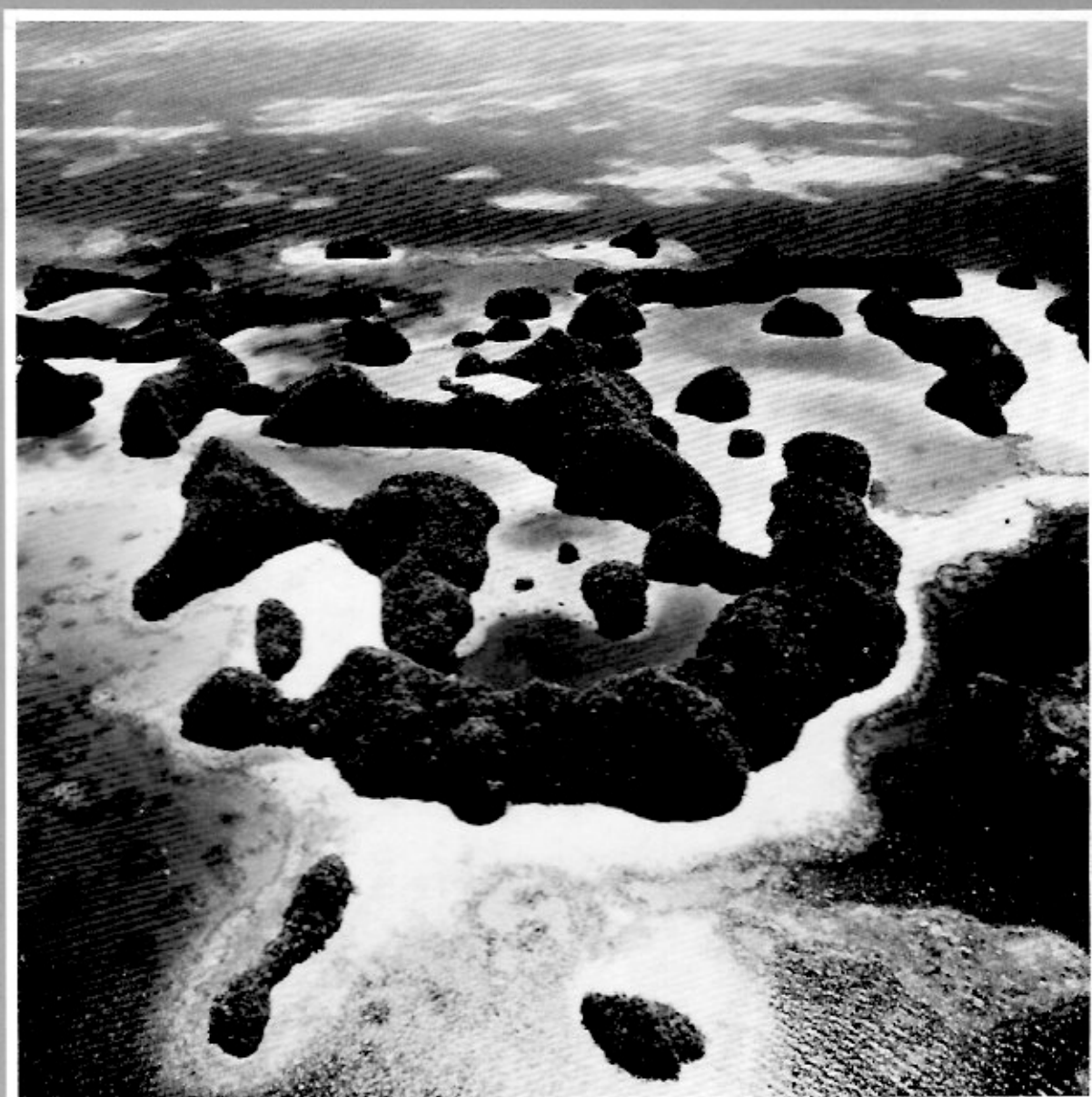

Review of the Protected Areas System in Oceania



REVIEW OF THE PROTECTED AREAS SYSTEM IN OCEANIA

Prepared by the

INTERNATIONAL UNION FOR CONSERVATION OF NATURE
AND NATURAL RESOURCES

COMMISSION ON NATIONAL PARKS AND PROTECTED AREAS

in collaboration with the

UNITED NATIONS ENVIRONMENT PROGRAMME

Based on the work of

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Secrétariat de l'IUCN
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FOREWORD

The International Union for Conservation of Nature and Natural Resources (IUCN) has long been involved in conservation activities in Oceania, dating back at least to the Regional Symposium on Conservation of Nature -- Reefs and Lagoons organized jointly with the South Pacific Commission (SPC) in Noumea, New Caledonia in 1971. Since that time the countries and territories of the region have made considerable progress in adopting conservation legislation and in beginning to establish protected areas.

At the Third South Pacific National Parks and Reserves Conference held in Apia, Western Samoa in 1985, the governments of the region adopted an Action Strategy for Protected Areas in the South Pacific Region which recognized the need to create a regional system of protected areas covering the rich diversity of species and ecosystems found in Oceania. IUCN, in partnership with UNEP, offered to prepare this review of the protected areas system in Oceania to assist governments in planning and adopting priorities in their conservation efforts.

At the same time an agreement was signed between SPC and IUCN formalizing and strengthening their long-standing working relationship. With the publication of this review and the stationing of an IUCN/WWF advisor with the South Pacific Regional Environment Programme at SPC, the foundations have been laid for a significant expansion in protected area coverage and other types of conservation activity in Oceania.

We have been very pleased to collaborate with UNEP in the preparation of this review and look forward to reviewing progress at the 4th South Pacific Parks Conference in 1989.

A handwritten signature in black ink that reads 'M. S. Swaminathan'.

M.S. Swaminathan
President

International Union for Conservation
of Nature and Natural Resources

SUMMARY

The area covered by this review is that served by the South Pacific Commission with some minor additions. It is a region of a few larger and many tiny islands, with diverse and often unique species and ecosystems, scattered across the world's largest ocean. This review aims to provide a basis for developing a protected areas system in Oceania. It looks at the conservation needs of the region as a whole, both to identify areas where rapid conservation action is needed now and to provide a basis for long-term planning.

The review is conducted on an island by island basis, with the available information for each island evaluated and rated in order to compare islands and to establish priorities. A first list of over a thousand islands is reduced to a shorter list of over 200 islands with particular natural richness, endemic species or protected areas. For these islands, the many different factors that contribute to the conservation interest of an island, to the threats to that interest, and to the practicality of taking some protective action are evaluated. Each island is rated for conservation importance on the basis of ecosystem and species richness, endemism, threatened and endangered species, special features, natural vulnerability, natural conservation status, practicality of conservation action, and reliability of data. The islands are also rated for human impacts such as population density and growth, resource use and economic development which can threaten their natural environments. Although such ratings are helpful in comparisons and rankings between islands, they must be used with caution because of the uncertainties involved in their calculation in a region where data are so uneven and imperfect.

While such a review can indicate international or regional priorities for protected areas, it cannot consider factors that are important at the national level, such as resource management, education, recreation, tourism, research and cultural preservation. These should be included by each country in their national conservation strategy which would be complementary to the present review.

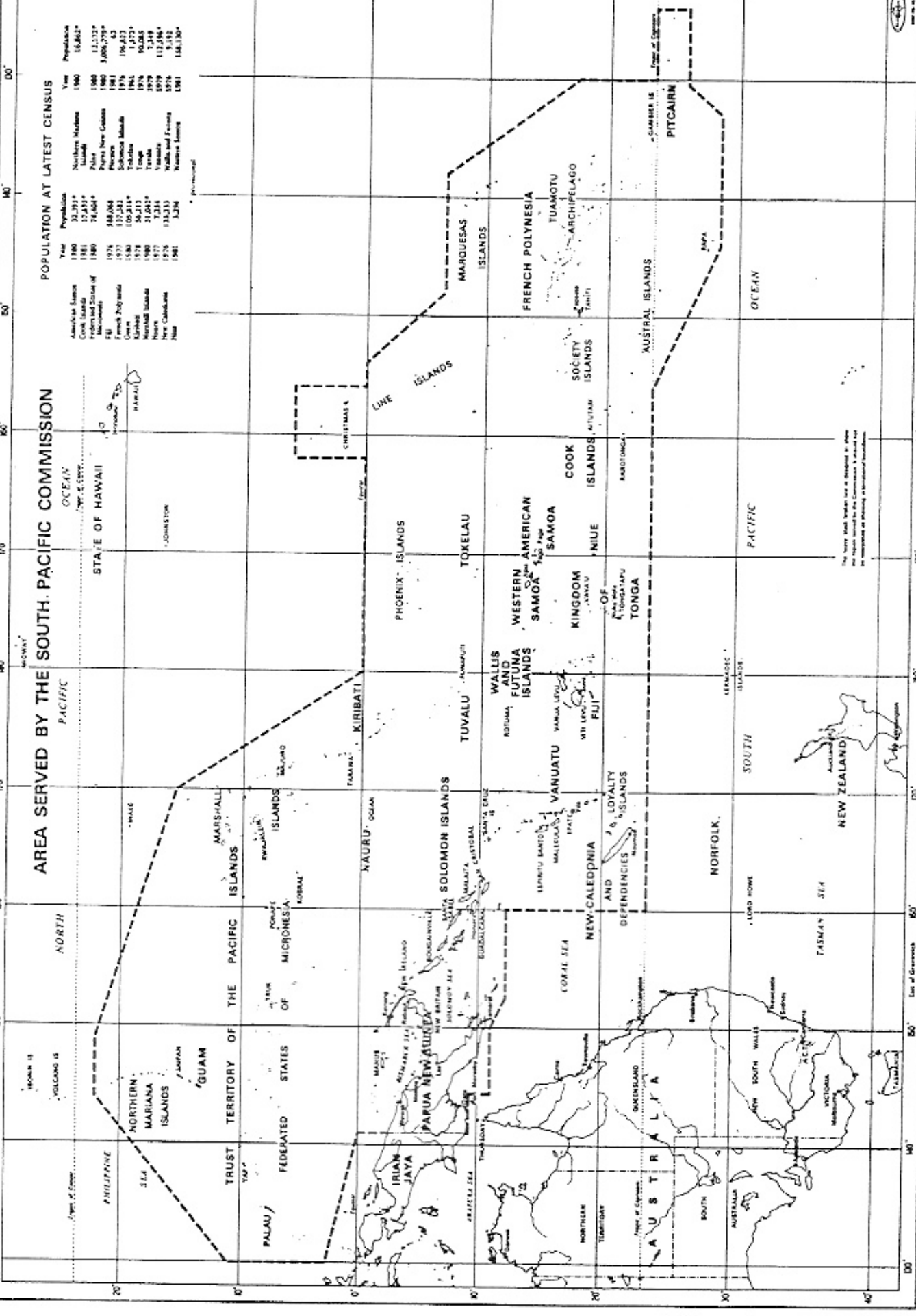
The conservation interest and status of knowledge of the major plant and animal groups are summarized, as well as the conservation approaches suitable for each major type of ecosystem.

The islands are then tabulated and ranked by country, by island type, and for the region as a whole. Tables also provide rankings by altitude, species endemism, human impact, and islands most at risk. Protected area coverage is listed by biogeographic province, by amount of area protected, and by percentage of the island protected as well as by country.

The protected area situation in each country is reviewed on the basis of the information collected. Suggestions for priority islands and habitats are given where appropriate, with a total of 77 islands identified for early action.

The Oceania Island List in the Annex summarizes available information for most of the islands in the region.

MAP I



AREA SERVED BY THE SOUTH PACIFIC COMMISSION

POPULATION AT LATEST CENSUS

Year	Population	Year	Population
1860	33,971*	1960	13,627*
1881	37,451*	1960	13,373*
1860	74,654*	1960	5,000,779*
		1961	63
1976	188,000	1976	196,837
1977	190,200	1977	40,020
1978	201,316	1978	1,5779
1979	208,313	1979	3,248
1980	216,842*	1979	1,368
1981	224,000	1979	1,125,964
1981	133,335	1979	5,182
1981	3,236	1981	158,320*

** Estimated*

American Samoa
 Cook Islands
 French Polynesia
 Niue
 Tokelau
 Tuvalu
 Wallis and Futuna
 New Caledonia
 New
 Year

Northern Mariana Islands
 Palau
 Papua New Guinea
 Solomon Islands
 Tonga
 Tuamotu
 Vanuatu
 Western American Samoa
 Northern Samoa

The heavy black border line is included in other maps issued by the Commission & should be considered as showing a transitional boundary.

120° 130° 140° 150° 160° 170° 180°

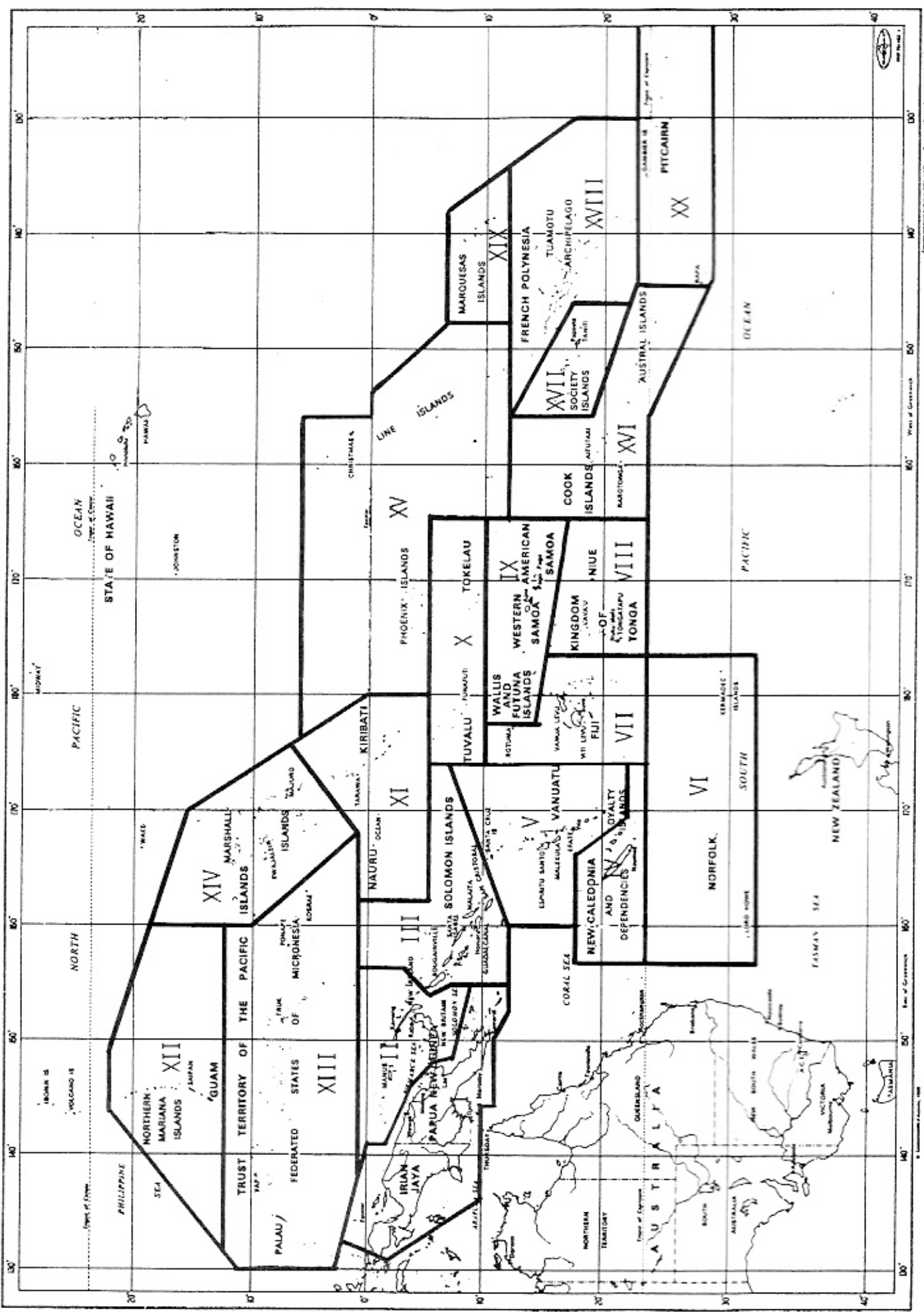
10° 20° 30° 40° 50°

PHOENIX ISLANDS
TOKELAU
LINE ISLANDS
MARIANAS ISLANDS
MARTIN ISLAND
NEW BRITAIN
NEW GUINEA
MELANESIA
VANUATU
TONGA
SAMOA
WESTERN AMERICAN SAMOA
TUAMOTU
ARCHIPELAGO
SOCIETY ISLANDS
COOK ISLANDS
NIEUE
FIJI
VANUATU
NEW CALEDONIA
AND DEPENDENCIES
AUSTRIAN ISLANDS
PITCAIRN
OCEAN
PACIFIC
SOUTH PACIFIC
NEW ZEALAND
NORFOLK ISLANDS
TASMAN SEA

STATE OF HAWAII
MARSHALL ISLANDS
FRENCH POLYNESIA
TUAMOTU
ARCHIPELAGO
SOCIETY ISLANDS
COOK ISLANDS
NIEUE
FIJI
VANUATU
NEW CALEDONIA
AND DEPENDENCIES
AUSTRIAN ISLANDS
PITCAIRN
OCEAN
PACIFIC
SOUTH PACIFIC
NEW ZEALAND
NORFOLK ISLANDS
TASMAN SEA

PHILIPPINE ISLANDS
NORTHERN MARIANA ISLANDS
JAPAN
GUAM
TRUST TERRITORY OF THE PACIFIC ISLANDS
PALAU
FEDERATED STATES OF MICRONESIA
MARSHALL ISLANDS
KIRIBATI
NORFOLK ISLANDS
NEW ZEALAND
TASMAN SEA
AUSTRALIA
NEW SOUTH WALES
ACT
NORTHERN TERRITORY
SOUTH TERRITORY
AUSTRIAN ISLANDS
PITCAIRN
OCEAN
PACIFIC
SOUTH PACIFIC
NEW ZEALAND
NORFOLK ISLANDS
TASMAN SEA

MAP 2: BIOGEOGRAPHIC PROVINCES



REVIEW OF THE PROTECTED AREAS SYSTEM IN OCEANIA

INTRODUCTION

Definition of the region

The region referred to as Oceania is centred on the islands of the tropical Pacific Ocean. However its boundaries vary depending on the criteria used to define it. Oceania can be defined anthropologically as the region peopled by the Micronesians, Melanesians and Polynesians. Geographically it may refer to the islands scattered across the tropical Pacific far from continental margins. Politically Oceania may be another term for what is usually called the South Pacific (even though including the parts of Micronesia north of the equator) and which corresponds to the area served by the South Pacific Commission (SPC) as shown in Map 1.

For the purposes of this review, Oceania is defined as the area served by the SPC and its South Pacific Regional Environment Programme (SPREP) with some minor additions. The reasons for this choice follow.

Hawaii and the other nearby islands belonging to the United States in the north Pacific (Wake, Johnston, Midway) would seem logically to be part of Oceania, but they are so much more developed and better known scientifically, and have so much greater access to resources for conservation action, that their inclusion in this review would throw it out of balance without adding to its usefulness.

Some Japanese islands approach the region on the north, but their location north of the Tropic of Cancer justifies their exclusion.

The island of New Guinea is a special problem. It is unreasonable scientifically to split an island down the middle, but politically the western half, Irian Jaya, is best considered with the rest of Indonesia and is thus excluded here. While the eastern half is nearly an order of magnitude bigger than the rest of Oceania, the other islands of Papua New Guinea fit very well into the region, and it would not be logical to treat only part of the country. In addition Papua New Guinea's closest political ties are with the region through organizations such as SPC and the South Pacific Forum.

The sub-tropical islands and reefs at the southern fringe of the region, including Norfolk, Lord Howe and the Kermadecs, are not (or no longer in the case of Norfolk) part of the SPC area, but they are included since they share some common characteristics with nearby islands or with other sub-tropical islands such as Rapa and Pitcairn which are within the region.

Similarly, Easter Island on the east has been included on the basis of its Polynesian and biogeographic affinities even though it is politically apart. The other islands of the eastern Pacific (Galapagos, Juan Fernandez, etc.) have sometimes been included in Oceania, but they are biogeographically and politically much closer to the neo-tropics of South and Central America and are thus excluded here.

Special characteristics of Oceania

The region covered by this review is distinctive in a world dominated by continental areas. Its size and the great variety of islands scattered over enormous distances set it apart as a place where the various mechanisms of island biogeography and evolution have been able to work particularly clearly free of nearby continental influences. Each island is a kind of "micro-unit" of evolution, and has developed over centuries and millenia in its own unique way depending on its size, location and degree of isolation. The total land area of Oceania is very small, but the region has the world's highest proportions of endangered species (Dahl, 1984a, b), and probably endemic species, per unit of land area or per inhabitant.

The Pacific is also the world's great ocean and an important centre of marine evolution. While marine biogeography in the region is still in its infancy, it is also of great scientific interest. For example, coral reefs are an ancient and highly productive ecosystem that survived in the Pacific even during the ice ages. There are gradients of diminishing coral reef species from west to east and from the equator towards more temperate waters. In the eastern parts of Oceania, coral reef species diversity seems to decrease to the point that niches become available and species endemism increases. Each island coral reef may thus be different in some ways from the others across the region.

Reviewing the protected areas system

As development proceeds around the world, undisturbed natural environments continue to shrink, threatening the survival of much of the world's natural heritage of plants, animals and the ecosystems in which they live. Conserving viable samples of these natural systems, especially through protected areas such as national parks and reserves, has become urgent as an essential foundation for sound development in the future. However the human and material resources available for conservation action are very limited, and it is necessary to develop short- and long-term strategies and to define priorities, so that as much of this natural heritage as possible can be saved for future generations.

This review aims to provide a framework for the development of a protected areas system in Oceania. It looks at the conservation needs of the region as a whole, both to identify areas where rapid conservation action is needed now before it is too late, and to provide a basis for long-term planning. It should be seen as a compliment to national conservation strategies and plans, which alone can treat specific areas and islands in the necessary detail.

Since many species and types of ecosystems are shared among countries, only a regional review can show where conservation can be achieved most easily and effectively. Such a review can also identify areas whose conservation interest may not be sufficiently appreciated nationally.

The approach used in this review has necessarily been different from that used in the protected area system reviews of other regions. Where continents may have broad vegetation zones and vast land areas from which to select samples for protection, an island region like Oceania is made up of many discrete units, each with its own particularities. The fauna, flora and

natural systems of an island are determined by interactions between its origins and structure, its biogeographic location and proximity to other land areas, and its size, climate, vulnerability to natural disasters, and other factors. Each island thus represents a different set of variations on the island theme, and conservation requirements for land and nearshore environments can only be considered on an island basis.

Since open ocean protected areas do not yet have wide international acceptance, they are not considered in this review.

Methods

This review is based on an island by island compilation of data, since choices concerning the location of protected areas will have to be made in the first instance on the basis of individual islands. A first listing was made of all islands (and some reefs) of sufficient size and/or isolation to be potentially of some distinct conservation interest (see the Oceania Island List in the Annex). This list excludes islands that are so small and so close to other land areas that they can best be considered as mere extensions of that land. Based on this list, a second list was then prepared of 226 islands known to have features such as endemic species or protected areas which give them some conservation importance. The islands in the second list were then rated and sorted according to various factors as explained in the Appendix. However, it should not be assumed that these are the only islands with conservation interest. Many islands not included on the shorter list may still have protected area potential, either for some special feature such as a seabird rookery, or as a typical and readily-preserved example of a more widespread ecosystem type. Islands may also not have been selected only because too little information about them was available to judge their importance. Any national conservation strategy should thus review all islands in the country, and not just those selected here.

The information used in this review has been drawn in part from several compilations and sources. The names of islands follow the list of islands prepared by the Pacific Scientific Information Center (1983), based on the most recent official usage in each country. There have been many recent changes in island names in some countries, often replacing earlier colonial names or spellings by ones reflecting local usage. Old names or variant spellings are shown in parentheses. Some smaller islands in archipelagos have been deleted to save space. The island descriptions and other geographic information have come in part from the Pacific Islands Checklist (Douglas, 1969) with extensive updating where more recent or complete information was available. This list thus largely replaces and expands on the checklist except for some references to the older scientific literature.

Four other sources should be seen as complimentary to this review, and should be referred to for further details on their particular topics. The Regional Ecosystems Survey of the South Pacific Area (Dahl, 1980) gives more information on the biomes and habitats in each biogeographic province (Map 2). It also includes lists of proposed and recommended protected areas or area types that have not been repeated here since most of those recommendations are still valid. The IUCN Directory of Protected Areas in Oceania (IUCN CMC, 1985a) provides more detail on most of the existing protected areas which are therefore only listed here. It also gives information on conservation legislation and protected areas administration for each country. The IUCN Directory of Coral Reefs of International Importance (IUCN CMC, 1985b)

gives more information on reefs generally and also references to the scientific literature describing reefs in the region. The indication "CRD" in the island list shows where specific reef descriptions are available in the IUCN directory. The IUCN and ICBP Red Data Books on threatened and endangered species provide detailed reports on many such species in the region. Species treated in one of these volumes are indicated by "RDB" in the list.

It has not been practical to cite the origins of all the information in the Oceania Island List. Complete references would have made the list unwieldy, and often the same (or contradictory) information was obtained from several sources. The principal sources are listed under References. More details on the island list are included in the introduction to the list in the Annex.

In order to permit comparisons and rankings between islands in Oceania for their conservation interest, as many pertinent factors as possible have been converted into simple numerical scales or ratings. Ratings have been calculated or estimated for ecosystem richness, species richness, endemism, economic pressure, human threat, natural vulnerability, natural conservation status, practicality of conservation action, and reliability of data. From these ratings and other data, two broad combined ratings have been calculated for each island listed in the tables. The Human Impact (HI) rating measures the threat presented to the natural environment by population density and growth, resource use and economic development. The Conservation Importance (CI) rating integrates information on ecosystem and species richness, endemism, threatened and endangered species, special features, natural vulnerability, natural conservation status, practicality of conservation action and reliability of data into a overall measure of the importance of the island for nature conservation. The fact that these ratings are numbers should not hide the fact that many involve an element of subjective judgement; they are used because they make those subjective elements explicit and thus open to review and modification. The detailed descriptions of these ratings and the methods used to calculate them are described in the Appendix.

While such numerical ratings can be useful in identifying islands of particular conservation significance and priority areas for action, care should be taken not to place too much weight on small differences in ratings, particularly since the data on which they are based are in many cases approximate or imperfect. Any such use of numbers tends to give an impression of accuracy which is often not justified, and they should be seen more as orders of magnitude than as precise and definitive measures. The problems with the data are discussed in detail in the introduction to the Oceania Island List in the Annex. The CI rating is also structured to favour greater ecological complexity, species diversity, endemism and larger numbers of threatened species. As such it undervalues smaller or simpler islands which may have great conservation interest for their simplicity and pristine state.

The CI rating is also sensitive to the amount of information available on an island. Better-known islands tend to rank higher because more species groups have been studied and more endemic or threatened species have been found. This is logical in that it favours action for known conservation problems over those that may just be suspected, but it hides the fact that many islands probably have serious problems that have not yet been identified. This dilemma cannot be avoided, but it is important to be aware of it.

While marine conservation is an important priority in the region, the coastal marine information available is inadequate for an island by island evaluation. Although the ratings used here are based solely on terrestrial data, some of the factors in the ratings also apply to the marine environment and similar biogeographic and evolutionary forces may be operating there. Thus in the absence of better information on coastal habitats, the ratings together with the marine data in the island list could be used with caution in suggesting priorities for marine conservation action. However reefs without land areas which have thus not been rated should not be overlooked. Since land and marine areas are often interrelated, any protected areas along coastlines should include both land and marine areas whenever possible.

Factors not considered in this regional synthesis

This regional approach to identifying islands in Oceania where conservation is most important or most needed does not take into account factors that may be of great national importance even if they carry less weight at the regional or international level. Some of these factors follow:

- a) Protected areas and other conservation actions may be important in managing the natural resources of an island or country. A reserve may protect an important water supply catchment, or may maintain a breeding population of a bird hunted locally for food even if the bird is not a threatened species. A marine reserve may cushion a reef area from the damaging effects of overfishing.
- b) Many other values of protected areas can be developed as part of a national conservation strategy or plan. A country's first park may not be in the area of greatest natural interest, but located where it can be accessible and demonstrate to the local people the importance of parks. Protected areas can be important for education, tourism development, recreation, and scientific research. None of these values enter into a regional survey, but they are extremely important at the national level.
- c) Protected areas can be significant in maintaining traditional cultures and lifestyles. Many island cultures had sacred or taboo areas which often served a nature conservation function in addition to their spiritual significance. The modern use of protective measures can reinforce traditional techniques of resource management which have proven their worth over generations. Important cultural or historic sites, and even traditional collecting and hunting grounds can be safeguarded in appropriate types of protected areas where traditional uses can continue. Such culturally important sites should be inventoried at the national level.
- d) In the selection of protected areas, the ideal of conservation importance may have to be subordinated to more practical questions. Land tenure or land ownership, public interest or opposition, political support, and legislative provisions are all of major importance. A protected area that is less than ideal but effective may achieve more for conservation than the perfect area that is never created or that cannot be enforced. While a rating for practicality of conservation action is included in calculating conservation importance, it may need to be given more weighting in particular circumstances.

RESULTS

Species dispersal in Oceania

Each group of plants and animals is spread or dispersed in different ways. Some are better adapted than others to crossing ocean barriers between islands. Some may be carried by the wind, others transported by migrating animals, and still others drift on the ocean surface, perhaps transported by a floating log. Not all these means of transport come from the same continental sources, go in the same directions or cover the same distances. The result in terms of biogeography in Oceania is that different groups of organisms are distributed in very different ways. Depending on what they found on an island, they may or may not have evolved into new and different forms, or radiated into a variety of available niches. The conservation interest of an island or island group may thus be very different depending on which kind of organisms are being considered.

Plants have reached the islands of Oceania by different routes. A few islands of continental origin such as New Caledonia have preserved remnants of the ancient flora inherited before they broke off from the main continental mass and preserved since in isolation. Others such as New Guinea may have been connected by land bridges over which plants could spread, or have been near enough to continents or other islands for many species to be transported over the short water gaps separating them. Some seeds may be carried in the stomachs of birds, others blown by the wind, and still others adapted for floating on the water. As a result each island may have a mixture of different plant types. Older and more mountainous islands may have old, long-established and sometimes unusual forms. Low coral islands and coastal areas generally have an atoll/beach forest or scrub of widespread water-dispersed species. Very remote high or raised coral islands may have been colonized sufficiently rarely to have evolved unique local forms.

Insects have not generally been well studied in Oceania. The butterflies are the only group for which a reasonable quantity of regional data are available. Since butterflies are both fragile and wind borne, their chance colonization of different islands has created some interesting distribution patterns, although they are heavily concentrated in the western Pacific where distances between islands are not so great.

Among the other invertebrates, the **land snails** have attracted particular attention because of the large numbers of endemic forms on certain Pacific islands. It is often the more remote islands such as some in French Polynesia that have seen the most explosive development of new land snail species.

While the **amphibians** are largely restricted to the larger western Pacific islands, certain groups of **reptiles** such as the geckos and skinks have reached islands across most of the region. In some places like New Caledonia they too have undergone an amazing adaptive radiation. There are no unique species of sea turtles in Oceania, but nesting areas for species considered threatened on a world basis are widespread in the region as indicated in the island list. As the numbers of turtles continue to decline with overhunting, the protection of all nesting sites becomes increasingly important.

The birds are the best known species group all across Oceania. Papua New Guinea is of course unique with its large number of species of both Asian and Australian origins. In much of the rest of Oceania, bird colonizations have been sufficiently rare for many different forms to evolve, often restricted to particular islands. Thus while the total number of bird species on an island may be small, the species present may be of considerable conservation interest. A few islands also have unusual bird species of ancient origin and uncertain relationships. In addition to the land birds, migrating shore birds frequently stop in the region, and many islands harbour populations of seabirds which, though wide ranging, depend on their remote and vulnerable island rookeries for reproduction and thus survival. Many islands with seabird rookeries are indicated in the island list in the Annex. Since seabirds are a regional resource ranging over many countries, it may be appropriate to plan for a regional network of reserves in these critical nesting habitats.

Apart from Papua New Guinea with its Australian connections, most **mammals** did not successfully cross the seas without the help of man and are thus of little conservation interest in the region. In fact, it was often the absence of predatory or grazing mammals that permitted many unique island forms to evolve as they did. Apart from the widespread Polynesian rat which may have travelled with early man, the only mammals that reached many islands are marine mammals such as the dugong in the western Pacific, and fruit bats or flying foxes which spread widely and in a few cases evolved local species or varieties.

The marine biogeography of the Pacific is even less well known than terrestrial biogeography, although coastal and shallow water marine species often face the same kinds of barriers to inter-island migration as land species. In general the greatest diversity of species is centred in the Indo-malayan region of the western Pacific, with the numbers of species decreasing eastward. However the poorer communities of the eastern Pacific islands also seem to show increased species endemism, at least in some groups, as the disappearance of some common species has allowed new forms to evolve. The islands in the somewhat cooler waters north and south of the equator also show significant admixtures of more temperate elements. Thus while there may be more of a biological continuum across Oceania in the marine environment than on land, the differences between island groups are such that each part of the region presents some conservation interest.

Ecosystem conservation strategies

One of the major goals of any conservation strategy is to preserve the diversity of species, ecosystems and genetic resources that has evolved on the planet. Since species can seldom be preserved without the ecosystems of which they are a part, most protected areas are created to preserve what are hoped to be viable samples of ecosystems. Since each type of ecosystem has its own characteristics, common species or features, and particular distribution among the islands of Oceania, it is worthwhile considering briefly the appropriate regional conservation strategy for each major ecosystem or biome type recognized in the Regional Ecosystems Survey (Dahl, 1980).

Lowland rain forests were originally one of the principal vegetation types on high islands. However, they have been the most disturbed by human activity since they are the first to be logged or cleared for agriculture and other development. They tend to be richer and more distinctive in the western Pacific, with different dominant species from province to province. In central

Oceania, widespread species tend to be the dominant elements. Because of the development pressures on these forests, representative examples of each type should be identified and protected relatively quickly in Papua New Guinea, the Solomon Islands and Vanuatu so that development can be directed elsewhere. In the rest of Oceania, lowland rain forests generally survive only as small fragments or in remote islands or areas. Wherever it is still possible, these remaining samples should be included in protected areas.

Limestone forests are a distinctive type of lowland rain forest with different species growing on raised coral substrates. Many of these forests have also been cleared for development, and the remaining undisturbed examples should be preserved whenever possible. Even many remote raised coral islands have been mined for phosphates, destroying their forest cover. Henderson and Rennell are isolated raised coral islands of particular conservation interest, and there are some smaller undisturbed islands in Belau and Fiji.

Montane and sub-montane rain forests at higher elevations are generally of considerable conservation interest wherever they occur, and may be the habitat for many endemic species. While they may be logged or cleared for agriculture on a few islands, the greatest threats on others may come from uncontrolled burning and grazing by feral animals. Their steep topography often provides some natural protection from human intrusion, and their lesser value for development and frequent importance for water catchment and erosion control may make it easier to include them in protected areas.

Cloud forest is a distinctive forest type of constantly wet mountain tops. It frequently contains rare and endemic species and should be protected wherever it occurs.

Special forest types such as **riverine forest, swamp and bog forest, bamboo forest** and **seasonal or semi-deciduous forest** may occur in specific localized areas. Samples of such types should be protected as part of any comprehensive conservation plan. Riverine and swamp forests may play an important part in erosion prevention and flood control, and may warrant protection for that reason.

Atoll/beach strand forest was common in Oceania on atolls, low coral islands and behind beaches on high islands, but it has frequently been cleared for coconut plantations and other development. While generally composed of widespread species of little conservation interest, it may be an important habitat for atoll birds and tree-nesting seabirds, and should be protected in such cases. It can also be important in protecting coastal areas from storm damage.

Mangrove forests are a common coastal ecosystem in the western Pacific but become increasingly scarce eastward and are absent in the eastern part of Oceania except where they have been introduced. The number of mangrove species also decreases from west to east. The principal conservation interest of mangroves lies in their importance as critical breeding habitats and food sources for many important marine species in coastal waters. Mangroves protect coastlines from erosion, supply firewood, and support significant subsistence fisheries. Since coastal land is scarce on islands, mangrove swamps are frequently filled in or otherwise developed. Where mangroves are scarce, they should be given some form of protection from overexploitation, pollution and development. Where large areas of mangrove

forests occur, some proportion can probably be developed, but sufficient areas should be protected to maintain their important role in coastal ecosystems and fisheries.

Various forms of **scrub** and other low woody vegetation are widespread in Oceania. They are frequently of secondary origin and little conservation interest, although on some islands they may provide habitat for birds and other species of importance. A special case is the scrub or "maquis" on ultrabasic or serpentine soils in New Caledonia composed almost entirely of endemic species, including many primitive species of great conservation importance. Wherever in the region such distinctive soil types occur, their floras should receive special conservation attention.

Grasslands and **savannas** with various proportions of trees cover large areas in Oceania, but in almost all cases they are secondary vegetation types resulting from frequent burning or grazing by feral or domestic animals. They consist largely of introduced grasses and are usually of little conservation interest.

Freshwater marshes, swamps and **bogs** occur frequently in localized areas, but many have been modified for taro cultivation. Any remaining natural marshes should be examined for their conservation importance.

Freshwater habitats such as **streams, rivers** and **lakes** are known in some areas to have unusual or endemic species, but in general they have been little studied in Oceania and their significance is thus unknown. Since they may be important for water supplies, and have scenic and recreational value, they should be included in protected areas whenever possible.

Desert-like areas such as sand dunes are very rare in Oceania and are thus features worth protecting. Barren areas resulting from volcanic activity are more frequent, and are often of scientific interest for studies of early colonization, as well as being potential tourist sites. They seldom have development potential and should thus be easy to include in protected areas.

Caves occur on many islands with raised limestone or in recent volcanic areas with lava tubes. They may be important for bats and other cave fauna, and in a few cases may harbour endemic species.

The shallow coastal environments are less well known than terrestrial island areas, but they are as subject to development and disturbance as the adjacent land.

Seagrass beds, like mangroves, become less frequent and poorer in species from west to east across Oceania. They are important feeding areas for fish and endangered species such as dugongs and sea turtles, and should be included in conservation planning.

Coral reefs are one of the most significant ecosystem types in the region, and are even responsible for building many of the islands of Oceania. They occur in a variety of forms including windward and leeward atoll reefs, barrier reefs, fringing reefs, and lagoon or patch reefs. They may also be built predominantly by corals or by coralline algae. They may stop growing if they have been submerged too quickly, or if the reef-building animals and plants have been replaced by other forms. Since coral reef species diversity and composition change across the region, appropriate examples of each reef

type should be protected in each biogeographic province. Spectacular or unusual reef features should also be included in protected areas, particularly if they are at risk from development, overfishing or heavy tourist use.

Beaches and sandy or sedimentary bottoms may also have a distinctive fauna and flora, and examples of these should be included in protected areas where they are common even though they may be less "spectacular" than many other ecosystems.

Rocky shorelines are much less common in Oceania than in other parts of the world, but where they occur they may be ecologically distinctive and support species not found elsewhere on the island. If they are at risk they may require some form of protection.

Oceania has a great variety of types of **lagoons** ranging from open lagoons little different from the surrounding ocean to completely closed lagoons with fresh or highly saline water, or to coastal lagoons and estuaries with heavy terrestrial influences. These conditions often result in unique combinations of species and ecosystems, sometimes with a small number of species occurring in great abundance. Some of the more extreme lagoon types may deserve special conservation action, and some examples of the more typical types should also be incorporated into comprehensive conservation plans. The few **marine lakes** in the region are unique and deserve protected area status.

Conservation significance of individual islands

The different types of information collected for this review have been used to give numerical ratings for conservation importance and human impact to the 226 most significant islands listed in the tables. While care should be taken not to put too much weight on such single ratings for various reasons explained below and elsewhere in this review, they can help to identify islands deserving priority attention for conservation action. The information can also be sorted according to different criteria to show, for instance, which islands are most important in each part of Oceania, or which are important for some particular characteristic. The following sections and the accompanying tables give the conclusions of some of these analyses.

The ratings in this review are based on presently available knowledge, and should this be considered as preliminary and very approximative. Changes in the values and relative positions of different islands can be expected as more information becomes available. Well-known islands tend to score higher than those that have not been fully studied, and information on such groups as insects, when available, can make a considerable difference in the ratings. It has unfortunately not been possible to remove entirely the bias introduced by the variations in the quantity and quality of the information available for each island.

While the analyses of conservation importance have been kept separate from the consideration of existing protected areas, it will be evident that islands with protected areas frequently score higher than those that have no protection. This in part reflects the actual conservation interest of the islands which led to the creation of the parks and reserves, but it is also in part an artifact due to the fact that such islands are better studied and more widely known because of their protected areas.

There is some problem in comparing single isolated islands with those clustered in archipelagos. Single island endemism may be higher for isolated islands, while islands in a group may share endemics with other nearby islands. This has been partly adjusted for in the ratings by including both island endemics and group endemics.

It cannot be emphasized too strongly that the comparison of islands across the region should not undermine the conservation efforts of any country based on any supposed lesser conservation value. Regional conservation interest is only one of many reasons for creating protected areas, and the wise management of whatever natural resources a country possesses can be just as important as regional or international significance.

The rankings of the islands in each country for **conservation importance (CI)** are shown in Table 1. Table 2 gives the CI rankings for the region as a whole, together with the values on which they are based. The abbreviations, definitions and methods of calculation are explained in the Appendix. New Caledonia comes out with the highest CI ranking (80) in the region, both because of its unique flora and fauna, and because of the high number of threatened species that have been identified. Lord Howe Island is in second place, although much smaller in size; its great isolation produced many endemic species, most of which are threatened. New Guinea is obviously the richest island in Oceania biologically, but it is only in third place in this rating of conservation importance because much of the island is still little disturbed and not many of its thousands of species are presently known to be in danger. Norfolk Island, in fourth place, is in a similar situation to Lord Howe. Viti Levu and New Britain, fifth and sixth, are both large and biologically diverse islands, and so on. The reasons for the position of each island in the ranking will usually be evident from the data columns and the descriptive information in the island list (see Annex). The column on the far right gives a numerical ranking for protected area coverage, so that this can be compared with conservation importance.

Each **type of island** is unique in its structure and the kinds of biological communities it can support. Table 3 therefore shows the rankings by conservation interest (CI) for each type of island, illustrating the best or most interesting examples of each type. Where islands are composites of several types, only the predominant type has been shown in this table. Among the few continental islands in the region (Table 3A), New Caledonia, New Guinea and Viti Levu (Fiji) obviously stand out. The volcanic islands (Table 3B) are both numerous (half the total list) and diverse in their size, age and structure. It is interesting that the top-ranking islands are from many different parts of the region, showing that no one part of Oceania has a monopoly on conservation importance. The atolls (Table 3C) are much simpler islands terrestrially, and this is reflected in their generally lower CI scores. Kiritimati and Ninigo Islands share the highest score, the former for its seabird populations, the latter because of an unusually high number of endemic land bird forms for an atoll. Among the low islands (Table 3D), the Talele Islands come out highest because they are already protected and share in the high group endemism of the Bismark Archipelago. The next five are all remote central Pacific islands. The raised coral islands (Table 3E) have their own special conservation interest, being generally much richer than atolls or low coral islands. Guam scores highest due to its large number of endangered species. Rennell and Henderson, in second and third places, are both relatively isolated, with high percentages of species endemism.

The mountain tops of high islands are particularly isolated environments which frequently harbour unique communities and species. Table 4 ranks by altitude the 50 islands (for which the altitude was known) reaching 700 metres or more.

Species endemism is one of the most important characteristics that give the islands of Oceania their conservation interest. While the data for endemic species are still variable and incomplete, the available information is summarized in Table 5, which ranks the islands by the number of endemic species. New Guinea and New Caledonia are obviously in first and second place. Lord Howe is surprisingly high for its size, probably because it is much better known in poorly-studied groups such as insects and other invertebrates. Since the birds are the best-known group all across the region, Table 6 ranks the islands by the number of single island endemic bird species or subspecies. While New Guinea and New Caledonia are highest as expected, Rennell is in third place, followed by New Britain, San Cristobal, Sunday (Kermadecs) and Futuna.

In determining priorities for conservation action, it is necessary not only to know what the conservation interest of an island is, but also how much that natural value is at risk. The **human impact (HI)** rating is intended to show the level of present and future risk to an island from its human population and their activities. Table 7 ranks the islands according to the amount of human impact. Those with a HI of 0 are generally uninhabited, or with a small or diminishing population. At the other extreme are islands with very high population densities and growth rates, where conservation action will be difficult given the high pressure on natural resources. This rating does not measure past human impact from activities which have now ceased, such as mining, warfare or previous habitation, so it does not show total disturbance, but only present risk.

Combining high values for human impact (5 or greater) and high values for conservation interest (10 or greater) produces a list of **islands most at risk** (Table 8). These are islands on which conservation action is particularly urgent because of the pressures of the human population.

Present protected areas in Oceania

Having reviewed the conservation interest of Oceania from different perspectives, it is necessary to see how much is already included in some kind of protected area. 101 protected areas are recorded for 50 islands on the list, covering a total land area of 7,821 square kilometres. However, this is less than a quarter of the islands with conservation interest, and only a small fraction of the surface area and ecosystems of those islands. At best less than 20% of the region's ecosystems are included in protected areas (Dahl, 1985b). The great majority of species and ecosystems still lack adequate protection.

The present protected area situation has been analyzed further using the data in the island list. Table 9 lists islands with protected areas by biogeographic province (Dahl, 1980 and Map 2). Three provinces have no protected areas: X: Tuvalu-Tokelau; XI: Kiribati-Nauru; and XVI: Cook-Austral Islands. The Society Islands (XVII) have only a marine reserve, and several others have only very small reserves. Only provinces VI: Norfolk-Lord Howe-Kermadec and XV: Phoenix-Line-Northern Cook Islands can be considered well covered by protected areas.

The situation is similar when the amount of area protected is considered (Table 10). Of the fifty islands with protected areas, only nineteen have parks and reserves totalling more than 10 square kilometers (1,000 hectares), and only five more than 100 square kilometres. Only Papua New Guinea has more than 5,000 square kilometres of protected areas, and this is still barely 1 percent of the land area of the island.

Looked at in terms of the percentage of the island that is protected (Table 11), half the islands with protected areas (25) are small islands that are entirely protected, many of them remote and uninhabited. Only five: Norfolk, Lord Howe, Easter and two in Papua New Guinea, have more than 10 percent of their area protected. Another five, including such important islands as New Caledonia, Guam, Taveuni (Fiji) and Upolu (Western Samoa) have 3 to 9 percent of their area protected. For the others 1 percent or less of the land has protected status.

These figures do not take into consideration the type of protection afforded in these areas. Some are only bird sanctuaries or provide for some protection and management of wildlife. The legislation in some countries does not provide complete protection against all kinds of development. Even where the legislation is adequate, enforcement is difficult, so that encroachments or illegal exploitation may occur, or the actual area protected may be less than the declared size of the park or reserve. Few if any protected areas in Oceania are well protected in fact as well as in law. Thus while some progress has been made, the present protected area system of Oceania is still far from adequate.

Obviously priority should be given to the strengthening of protective measures for existing reserves and the provision of adequate means for enforcement. In the small island situation, enforcement is only possible with wide public support, so education and public information are essential to any plan to improve protected area management.

Strategies for development of the protected areas system

No single strategy for developing protected areas will be appropriate for all islands or all countries in the region. Large islands with extensive undisturbed natural areas and low population densities need to develop a long-term conservation strategy which allows for careful selection of sites and gradual development of protected areas before the most significant natural features are threatened by development. Heavily populated islands, on the other hand, may need to take rapid steps to protect the few remaining natural areas before they disappear entirely. Where species are already in danger from predation or habitat destruction, steps may need to be taken to restore appropriate habitat types or to control introduced predators or competitors.

In the same way, there are many types of protected areas which can be adapted to local island needs, conservation requirements and land tenure situations. Protected areas are not just national parks and nature reserves, although these have their place. On a small island conservation of nature needs to be combined whenever possible with other uses of the limited space available. There is no reason why, for instance, a protected remnant of lowland rain forest cannot also serve educational or recreational uses which are compatible with its preservation. Some types of protected areas allow or encourage uses of resources or even the continuation of traditional lifestyles when this is in harmony with the basic goal of conservation. Further information on the many types of protected areas is available in various IUCN publications.

The Action Strategy for Protected Areas in the South Pacific Region (SPC, 1986) adopted at the Third South Pacific National Parks and Reserves Conference (1985) and accepted by the South Pacific Conference in October 1985 sets many objectives for protected area development, among which are the following targets for the next four years:

- the establishment of at least one protected area in each country and territory of the region and the establishment of an additional 50 protected areas in the region as a whole; and
- an increase to 40% in the number of ecosystems receiving some kind of protection.

To achieve such targets it is necessary to identify possible priority areas for action in each country of the region. This country perspective is particularly important since protected areas can only be created on a national basis. Ratings within a country are thus often more important than comparisons between countries in developing a national conservation strategy and in selecting sites for protected areas. Table 1 provides a country by country list of the islands identified in this survey as having the greatest conservation significance, together with existing protected area information, human impact (HI) ratings and conservation importance (CI) ratings. The following discussion of each country is based on this table and the information in the island list.

Northern Mariana Islands

The two islands protected under the constitution, Maug and Sarigan, should be supplemented by protected areas on the islands with the highest conservation interest, Ascuncion and Rota. Saipan may also be worthy of priority attention as one of the islands most at risk. The existing recommendations for marine sanctuaries provide a good selection of priority marine conservation areas.

Guam

Guam ranks highly for its endemism, and as one of the islands most at risk. The recent decline in endemic species populations shows that present protected areas and other measures are not sufficient. Attention should be focussed on improving the protection of remaining natural areas, particularly undisturbed forest, and possibly also on planting and restoration programmes to try to increase the area of appropriate habitats.

Belau

The Ngerukuid Reserve is too small to protect Belau's natural heritage adequately. Terrestrial reserves should be considered on Babeldaob and in the Chelbacheb Islands, including the marine lakes. The richness of the marine environment warrants protection in some significant marine reserves at sites such as Ngemlis. Helen should probably also be protected because of the problem with poaching.

Federated States of Micronesia

The complete lack of protected areas in the Federated States of Micronesia should be remedied as rapidly as possible. All the highly rated high islands for conservation importance (Pohnpei, Kosrae, Yap and Tol) are also among the islands most at risk. Pohnpei and Yap also rate highly for endemic species. Some of the islands with significant seabird rookeries and turtle nesting area should also be protected. Marine reserves should be selected in each state, both to represent the natural richness of the region and for their usefulness in fisheries management.

Marshall Islands

The old protected status of Bokaak and Bikar should be confirmed by appropriate legislation. New smaller reserves for birds and remaining areas of natural vegetation on other atolls should also be considered. At least one major coral reef protected area should be created.

Papua New Guinea

Only a comprehensive national conservation plan could identify the appropriate priorities for protected areas in Papua New Guinea. It is clear from the limited data available that more protected areas will eventually be needed to cover the great richness of life on the island of New Guinea, but attention should also be given to establishing or expanding significant protected areas on other large islands like New Britain, Goodenough, Bougainville, Fergusson, New Ireland and Manus. Smaller islands with significant endemism such as the Ninigo Islands and Luf (Hermit Islands) may actually be under greater relative human threat which could give them

priority for early action. The largely unexplored richness of Papua New Guinea's marine environments will eventually require a network of marine reserves.

Solomon Islands

The present protected area situation in the Solomon Islands is very weak, with much of the park on Guadalcanal degraded by subsistence gardens, and the Kolombangara forest reserve a 500 metre wide strip which may be unsustainable ecologically. Major protected areas should be considered for Rennell, San Cristobal, Guadalcanal, Malaita and Vanikolo, with smaller areas to protect interesting sites and species on other islands. Reforestation with native species might be considered alongside the Kolombangara reserve to reinforce it and buffer it from intrusions. As with Papua New Guinea, a national conservation plan should be developed and widely discussed to build the necessary public support for protected areas.

Vanuatu

Vanuatu presently has only one small marine reserve. A major protected area should be planned for Espirito Santo, and smaller reserves at least on Tanna, Anatom, and Erromango. A park that could also contribute to public recreation and tourism would be appropriate on Efate. Vanua Lava should receive some protection for its saltwater crocodile population.

New Caledonia

While New Caledonia already has an extensive series of reserves, they are still inadequate to protect the great richness of the island, which is among the islands most at risk. Additional reserves should perhaps be based on the requirements of individual species requiring further protection, such as the Kagu and certain restricted plants. Protected areas are also needed on the Isle of Pines, Mare, Ouvea and Lifou, and these will have to be developed with the support and under the control of the traditional land owners. Some of the remote islands and reefs with important seabird and turtle populations should also receive protection. New Caledonia already has the most important marine reserves in Oceania, but others will eventually be needed to cover the great diversity of reef and lagoon environments.

Australian and New Zealand territories in Oceania

Lord Howe, Norfolk and the Kermadec Islands all rank high in conservation interest, and all have already seen important recent efforts to strengthen their protected area status and reduce the threats to their endemic species. Norfolk Island National Park was established early in 1986. Some of the interesting Australian reefs in the region are already protected and others are under consideration.

Fiji

While there are only a few significant protected areas in Fiji at present, the government does have a comprehensive parks and reserves plan identifying the further protection measures needed. Unfortunately the existence of a plan is no guarantee that it will be implemented. The challenge for Fiji is to identify those areas or species most immediately at risk for priority conservation action, and to mobilize enough public support to make that action possible. Obviously further protected areas are needed on Viti Levu and Vanua Levu, but smaller islands with particular features should not be overlooked. Representative examples of each island type, and a selection of marine areas, should also be included in protected areas.

Tonga

Tonga has some marine reserves and tiny protected islands, so the major priority should be for the establishment of significant protected areas on land. These should include the planned national park on 'Eua, the protection of 'Ata, and some protected areas on Niuafo'ou and Kao. Other small reserves should be considered for particular features, as should an expanded role for coral reef reserves in managing coastal fisheries with the support of the local population.

Niue

Niue has one of the few remaining traditional (taboo) protected areas in Oceania. It should be maintained, and reinforced with legislation if necessary. Other sites may also need protection if they are being degraded.

Wallis and Futuna

The territory has no protected areas. Futuna and Uvea are both among the islands most at risk. Futuna and Alofi both have significant endemism, and the latter also has a significant area of undisturbed forest. An important protected area should be considered on Alofi, and the remaining forest on Futuna should also receive protection.

Western Samoa

Western Samoa already has a good start with a parks and reserves survey, and important protected areas on Upolu. The highest priority would be for a major park in the centre of Savai'i, possibly also including a sample of lowland forest. Protection for both land and marine areas in the Aleipata Islands should also be considered. Since Upolu is among the islands most at risk, priority action may be needed for other areas identified in the parks survey if they come under threat.

American Samoa

With one remote atoll and one marine reserve, the urgent need in American Samoa is for protected areas on Tau, Tutuila, and Ofu, the latter two being particularly at risk.

Tokelau

There are no protected areas in Tokelau, and the possibilities of creating them on small inhabited atolls are limited. The remaining areas of atoll forest on Nukunonu should be protected. If traditional fisheries management begins to break down, then selected marine reserves may be useful as a replacement measure.

Tuvalu

As with Tokelau, there are no protected areas in Tuvalu and the possibilities are limited. Marine protected areas might be considered on Funafuti and Vaitupu to help control overfishing.

Nauru

Nauru has no reserves but there are a few species of conservation interest. Any remaining forest areas not scheduled to be mined should be included in a protected area, perhaps along with Buada lagoon. Some habitat restoration would also be worth considering.

Kiribati

There are no protected areas in province XI which includes the Gilbert Islands; the small forested islets with seabird rookeries on Butaritari and Nonouti might be considered for reserves under local management. There may also be a role for marine reserves in fisheries management. Seven of the Kiribati islands in the Line and Phoenix Islands are already protected. The only unprotected island that stands out for its conservation value is Teraina (Washington), where the bogs and other natural habitats might be worth protecting.

United States territories in Oceania

The American islands in the central Pacific with conservation value are already protected except for Palmyra.

Cook Islands

Suvarrow is the only protected area at present in the Cook Islands, and it only has moderate terrestrial conservation interest. Priority should be given to a major protected area in central Rarotonga, which both has considerable endemism, and is considered at risk. Natural areas on Mangaia, Mitiaro and possibly other islands should also receive protection if necessary for their endemic forms. Coastal and marine reserves could contribute to better environmental management.

French Polynesia

The four French Polynesian islands with the highest conservation interest have no protected areas: Nuku Hiva has the highest rating, and Tahiti, Rapa and Moorea are all among the islands most at risk. All have important species endemism, and the establishment of appropriate protected areas should be a high priority. Some habitat restoration may be needed on Moorea and other islands. The territory covers a number of island groups and biogeographic provinces, and many of the islands are subject to human pressures and the damage of feral animals. There are no terrestrial reserves in the Society Islands despite their great significance; in addition to Tahiti and Moorea, protected areas should be considered at least on Raiatea and possible Huahine and Tahaa. In the Austral Islands, Rimatara and Raivavao should be given priority for their endemism, as should Mangareva in the Gambier Islands. The Tuamotu atolls are simpler island ecosystems, with one reserve at Taiaro; additional reserves are needed at least at Matureivavao, Niau, Napuka and the raised coral island of Makatea, which despite former mining damage retains some significant species. The Marquesas are so unique biologically that the four present island reserves are inadequate and protected areas on each island could easily be justified. In addition to Nuku Hiva, priority should be given to protected areas on Hiva Oa and Ua Pou, and to the general control of feral animals which are causing great destruction. A representative series of marine reserves across the great expanse of French Polynesia should also be developed.

Pitcairn

Apart from Pitcairn, the islands of the group are all of conservation interest for their remoteness and lack of disturbance. Henderson is obviously the high priority for protected status because of its endemism and its rareness as an undisturbed raised coral island.

Chilean territories in Oceania

A major part of Easter Island is already protected.

Conclusions

The above listing identifies 77 islands which should be given priority for protected area establishment in accordance with the principles and targets adopted by the governments of the region and the evaluation made in this review. Obviously protection should not be refused other islands because they are not mentioned, as there are many justifiable criteria for conservation, not all of which could be considered here. Also, certain recommendations may well change as new information becomes available. However, failure to take action to protect the significant species and ecosystems of the priority islands mentioned will almost certainly lead to the extinction of species, a reduction in the quality of the local environment, and the permanent loss of some of the rich natural heritage of Oceania.

While this review has tried to identify islands on which conservation action is needed, the precise areas to be protected can only be determined by up-to-date studies in the field and by consultation with the governments, traditional authorities and local inhabitants who are after all the ones most directly concerned. The intrinsic conservation interest of an island or area

may weigh less heavily in the final choice than the practicality of conservation action as reflected in government and public support. However this support can be modified through education, and it has thus not been given a larger place here. Indeed one of the principal aims of this review is to increase support for the conservation of the most important areas.

It should be emphasized again that the information on which this review is based is far from adequate, and the results should be treated with suitable caution. Hopefully this will be the last such review before the great steps forward in data collecting and analysis made possible by remote sensing and computer data processing revolutionize and bring up to date our knowledge of Oceania in ways never before possible. While such techniques cannot provide species information, they can give recent information on habitats that would be invaluable for such reviews, as well as for monitoring islands and protected areas.

With the plans to focus increased attention on island conservation problems over the next few years, it can be hoped that both information collecting and conservation action on islands will increase rapidly, so that great progress can be made in preserving the unique heritage of Oceania.

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This work is in some ways an extension and up-date of the Regional Ecosystems Survey of the South Pacific Area (Dahl, 1980), produced with the support of IUCN when I was with the South Pacific Commission. The SPC and its staff have made important contributions to the collection of information before and after the survey, as well as to conservation and environmental management throughout Oceania, most recently through the South Pacific Regional Environment Programme.

Other essential sources of information have been the Guide to Islands in the Tropical Pacific (Pacific Scientific Information Center, 1983) based on the work of the late E. H. Bryan, Jr., and the Draft Check List of Pacific Oceanic Islands (Douglas, 1969),

Many individuals have contributed unpublished information for this review, either directly or through the files of the IUCN Conservation Monitoring Centre. Their contributions are indicated in the references within square brackets [↓

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Appendix

EXPLANATION OF ISLAND RATINGS

For a regional systems review, it is necessary to make comparisons between different islands or areas as a basis for determining relative importance and priorities for action. Given the large number of islands in Oceania, the diversity of their characteristics, and the inadequacies in the data, it seemed important to show as clearly as possible the bases on which choices were made, and the weightings that were given to different objective and subjective factors. To do this, a series of simple numerical measures were developed for features of conservation interest, for risks to that conservation interest, and for the feasibility of conservation action. These ratings are included in the island list and the various tables. They make it possible to reduce, or at least to make more consistent and explicit, the subjectivity of judgements as to relative conservation importance. They also can help to identify islands with particular characteristics.

While this approach using numerical values reduces the chances of personal bias or the drift in judgement that can occur between the beginning and the end of a long analysis, it does have its weaknesses. First among these is the tendency to see the numbers as having more accuracy or weight than is actually the case. The ratings only reflect present information, and can be expected to change as more data become available. A low overall rating including a low reliability of data rating can easily reflect a lack of information rather than a lack of conservation interest. At the same time, the system of ratings can be updated rapidly when appropriate.

Users of this review are cautioned not to place too much weight on these ratings without first studying their derivation to ensure that they are appropriate to the intended use of the information. Small differences between ratings should not be considered important, since there are too many uncertainties in the data base, and some ratings are derived from purely subjective judgements based on the author's long experience in the region. Where particular uses require other selection criteria, it is not difficult to modify the content and weighting of the ratings for such other uses.

For some of the calculations, essential figures were lacking for certain islands. In order to keep the analyses comparable across the region, it was necessary to use order of magnitude estimates for these figures in some of the tables. Round figures in the tables (i.e. 10, 100, 500) should not be relied upon for accuracy without confirming them in the island list where such estimations have not been included or have been specifically indicated. For similar reasons of uniformity in calculations, it was necessary to enter all figures to the same number of decimal places. This may give a greater impression of precision than appropriate for large figures.

For some ratings it would obviously be desirable to use real numbers rather than simple ordinal numbers for general categories. However the range of such real numbers makes the relative weighting of different factors almost impossible in the combined ratings, and logarithmic transformations were beyond the possibilities of the programme used.

Despite these weaknesses in detail, the ratings do give a good overall picture of conservation needs and relative importance across the region, and should prove a useful tool in conservation planning if used wisely.

Natural Conservation Status (NC)

The natural conservation status is a measure of the protection afforded naturally to the island by its condition or situation. One point each is given for:

- a) remoteness from significant population centres and transportation routes;
- b) not presently inhabited;
- c) considerable difficulty of access (high cliffs, few good landings or anchorages);
- d) few or no introductions of predatory or competitor species such as feral animals, european rats and aggressive weeds. [Scale: 0 to 4]

Ecosystem Richness (ER)

The scale for ecosystem richness is based on the number of terrestrial ecosystem types or biomes, based on the categories and information in the Regional Ecosystems Survey (Dahl, 1980) or estimated from the island description and structure.

- 0 = less than 5 ecosystems or biomes, such as on impoverished low coral islands;
- 1 = 5 to 10 ecosystems, indicating some distinct vegetation types;
- 2 = 10 to 25 ecosystem types, such as on high islands with some habitat diversity and differentiation of biomes with altitude;
- 3 = 25 to 40 ecosystem types, showing considerable diversity of habitats;
- 4 = many (more than 40) biomes and ecosystems, approaching continental areas in richness.

Note that marine ecosystems are not included in this rating as the data are insufficient for reliable estimations.

Species Richness (SR)

The numbers of species that occur on an island are an important measure of its biological diversity. For Oceania, the figures most frequently available are for terrestrial plants and/or land birds, and these were used as the basis for the rating scale. Where individual island data were not available, estimates were made based on figures for the country or island group.

- 0 = few or no species (less than 20 plants and/or 4 land birds).
- 1 = poor in species (20-300 plants; 5-20 land birds).
- 2 = moderate species richness (300-1000 plants; 21-50 birds)
- 3 = rich in species (over 1000 plants and/or 50 birds).

10

5

Handwritten notes and scribbles in the bottom right corner, including numbers like 23, 39, 40, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, and some illegible text.

Handwritten notes on the left margin: "Terrestrial 10/10", "100%", "12/5".

Economic Pressure (EP)

This measures the level of economic development and thus of modern development impact on the environment. A rating was first calculated for each country, based on the Gross Domestic Product (SPC, 1984) divided by 2000, giving:

3 for French Polynesia, Nauru and New Caledonia;

2 for American Samoa and Guam;

1 for Cook Islands and Fiji; and

0 for all other countries.

These average ratings for each country were then decreased one point for rural islands with less development, and increased one point as appropriate for islands with urban centres or major development projects. Estimates were made for islands outside the SPC area for which separate statistics were not available.

Human Threat (HT)

A rating was needed for the pressure of the local population on the land and resources. Statistics for the percentage of the population in agriculture and mining (SPC, 1984) were divided by 30 and adjusted for under-reporting of subsistence activities in some countries, giving:

0 for Guam;

1 for Cook Islands, French Polynesia, Kiribati, New Caledonia, Niue, and Tuvalu;

2 for Fiji, Nauru, PNG, Solomons, Tonga and Western Samoa; and

3 for Wallis and Futuna.

Some adjustments were made for specific islands (such as uninhabited islands) where the situation was known to be different from the country average.

Natural Vulnerability (Vu)

One point was given for each of the major categories of natural threats to the island environment:

--- cyclones (hurricanes or typhoons);

--- volcanic eruptions;

--- earthquakes, tsunamis (tidal waves), landslides, etc.;

--- severe drought;

--- susceptibility to major fires.

This is a measure of the risk of natural catastrophes that could endanger an endemic species or single protected area, thus increasing the importance of adequate conservation action. [Scale: 0 to 5]

Practicality of Conservation Action (PC)

The successful creation of protected area requires a series of favourable conditions which are estimated in this rating. One point is given for each of the following:

- government interest in and support for conservation;
- public interest and support;
- the existence of legislation for parks and reserves;
- land tenure arrangements permitting or facilitating the creation of protected areas.

Inevitably this rating involves some subjective judgement based on past experience. It should be remembered that in particular cases support by the government and the general public can be considerably modified (one way or the other). Since this rating can be so easily modified, it has not been given a higher weighting in the combined rating. [Scale: 0 to 4]

Reliability of Data (Da)

It is important to know whether an island situation or local conservation problem is well documented and clearly understood, or only suspected on the basis of inadequate data. The following scale is used:

- 0 = no reliable data;
- 1 = poor data (both partial and out of date);
- 2 = data only partial or out of date
- 3 = good recent data (within the last 10 years).

This scale favours islands with problems that are well understood, and where conservation action can be clearly defined, over those that closer examination may show not to have problems, or to be irremediable. A low rating does not mean that conservation action is not needed, but that it should be preceded by further studies to determine the present situation. This rating can also be used to judge the overall accuracy of the combined ratings.

Other ratings have been derived from the information in the island list for use in the tables and calculations:

Population Trend

The population trend is based on the most recent five year estimate of the population growth rate (SPC, 1984), as follows:

- 1 = negative growth rate (declining population)
- 2 = growth rate 0 to 1% per year
- 3 = growth rate over 1% to 2%
- 4 = growth rate over 2% to 3%
- 5 = growth rate over 3% per year.

Urban areas (City)

One point is given if there are one or more urban areas on the island, since these tend to concentrate pressures on the surrounding natural resources.

Endemism

The endemism is rated both for island groups (GE) and individual islands (IE) on the basis of the number of endemic species and sub-species recorded, as follows:

- 0 = no endemic species;
 1 = 1 to 4 endemic species;
 2 = 5 to 15 endemic species;
 3 = 16 to 100 endemic species;
 4 = 101 to 1000 endemic species;
 5 = over 1000 endemic species.

The two ratings permit identifying both individual islands with endemic species restricted to that island, and islands in a group which may share endemic species with other nearby islands.

Protected Area Coverage (CoPA)

The amount of an island covered by protected areas also required a rating for use in the evaluation.

- 0 = no protected areas;
 1 = less than 1% of the island protected, or only marine areas;
 2 = 1% to 10% of the island surface protected;
 3 = 10% to 90% of the island protected;
 4 = island entirely protected (over 90%).

The data for each island have been summarized in two composite ratings to give an overall evaluation and to permit comparisons and rankings.

Human Impact (HI)

The Human Impact rating measures the overall human pressure or impact on the island and therefore the potential threat to remaining natural areas or endemic species. Since it is based on the present situation and its potential for future change, it does not measure past changes (such as caused by former inhabitants or abandoned mines) which no longer represent a current threat, nor does it reflect the cumulative human impact of such past changes.

The HI rating is calculated as follows: the population density (for the island if known, or else for the country), divided by 50, is multiplied by the population trend rating divided by 2 (this produces a reduced figure for a declining population and a larger value for a fast-growing population). To this figure for the demographic pressure on resources is added the Human Threat rating (based on the percent of the population in agriculture and mining), the Economic Pressure rating (based on GDP), and an additional point for a city or urban area.

$$HI = \frac{\text{density}}{50} \times \frac{\text{trend}}{2} + HT + EP + \text{city}$$

[Range: 0 to 31]

Conservation Importance (CI)

The Conservation Importance rating is intended to give an overall numerical evaluation of the significance of the island for the conservation of nature. It consists of the sum of a series of measures of conservation interest weighted for their relative importance. Both measures of biological importance and measures influencing the effectiveness of conservation have been included, since both are important in the selection of sites for protected areas, although biological factors are given the heavier weighting. In a sense the formula tries to reflect the kind of evaluation process used by a protected area manager in selecting a protected area. The elements of the CI rating are:

the Ecosystem Richness (ER) rating and the Species Richness (SR) rating, both multiplied by 2 (scale: 0 to 14 points) as measures of the richness of natural communities;

the Island Endemism (IE) and Group Endemism (GE) ratings based on numbers of endemic species (maximum 10 points), and the percent endemism for the terrestrial flora and fauna, where known, divided by 10 to give a scale of 0 to 8 points;

measures of threatened species, including the number of Endangered Species (E) divided by 2 (up to 8 points), and the number of species classified as Vulnerable, Rare, Indeterminate or K (VRI) divided by 5 (up to 31 points in the exceptional case of New Caledonia);

one point each for Special Features (SpFe) of conservation interest that might warrant the creation of protected areas, such as seabird rookeries, sea turtle nesting areas or other critical habitats, lakes, unusual geological formations or other features deserving specific protection (generally 0 to 4 per island);

the Natural Vulnerability (Vu) rating (up to 5 points);

the Natural Conservation Status (NC) rating (0 to 4 points);

the Practicality of Conservation Action (PC) rating (0 to 4 points); and

the Reliability of Data (Da) rating (0 to 3 points).

$$CI = (ER+SR) \times 2 + IE + GE + \frac{\%end}{10} + \frac{E}{2} + \frac{VRI}{5} + SpFe + Vu + NC + PC + Da$$

The theoretical maximum value of the CI (for present numbers of endangered and threatened species) is 91.

This measure of Conservation Importance will thus favour islands with greater ecological complexity and species diversity, with more species endemism, with larger numbers of endangered and threatened species, with more special features of conservation interest, with greater vulnerability to natural disasters, with better natural protection and greater possibilities of creating protected areas, and with better data on their actual conservation status.

The CI does not measure importance for marine conservation, nor does it favour pristine but simple islands except for their natural conservation status. Protected areas for these should be identified using other measures.

There can be many reasons for creating protected areas, and the above choice of measures and weightings may be debatable in particular instances. Overall, however, a broadly-based measure such as CI should help to identify and rank the different islands in terms of priorities for conservation action.