THE POTENTIAL FOR MANAGEMENT OF ISLAND ECOSYSTEMS

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ABSTRACT

The diversity of island environments and the evolutionary processes inherent in the island condition have produced a great variety of ecosystems in the different ecological regions of the Pacific. These ecosystems provide or maintain the natural resources on which most island communities depend. They also hold in their genetic diversity great potential for the future.

Island ecosystems tend to be fragile and easily disrupted or degraded, as demonstrated by trends in many parts of the Pacific. It is thus imperative to manage these systems if the resource base for human development and even survival is not to be damaged or destroyed.

Several resource management approaches are now being explored in different parts of the Pacific at both the national and regional level. Such approaches must be adapted to the special nature of island ecosystems if they are to succeed. Some types of development will have to be restricted to preserve essential island resources. The sustainable management of island ecosystems must be integrated with the social goals and development approaches of Pacific countries to achieve a balance particularly suited to island limits.

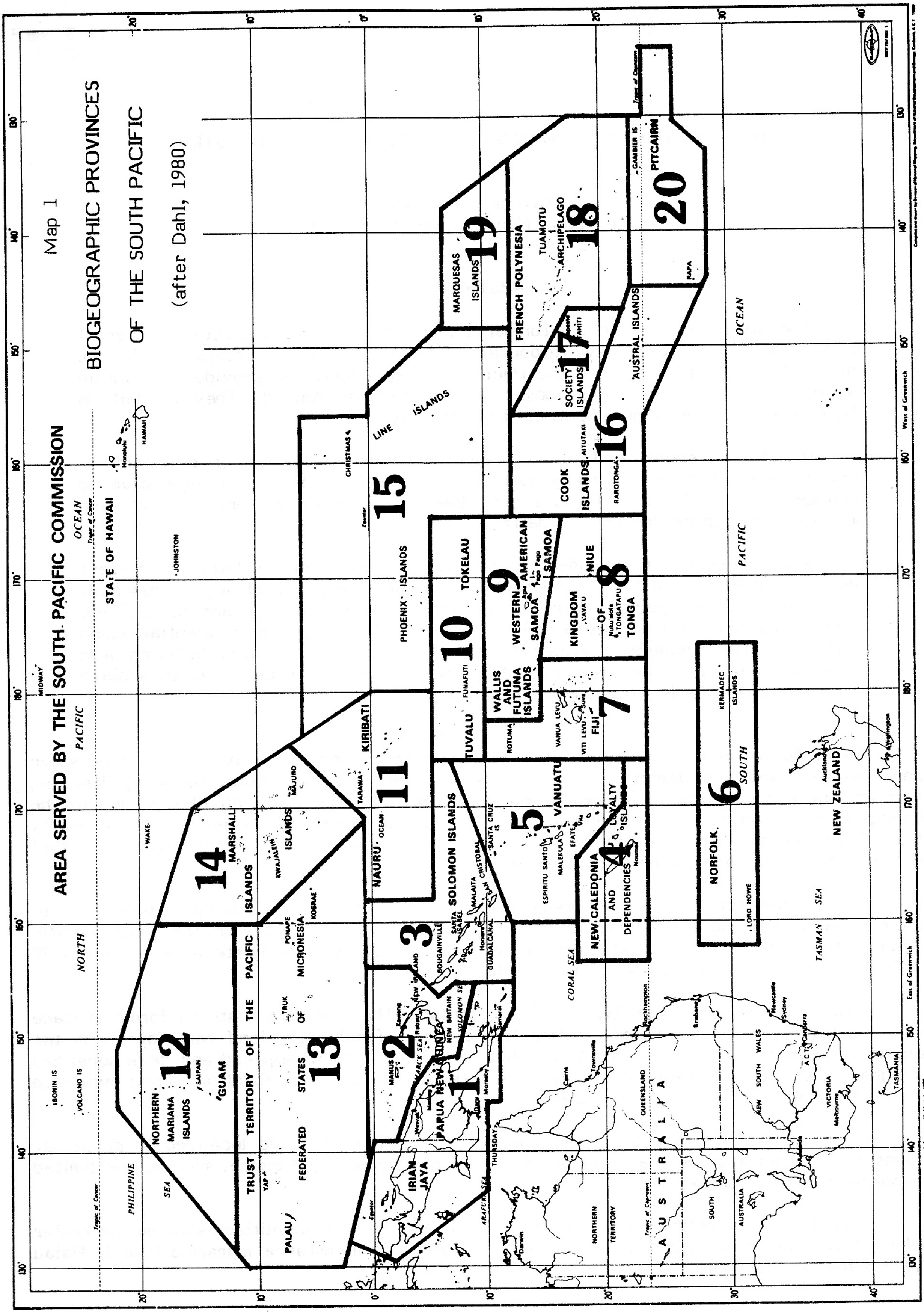
Man's future in the Pacific Islands depends in large measure on his ability to conserve and manage island ecosystems. Subsistence and commercial agriculture, forestry, fisheries, tourism, and even supplies of materials and traditional medicines, are all closely tied to the biological communities that differentiate the islands from lumps of barren rock in an empty sea. These ecosystems are also reservoirs of genetic diversity of world importance that should become increasingly significant in the future.

Island ecosystems have a diversity and specificity that present unique challenges for their preservation and management. The Regional Ecosystems Survey of the South Pacific Area (Dahl, 1980) estimated that there are about 2,000 types of ecosystems or biomes in 20 distinct biogeographic areas of the region (Map 1).

Some of these ecosystem types are widespread. The atoll/beach strand forest is made up of a few common and widely distributed species. Tropical lowland rain forests in the region are similar in type and structure while containing both widespread and more localized species. Coral reefs maintain similar ecosystem structure and function along extended gradients of species distributions and diversity.

Other ecosystems may be common in the region but rare and localized in particular countries or islands where they may be of special ecological significance, such as the limited mangrove areas in Samoa.

Conditions may restrict other ecosystems to rare isolated localities, such as the crater lakes of volcanic islands, and a few are even unique, as for instance a marine lake in Palau were a few species flourish in large numbers.


Map 1
BIOGEOGRAPHIC PROVINCES
OF THE SOUTH PACIFIC
(after Dahl, 1980)
AREA SERVED BY THE SOUTH PACIFIC COMMISSION
NORTH
PACIFIC
OCEAN
PHILIPPINE
SEA
STATE OF HAWAII
JOHNSTON
MIDWAY
WAKE
BONIN IS
VOLCANO IS
1
2
3
4
5
6
7
8
9
10
11
12
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20
NORTHERN MARIANA ISLANDS
SAIPAN
GUAM
TRUST TERRITORY OF THE PACIFIC ISLANDS
FEDERATED STATES OF MICRONESIA
PALAU
YAP
TRUK
PONAPE
KOSRAE
MARSHALL ISLANDS
KWAJALEIN
MAJURO
NAURU
OCEAN
TARAWA
KIRIBATI
PHOENIX ISLANDS
LINE ISLANDS
CHRISTMAS
TUVALU
FUNAFUTI
TOKELAU
WALLIS AND FUTUNA ISLANDS
WESTERN SAMOA
AMERICAN SAMOA
KINGDOM OF TONGA
NIUE
FIJI
VITI LEVU
VANUA LEVU
ROTUMA
VANUATU
ESPIRITU SANTO
MALEKULA
EFATE
NEW CALEDONIA AND DEPENDENCIES
LOYALTY ISLANDS
SOLOMON ISLANDS
BOUGAINVILLE
GUADALCANAL
MALAITA
SAN CRISTOBAL
SANTA CRUZ IS
PAPUA NEW GUINEA
NEW BRITAIN
NEW IRELAND
MANUS
IRIAN JAYA
COOK ISLANDS
RAROTONGA
AITUTAKI
FRENCH POLYNESIA
SOCIETY ISLANDS
TAHITI
MARQUESAS ISLANDS
TUAMOTU ARCHIPELAGO
AUSTRAL ISLANDS
RAPA
GAMBIER IS
PITCAIRN
KERMADEC ISLANDS
NORFOLK
LORD HOWE
NEW ZEALAND
SOUTH
TASMAN SEA
CORAL SEA
ARAFURA SEA
AUSTRALIA
QUEENSLAND
NORTHERN TERRITORY
SOUTH AUSTRALIA
NEW SOUTH WALES
VICTORIA
TASMANIA
ACT
Equator
Tropic of Cancer
Tropic of Capricorn

Islands, of course, vary in the number and richness of their ecosystems depending on their size, form, origin and degree of isolation. Low coral atolls present a more limited set of environments than high volcanic islands, which are in turn generally less rich that large islands of continental origin. Each island, therefore, has unique features that make it difficult to extrapolate detailed management plans or approaches from elsewhere.

Vulnerability

Island ecosystems are particularly noted for their fragility and their susceptibility to degradation. They have evolved in isolation, often from a limited number of accidental species introductions or, in the case of continental islands, from primitive ancestral stocks. Predators were few and the need for competitiveness or defenses limited. The equilibrium of introductions and extinctions was determined by island size and isolation, among other factors. Island biogeographic theory predicts that any reduction in the area of a community or habitat will lead to simplification and the loss of species (MacArthur and Wilson, 1967).

To date, modern man's "management" of island ecosystems has been largely negative, destroying natural systems and converting them to other uses or leaving them as abandoned wastelands. Forests are cut, cleared or burned; soil is exposed to erosion by wind and rain; aggressive species are introduced and run rampant. At times all that is left is worthless land barely supporting worthless plants. Where mineral resources are present they are mined, leaving a rocky desert behind, and the wastes are often dumped in the nearest river. Some islands such as Banaba (Ocean Island) have been so degraded by mining that their populations have had to be evacuated. In the lagoon and on the reef, people fish with dynamite and poison, dredge and fill, spill toxic chemicals and oil, and let their wastes push ecosystems to the point of collapse. The number of natural areas protected from such degradation in parks and reserves is pitifully small in relation to the need (Dahl, 1980).

The recent report on the State of the Environment in the South Pacific, prepared by the South Pacific Regional Environment Programme (Dahl and Baumgart, 1982), has documented how widespread such damage has become throughout the Pacific Islands.

It is thus imperative that we learn to manage island ecosystems if the resource base for human development and even survival on the islands is not to be damaged or destroyed.

Island environmental management

Management of an ecosystem means actively intervening in the composition or functioning of the system to achieve certain ends. Such management is particularly justified on islands where human activity has degraded or destabilized an ecosystem to the point that it can no longer recover on its own. The goal of management should be to restore the ecosystem to its natural state, or at least to maintain its desirable and useful qualities in spite of the changed conditions brought about by human use. For instance, if a forest tree depends on fruit eating pigeons for its seed dispersal and the pigeons have been hunted to extinction, then artificial seed dispersal or planting of the tree would be necessary to ensure its survival. Management might equally involve exterminating introduced pest species, breeding an endangered or exploited species in captivity and releasing the young in the wild, or recreating vegetation where it has been destroyed.

Ecosystem resource management is inevitably constrained by island limits and by our lack of adequate scientific understanding of many island ecosystems. Effective management must respect and balance both ecological imperatives and economic constraints. It must be part of development, aiming to achieve the goals of development in terms of sustainable human betterment. It must also complement the social and cultural dimensions of each island society. This will be difficult, and we are far from having all the answers.

Some interesting approaches now being tried in the Pacific Islands may show possible directions for new management strategies. These include small scale village-level forestry projects in Vanuatu, agro-forestry experiments in Papua New Guinea, and rotating coral reef reserves in New Caledonia and Hawaii. Training materials to strengthen natural resource management at the village level are being developed with the support of the South Pacific Regional Environment Programme. The revival of traditional management techniques is also being encouraged.

It is possible to establish some general guidelines for adapting ecosystem management to islands. Integration of development needs and multiple use of resources are essential on an island. Land areas are too limited on all but the largest islands to permit the allocation of significant land areas to single uses as is commonly done on continents. For instance, agricultural land may need to be managed simultaneously for water catchment and as habitat for an endangered bird species, with the development of the land being modified to be compatible with its other roles. Many overlapping uses of the same area or resource will be the rule. Planning will need to look at the island as a whole, to ensure that all needs of man and the natural environment are provided for, and to prevent any one activity from threatening other essential resources. This may require modification of the land tenure and land use systems and legislation imported by colonial governments which have tended to define ownership in absolute "all or nothing" terms. What islands need are approaches closer to many traditional land tenure systems, where, within a general context of family or tribal ownership, it was possible to hold certain limited rights, such as to farm for the duration of the crop, to hunt or to collect building materials. Such systems encouraged multiple compatible uses, and allowed greater flexibility and efficiency in land use. For instance, rotating gardens and extended fallows allowed traditional agriculture to respect the limited fertility of many island soils.

Development has concentrated many human activities in the coastal zone, creating resource use conflicts. Such zones must be managed as an integrated system to ensure that terrestrial development is compatible with reef and lagoon management.

The scattered isolated nature of island communities places more responsibility for environmental management at the local level, and prevents the kind of centralization common in the government structures and bureaucracies of continental developed countries. Traditionally most small island communities had their own experts on fishing, farming, the forests, land use, etc., but colonization and modern systems of education have broken down these traditional systems and prevented the transmission of traditional knowledge to succeeding generations. It will be necessary to recreate this local expertise, bringing it together with a modern scientific understanding of resource management.

The inherent limits of the island situation will make it necessary to restrict some kinds of development. Toxic and hazardous chemical use, for instance, must be restricted or prohibited where a single accident could contaminate an entire lagoon or water supply. Single crop agriculture may be too vulnerable given the inherent variability in many island environments; extensive land clearing and uncovering of soils may damage water catchments and produce irreparable soil loss. Many modern technologies are inappropriate in an island context where they have a short useful life and are beyond the maintenance capabilities of small island communities. They are only a waste of capital and foreign exchange. For example, a modern automobile designed for driving all day on a superhighway may rust out in one to two years after going 10,000 km on an atoll with 30 km of road and a speed limit of 40 km/hr.

Other types of development may solve long-standing island problems and should be encouraged. Modern communications technologies may permit creative solutions reducing the isolation of island communities. Microcomputers may similarly be able to compensate in some ways for the lack of specialization inherent in small island societies.

Such approaches working towards the sustainable management of island ecosystems and towards appropriate development within island limits should help to reverse the trend towards decreasing island self-sufficiency and permit island people to face the future with confidence and dignity.

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