectiveness of planning will be considerably enhanced if the linkages between these subjects are understood.

Accepting that an integrated approach is mandatory, it is nevertheless advisable to have only one agency responsible for CAP implementation. This can be thought of as the co-ordinating agency, responsible for overall management of the project. This will be an environmental agency and will probably be either the DEC or O le Sio'sio'maga Society. Having one agency in overall control considerably lessens the possibilities of confused and poorly focussed and implemented management prescriptions.

CHAPTER 5: SUMMARY OF FINDINGS

This thesis is a case study of the first Conservation Area Project proposed for Western Samoa- the Sataoa-Saanapu Conservation Area. Data gathered on this site confirm the suitability of the site for conservation area status. The site has significant ecological value with montane and lowland rainforests, a herbaceous marsh, a coral reef and a relatively undamaged mangrove forest. The research focused on the Sataoa-Saanapu mangrove forest as it is one of the priority sites for conservation in Western Samoa.

The Sataoa-Saanapu mangrove forest has considerable social and economic value to local people as a source of food, firewood, medicines, materials for house and boat construction, cultural handicrafts and as a place for recreation. Both cash and subsistence needs are provided by the forest and its products. Although valued highly by local people and still in relatively good condition, overharvesting of resources and the use of inappropriate and destructive harvesting techniques such as the use of dynamite and fish poisons are threatening the mangrove forest ecosystem. One effect of these practices is an apparent decline in fish and crab stocks.

Migration of people away from the coast has probably alleviated much of the pressure on the mangrove forest. This movement appears instead to have increased the pressure on the inland rainforests, which are rapidly disappearing. There is evidence however, that coastal population will begin increasing again. This, along with rising material aspirations, is likely to further increase threats to the mangrove forest in future.

A strong commitment to environmental conservation was expressed by people in the proposed conservation area. This bodes well for the successful implementation of conservation area management regimes. To reduce the pressure on natural resources, it is recommended that more sustainable resource harvesting regimes be encouraged and new and environmentaly benign income generating opportunities be developed. Ecotourism, aquaculture and agricultural diversification have considerable potential. It is also recommended that the conservation area be extended to include the adjacent village of Lotofaga so that complete river catchments be included. Finally, it is recommended that local people be involved in every stage of the planning and implementation of conservation area management prescriptions.

Fortunately for Western Samoa it is not too late to conserve the biological diversity of the Sataoa-Saanapu Conservation Area. There is still much left to conserve. Time however is rapidly running out.

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GLOSSARY OF SAMOAN WORDS

(Source: Allardice 1985)

(Note: Many Samoan words have multiple meanings. The definitions given are for those meanings used in the text)

ʻAiga: Extended family

Alii: A chief

FaaSamoa: Samoan custom, way of life and language

Fale: House

Fono: Council of chiefs

Malae: Open space or village green

Matai: Titled family head

Pulenuu: Village mayor

Siapo: Cloth made from the bark of *Broussonetia papyrifera trees*

Tulafale: Talking chief

APPENDIX 2: LIST OF SPECIES RECORDED IN SATAOA-SAANAPU MANGROVE FOREST BY PARK *ET AL* (1992)

1.Flora

a.Trees and shrubs

Barringtonia asiatica, Bruguiera gymnorrhiza, Clerodendrum inerme, Dendrolobium umbellatum, Erythrina fusca, Fagraea berteroana, Hibiscus tiliaceous, Inocarpus fagifer, Pandanus tectorius, Psidium guajava, Thespesia populnea, Rhizophora mangle

b.Ferns (all epiphytes except *Acrostichum*)

Acrostichum aureum, Asplenium nidus, Asplenium polyodon, Ctenopteris seemannii, Davallia epiphylla, Davallia solida, Humata banksii, Humata heterophylla, Lycopodium phlegmaria, Nephrolepis biserrata, Ophioglossum pendulum, Phymatosurus scolopendria, Trichomanes spp, *Vittaria elongata*

c.Orchids (all epiphytes)

Bulbophyllum longiscapum, Bulbophyllum polypodioides, Bulbophyllum rostriceps, Dendrobium biflorum, Dendrobium dactylodes, Dendrobium samoense, Dendrobium sladei?, Eria robusta, Flickeringia comata, Phreatia micrantha, Taeniophyllum fasciola

d.Others (all epiphytes)

Ficus prolixa, Hoya australis, Procris pedunculata

2.Fauna

a.Bats

Pteropus tonganus (roosts have been recorded in the area)

b.Birds

Aquat. Grey Duck Wandering Tattler Reef Heron Samoan Broadbill

Acridotheres fuscus, Anas superciliosa, Aplonis atrifuscus, Egretta sacra sacra, Foulehaio carunculata carunculata, Halcyon recurvirostris, Heteroscelus incanus, Myiagra albiventris, Myzomela cardinalis, Pachycephala flavifrons, Pcynonotus cafer bengalensis, Petroica multicolor, Pluvialis dominica fulva, Ptilinopus porphraceus faciatus, Rallus philippensis goodsoni, Rhipidura nebulosa, Vini australis

Ca. Hon

Samoan Whistler

Crimson crowned fruit dove

APPENDIX 3: QUESTIONNAIRE USED IN VILLAGE SURVEY

English translation of Household Questionnaire

Date .....
Village .....
Head of household .....
Matai of household .....
Relationship of matai to head of household .....

People in household:

Name	Age	Sex
.....	....	....
.....	....	....
.....	....	....
.....	....	....

Use of natural resources:
(Answer YES or NO, if YES, name the person(s))

(1) Does anyone in your household use the mangrove forest for:

a)Catching fish? .....
b)Catching crabs? .....
c)Collecting shellfish? .....
d)Collecting firewood? .....
e)Shooting animals? .....
f)Washing? .....
g)Other uses? (name them) .....
....
....

(2) Does anyone in your household fish in the lagoon?

.....

(3) In what ways has the mangrove forest changed since the previous generation (ie in the past 20 years)?

.....
.....

(4) In what ways would your village benefit from conserving the mangrove forest (if any)?

.....
.....

(5) Turtles

a) does anyone in your household catch turtles? .....
b) does anyone in your household collect turtle eggs? .....