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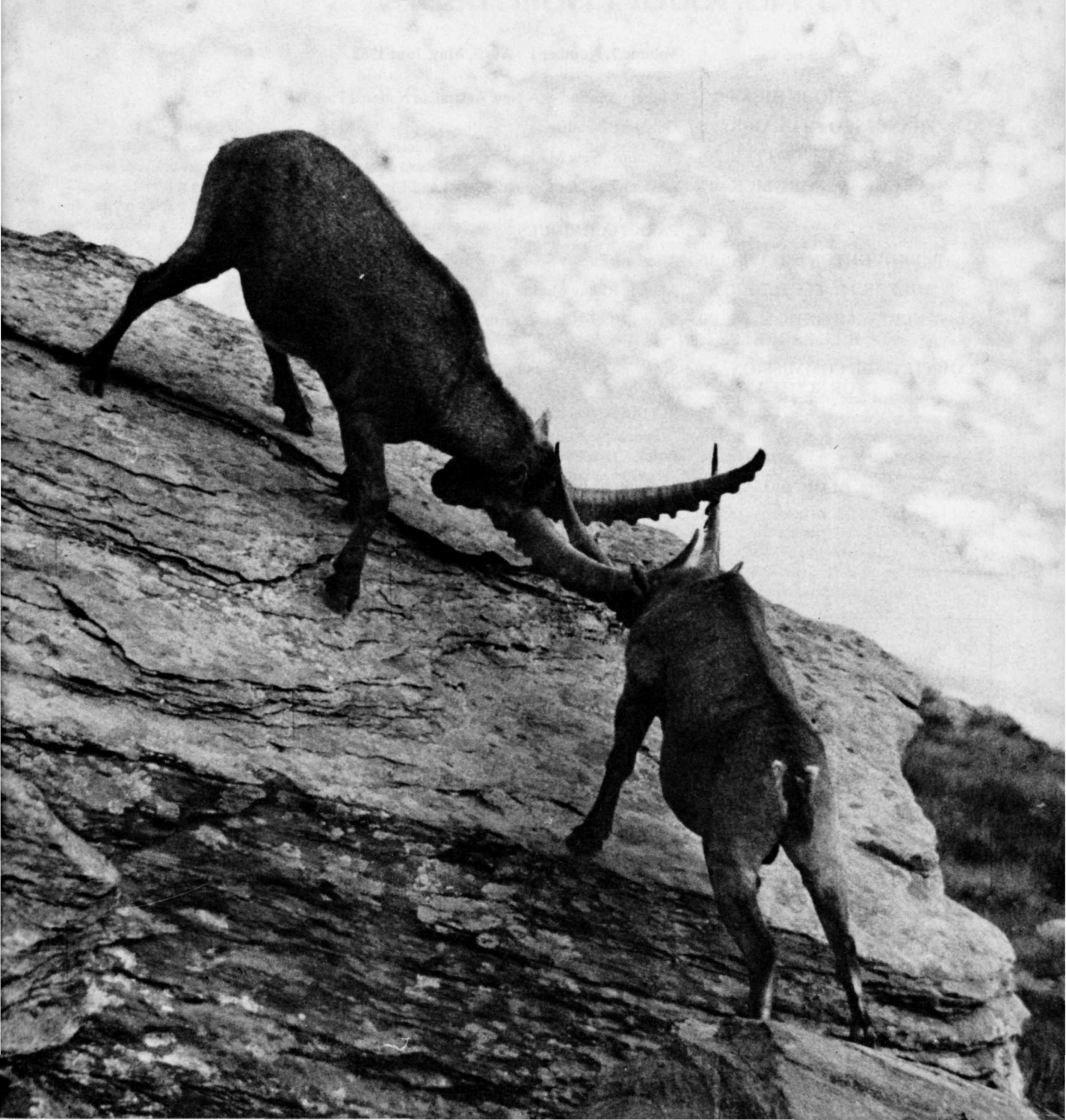

PARKS

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Front cover: Alpine ibex (Capra ibex) *are the largest animals found in Gran Paradiso National Park in the western Italian alps. As the last refuge of the Alpine ibex, this area was set aside in 1856 by the King of Savoie as a royal hunting preserve. The animals thrived under protection and today there are an etimated 3,000 ibex in the Park. Photo: Guy Dhuit*

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John Hicks

Christmas Island — A New Australian National Park

Remote islands are often fascinating places with seabird colonies and unusual flora and fauna. Australia's isolated Indian Ocean Territory of Christmas Island is no exception. It has appropriately been described as one of the world's great seabird islands with boobies, frigatebirds and noddies making up the bulk of the nesting population. Endemic wildlife includes 4 species of bird, 6 subspecies of bird, 21 plants, 5 reptiles, 2 crabs, 2 bats and a number of insects. But perhaps the most interesting aspect of the 135 square-kilometre island is its landcrabs which are remarkable for their abundance and the significant role they play in the ecology of the rain forest.

Until settled in 1888 Christmas Island was one of the few large tropical islands which had never been inhabited and its wildlife was appealingly unafraid of man and easy to observe. This remains the case despite more than 90 years of settlement.

On 21 February 1980, recognition was given to the special natural attractions of the island when the Christmas Island National Park was declared under the National Parks and Wildlife Conservation Act 1975. The park covers 1600 ha of representative rainforest in the undisturbed southwestern portion of the island.

Some History

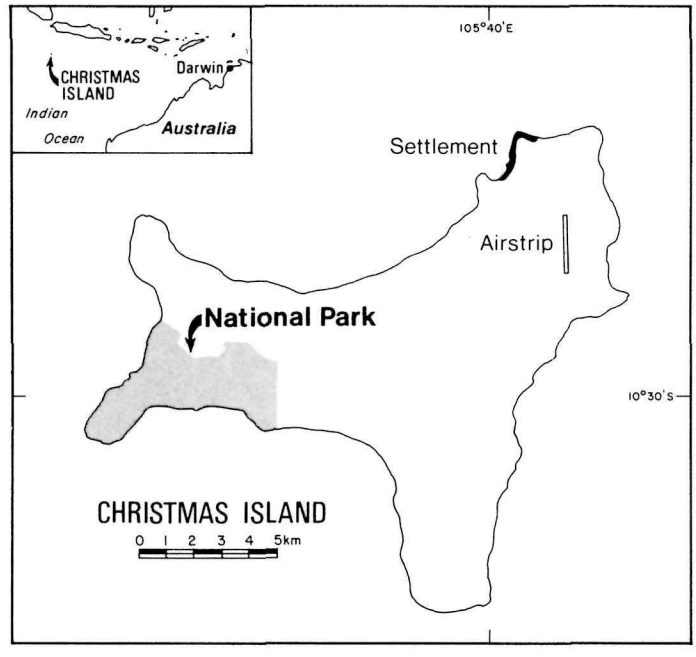
Although named on Christmas Day 1643 by Captain William Mynors, the first recorded landing on Christmas Island was not made until 1688 during a visit by William Dampier on his way from Sumatra. Sailors from his ship appreciated the island's wildlife in a culinary way, bringing on board "as many Boobies and Man of War Birds (Frigatebirds) as sufficed all the Ships Company . . . They got also a sort of Land-Animal, somewhat resembling a large Craw-fish (Robber Crabs). . . ."

The Clunies-Ross family began using the island as a regular stopover en-route to Cocos Keeling Islands from Singapore and Batavia in the 1820s. They too took island seabirds and crabs for food and also extracted timber for use on Cocos. In 1888 Andrew Clunies-Ross and a party of Cocos Malays established the first settlement at Flying Fish Cove in the northeast of the island.

Meanwhile John Murray, the naturalist on board the "Challenger" oceanographic expedition in 1872-76, had arranged for samples of rock to be collected from the island. The samples confirmed his prediction that phosphate deposits would be found. Murray was something of an entrepreneur as well as man of science. His persistent advocacy secured Christmas Island for the British Crown in 1888 and a half share of its phosphate for himself in 1891, the other shareholder being Clunies-Ross. Whilst fathering the island's phosphate industry he furthered understanding of its natural features whose interest value he readily acknowledged:

> "It seemed highly desirable that this interesting island—which was evidently an upraised coral atoll—should be carefully examined and described by a competent naturalist and geologist, before being opened up by Europeans for agricultural and commercial purposes. . . . It has not hitherto been possible to watch carefully the immediate effects produced by the immigration of civilized man—and the animals and plants which follow in his wake—upon the physical conditions and upon the indigenous fauna and flora of an isolated oceanic island. I hope to arrange that this shall be done in the case of Christmas Island."

Thus wrote John Murray in the Introduction to an impressive report of a study of the island's natural history carried out in 1897 by Chas. Andrews of the British Museum under Murray's sponsorship. True to his word Murray also arranged for Andrews to revisit the island in 1908 to document the changes wrought by the first 20 years of settlement. On his second visit Andrews reported the extinction of 2 endemic rats and a shrew and the colonisation of a number of plants and animals. Despite this ominous start, Christmas Island's unique flora and fauna has fared better under settlement than that of some other isolated islands. Although phosphate mining has been proceeding continuously since 1897, with the exception of World War II, some 75 percent of the island's rainforest remains intact. Apart from the endemic rats and the shrew, all known endemic species have survived settlement. Troublesome exotic plants such as *Leucaena leucocephala* and *Mimosa invisa* are so far limited to disturbed areas, and only cats *(Felis catus)* and rats *(Rattus rattus, R.norvegicus* and *R.exulans)* have become problem feral animals.



Park Declaration

The 1970s saw increasing interest in Christmas Island's endemic species. Conservation concern centered on the protection of the world's rarest booby, Abbott's booby *(Sula abbotti)*. Other matters such as controls on rainforest clearing, rehabilitation after mining, enforcement of laws to protect wildlife from hunting pressures, disposal of rubbish, control of importation of new species and the control of feral plants and animals also attracted attention.

An Environment Advisory Committee was established on the island early in 1973 and later the same year the House of Representatives Standing Committee on Environment and Conservation initiated an inquiry into the effects of mining and other activities on the island's wildlife. The Committee recommended amongst other matters, that wildlife reserves be established. In 1975 an Environmental Reconnaissance Team of Australian and New Zealand Government officials was formed to advise on matters arising from the Committee's report and the team recommended an extensive reserve area for the island. A few years later representations by the International Council for Bird Preservation and the International Union for Conservation of Nature and Natural Resources added support for protection of island endemic species and habitat preservation.

A park proposal for 1600 hectares in the southwest of the island was placed before the public in October 1979. A number of submissions supporting the proposal were received with most suggesting the inclusion of additional areas. The 1600 hectare park was proclaimed on 21 February 1980.

Entrance signs welcome visitors in English, Chinese and Malay, reflecting the diverse ethnic background of the island's mining community of 3200 people. Visitor pressures on the park are low.

Description

Christmas Island is a raised atoll, the tip of ancient volcanic cone of basaltic composition rising 4500 metres from the depths of the Indian Ocean. A sequence of interbedded limestones and volcanic rocks dating from the upper Eocene (36 million years ago) is draped over the cone and the sequence has been intruded by andesitic dykes, is marginally faulted and has been terraced by wave action.

A mantle of red soil covers the more gently sloping surface limestone areas to varying extent and thin greyish soils are found on exposed terrace areas. Soil and surface rock layers have been phosphatised to different degrees. The most plausible origin of the phosphate is the deposition of bird guano when the island was an atoll complex and the climate more arid. Relatively little commercial phosphate lies in the park (an estimated 190,000 metric tons of "A" grade), a factor that eased the way for its declaration.

From the low water mark to the highest point on the island (Murray Hill, 357m ASL) the park has representative samples of most of the island's wildlife communities. From Murray Hill the park drops in a series of terraces, slopes and, in places, imposing scarps to a jagged coast of limestone pinnacles and cliffs. The sea cliff is heavily undercut on the southern coast giving rise to spectacular blowholes under the influence of the prevailing southerly swell. On the western coast the sea is usually a little quieter and access to the water's edge is possible (but dangerous)

Sculptured buttresses of Inocarpus altilis. *The structural simplicity of some of the island's rainforest is unusual. Absent are the vines and shrubby understory which characterise Indo-Malayan rainforest and the forest floor is unusually bare, swept clean by scavenging landcrabs.*

through the mouths of a series of streams known as the Dales and at one small beach.

Although the island's annual rainfall averages 2000 to 2500 mm, surface streams are few as the water percolates quickly through the porous limestone and soil to the underlying harder volcanic rock. Permanent springs and streams are found where the volcanic rock surfaces, with the Dales area in the National Park having the best developed streams on the island. The lime-rich spring water rapidly deposits limestone, in some cases encrusting fallen twigs, fruits and even leaves. Extensive limestone terraces have developed on the bed of one of the Dales.

High rainfall and humidity and a mean temperature of around 27°C contribute to lush vegetation. Shoreline pandanus *(Pandanus nativitatis)* and *Scaevola sericea* pass into rainforest as the soil deepens and exposure lessens.

"Plateau" rainforest, the best developed of the three recognizable rainforest phases on the island, occurs generally above the 200 m contour on deeper soils.

Although not rich in plant species (there are only about 200 plants and ferns, including 21 endemics on the island) the structural simplicity of the plateau rainforest is probably unique. Absent are the tangle of vines and profusion of shrubby understory which characterise India-Malayan rainforest and the forest floor is unusually bare—swept clean by scavenging land crabs. On better sites the rainforest assumes majestic proportions with a 40 m canopy and many exquisitely sculptured buttresses. Characteristic dominants are *Eugenia gigantea, Planchonella nitida* and *Hernandia ovigera*. There are some deciduous trees such as *Terminalia catappa* present but basically the forest is evergreen.

"Marginal" rainforest is associated with shallower soil and is quite extensive, covering high terraces and areas of major faulting and volcanics across the shore terrace. Plateau species occur, though their canopy height is reduced, along with others such as *Ficus microcarpa, Macaranga tanarius* and *Pongamia pinnata*.

"Terrace" forest, the forest of poorest soils and limestone ridges and slopes, has a greater diversity of plant life and a more stunted and often windswept canopy. Deciduous trees such as *Terminalia catappa* and *Gyrocarpus americanus* are present in greater numbers giving the forest a distinctive appearance at the end of the dry season when these trees are bare.

The endemic Christmas Island goshawk (Accipiter fasciatus natalis) *is appealingly bold and occasionally follows walkers through the rainforest. Christmas Island was not settled until 1888 and most of its wildlife remains unafraid of man.*

Of the eight seabirds nesting on the island, six species are represented in the park. The guttural call of begging Abbott's booby can be heard from high in emergent trees in the northeast of the park. Twenty-one percent of the nesting sites for this endangered species occur in the park; however the island's other endangered seabird, the endemic Christmas Island frigatebird *(Fregata andrewsi)* nests mainly on the northeast terraces of the island, well away from the park.

Brown boobies *(Sula leucogaster plotus)* favour the sea and inland cliff where their nests are scattered on the ground. The red-footed booby *(S. sula rubripes)* together with the greater frigatebird *(F. minor)* choose deciduous trees on the shore terrace whilst the beautiful golden bo'sun *(Phaethon lepturus fulvus)*, an endemic subspecies of the widespread whitetailed tropicbird, uses tree hollows of the terrace and plateau. Silver bo'suns *(P. rubricauda westralia)* nest in nooks and crannies of the inland cliff.

The booming call of the male Christmas Island imperial pigeon *(Ducula whartoni)* is a familar sound of the park. All seven endemic landbirds are found in the park.

Landcrabs are everywhere and in large numbers. There are 13 species of land crabs on the island. By far the most common is the endemic red crab *(Gecarcoidea natalis)* which measures up to 100 mm across the carapace. Landcrabs play a significant role in the functioning of the rainforest. They eat mainly fallen vegetation—leaves, fruits and flowers—thereby breaking down the litter layer and releasing nutrients. Their burrowing tills the soil and their selective browsing on fruits and shoots probably influences forest composition. The annual breeding migrations of the red crab are spectacular. At the beginning of the wet season in late October the crabs pour down from the plateau and terrace forest to the sea. In places it is difficult to walk without treading on crabs. A brief rinse in the sea and the crabs retreat to the shore terrace where mating occurs. Later the females take their spawn to the shore and sit in the shallows where their eggs are washed off. Under favourable conditions, baby crabs return to the shore a month or so after the spawn was deposited. They form a vivid red plimsol line on seashore rocks and a day or so later start moving inland. In good years the ground along migration routes is a rustling, seething pink carpet of crabs, an amazing sight.

The world's largest land crustacean, the robber crab *(Birgus latro)* is abundant. Although this species is widespread throughout the Indo-Pacific it is under pressure in many parts of its range from habitat clearing, hunting and feral animals. The island's robber crabs are unusual for their diurnal habits and boldness. A favourite food is the fruit of the endemic Arenga palm *(Arenga listeri)* and under suitable conditions a crowd of 100 or so giant crabs (up to 140 mm carapace width) will gather around the base of a fruiting palm eating fallen fruits. Others will climb 10 m to 15 m up the trunk to reach fruits on the tree. The pith of a fallen palm also attracts large concentrations of these crabs.

Management

The Australian National Parks and Wildlife Service has management responsibility for the park and has had an officer stationed on the island since 1979. The officer also provides assistance to the local Administration on conservation matters affecting the rest of the island, principally mining-related issues, endangered species conservation, wildlife law enforcement, control of introduced species and advice on importation of plants and animals.

Developments within the park are few — one fourwheel drive track traversing the southern portion, two walking trails, two disused guaging weirs and some small entrance signs. The entrance signs welcome visitors in English, Chinese and Malay, reflecting the diverse ethnic background of the island's mining community of 3200 people. Visitor pressures are low.

Robbers crabs (Birgus latro) *crowd together to feed on the pith of a fallen Arenga palm. There are 13 species of landcrabs on Christmas Island and they play an important role in the functioning of its rainforest.*

In the park, management has been low key, restricted to maintenance of access tracks, the erection of entrance signs, control of some introduced species, control of poaching and guided interpretation activities, particularly school outings and weekend nature walks.

Emphasis has been given to production of interpretative literature with the establishment of an active Natural History Association. The response of the rather captive island audience to such literature has been staggering. For example, the first project of the Natural History Association was the distribution of a general book about the island's natural history and in its first week of release, island sales of the $12.50 book reached 1400 copies, that is, 1 copy for every 2.3 residents.

No park is an island and the future of Christmas Island National Park and the island's species is unavoidably interwoven with future island-wide developments. Phosphate mining was the reason for the island's settlement and remains the economic lifeline of the island today.

Mining has had a profound effect on the island's ecosystem, mainly through forest clearing, and there has been concern about the survival of some of the island's endemic species, particularly Abbott's booby. The rainforest nesting habitat of this bird partially coincides with high grade phosphate deposits and the park contains only 21 percent of Abbott's booby habitat, insufficient to guarantee its survival. Aware of the concern, the mining company (the British Phosphate Commissioners) initiated a comprehensive two-year study of Abbott's booby nesting habitat in 1979 and placed a moratorium on clearing certain habitat areas pending the outcome of the study. Study results were evaluated by a panel chaired by Professor J. D. Ovington, Director of the Australian National Parks and Wildlife Service, and the panel recommended a course of action that would permit most of the intended high grade phosphate mining operations to proceed whilst protecting most (97.2 percent) of the existing habitat. A Government decision on the panel's recommendations is expected shortly.

At the present extraction rate of 1.4 million metric tons a year, high grade phosphate reserves will be exhausted in four years or so. The future of the island is now the subject of a Government Inquiry and the possibilities being canvassed include a continuing phosphate industry based on lower grade ore, large quantities of which are stockpiled from previous operations or lie in existing cleared areas. However there are also considerable reserves of low grade ore under intact rainforest and the future impact of mining will depend largely on how much more, if any, rainforest is cleared. It is perhaps ironic that the fate of some of the island's unique seabirds could be at risk because of the value placed by people on the deposits of their avian ancestors.

Another possible future industry being examined is nature-based tourism, the island's seabirds and landcrabs being the main attractions. Obviously, management programs in the park and elsewhere on the island would need to be devised to ensure that the wildlife attractions could be viewed without damaging disruptions.

More information about many of the island's endemic species is needed. For example, the number of nesting pairs of the beautiful golden bo'sun is not known, the breeding biology and distribution of the endangered Christmas Island hawk-owl *(Ninox squamipila natalis)* is unknown, indeed no nest of the bird has ever been observed, and the biology of the remarkable red crab, the dominant animal on the island, cries out for detailed investigation.

The founder of the island's phosphate industry, John Murray, balanced his entrepreneurial flair with a deep appreciation of the island's natural qualities. Hopefully this balance will be reflected in future island developments and ensure the survival of Christmas Island's special natural features.

John Hicks is Government Conservator of Christmas Island for the Australian National Parks and Wildlife Service.

Francesco Framarin

Guarding Paradise

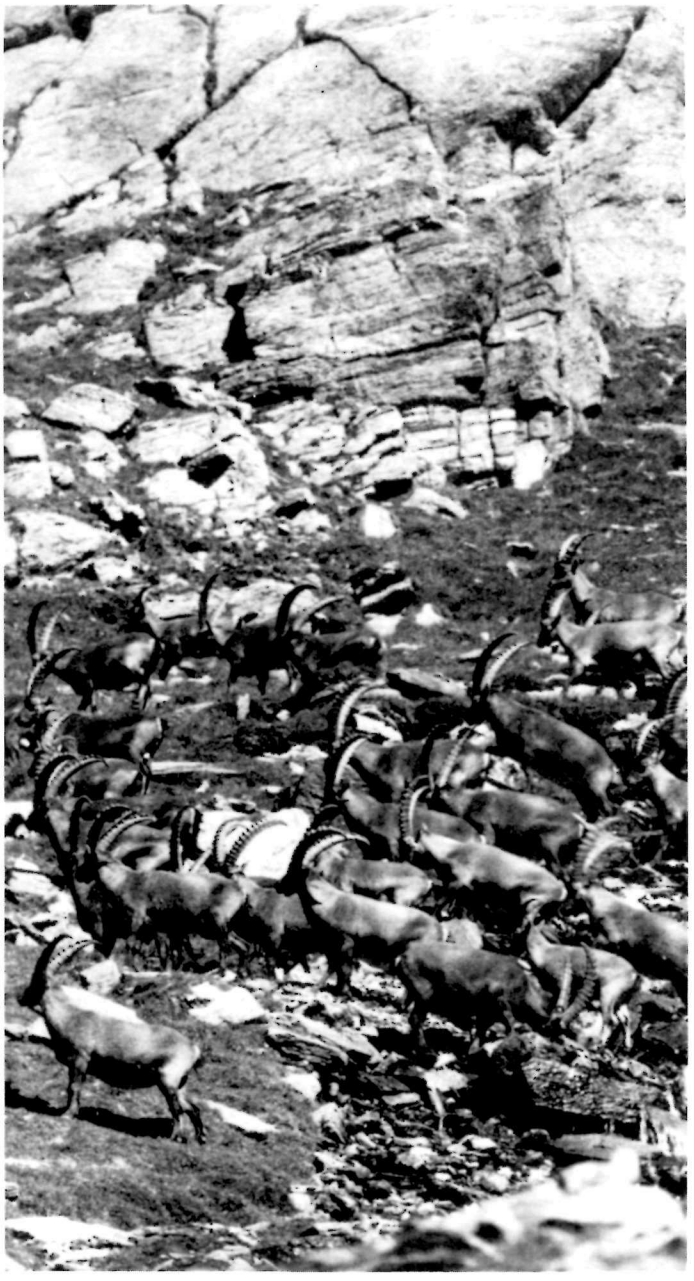
In a period when the old game guarding system of the Gran Paradiso National Park apparently is being allowed to decay through a variety of actions and inactions beyond control of the park superintendent, I think it may be interesting to describe the main features of this highly-successful organization which dates back to 1856. It can still teach something to the park managers of the 1980s.

In 1856 Vittorio Emanuele II, King of Savoie who became Italy's first king in 1861, established some royal hunting preserves, among which was Gran Paradiso in the western Italian Alps. It was an important decision for natural history, mainly because this was the last refuge of the alpine ibex, at that time brought to near extinction everywhere else in the Alps. In 1922 the royal hunting preserve became a national park and most of the royal guards became park guards. They retained their way of work, their mountain huts, the mountain paths, etc.—in short, all but their uniforms.

Before describing the guard system, let us briefly describe the Park itself. This is a high mountain park of some 550 km^2 (recently enlarged to 700 km^2), ranging from an average elevation of 1500 m at its border to 4061 m. The timberline is about 2200 m, but woods make up only 6 percent of the whole area, whereas glaciers comprise nearly 20 percent. Most of the Park consists of steep alpine meadows and rocks barely accessible in summer and almost inaccessible in winter when avalanches are a serious hazard. There are now more than 3,000 ibex and 5,000 chamois in the Park, their current densities being perhaps higher than the natural ones due to the absence of natural predators. This explains the great interest poachers have in the Park: chamois are very scarce outside its boundaries and ibex are practically unknown. The reasons for this are the heavy hunting and poaching around the Park and the different characters of the two ungulates. While the chamois is rather wary and shy of man, ibex is not, probably because it has no real natural enemy. Apart from the meat, a stuffed ibex trophy can be sold for US $1,000, and even more.

Villages totalling some 2,500 people are scattered along the border of the Park on the floors of the valleys at about 1,500 m elevation, except for 150 people living in the Valsavarenche valley. There are no fixed and controlled entrances: several free automobile roads enter and skirt the Park which can be freely crossed by foot by anyone anywhere. In fact, the Park administration owns or rents only 20 percent of the land, the rest belonging to private landowners and communes.

The guards of the royal preserve were always taught to watch, principally, the ibex and chamois, the same targets of the royal hunters, and of the poachers. Still today the guards are fundamentally shepherds of ibex and chamois, and more mindful of the former because of their greater scarcity and value. The guards keep some 100 salt licks in strategic places in order to reduce dispersion of the herds. When I drew their attention to the drawbacks of this program (local overuse of pastures, danger of infections, consanguinity) they answered, "Do you want us to leave only the salt licks of the poachers all around the Park?," and after a few years



Ibex, pictured here, and chamois were sought by the royal hunters who established Gran Paradiso as a royal preserve in 1856. Today these animals are sought by poachers.

Modern guards at Gran Paradiso are skilled and well-equipped. Binoculars are standard but telescopes are often necessary. In practice guards use an alpenstock, as shown here, instead of a tripod to steady the telescope.

of experimental suspension of the inner salt licks (but I suspect some guards were feeding them secretly), I had to give up and restore them.

The guards must count the ibex and chamois of their zone twice a year, at the end of the winter, when they see the whole herds again in high mountains, and toward early September, well after the births of the kids and just before the hunting season, when poaching is going to rise. It is not difficult to count herds of undisturbed ibex and chamois because they are habit-bound animals and most of them live outside the scarce woods. The bodies of recently dead animals and the head of every dead one must be collected: the guards' dogs smell out some carcasses or blood tracks, but even ravens and crows may alert watchful observers.

The whole park is divided into 30 zones of some 20 km^2 each on the average (the innermost zones are larger), in each of them a small hut was built, and this is inhabited by a couple of guards from June (the melting of the snow) to November (the falling of the snow). These huts are at an elevation of about 2,200 m, more or less that of the timberline. They are very small and have no electric power; most supplies of fuel, food, etc. are brought by helicopter once a year; use of mules was abandoned because they are no longer available. Even so, the guards must bring in most of their food themselves from the villages, about once a week: this is the frequency of their coming home from their huts. On an average, the huts are a two hours' walk from the villages, sometimes up to four hours. Guards work as a pair only two or three days per week, because of their days off.

In addition to the paths from the villages to the high mountain pastures where the guards' huts are, a continuous path connects nearly all huts, roughly forming a ring by which any patrol can reach any neighbouring patrol in about one or two hours. This has been very useful, especially when the guards could not rely on portable radio transmitters, as they now do. Moreover, this ring path is useful even to cut the routes of the poachers between the high pastures of the wild ungulates and the roads in the bottoms of the valleys.

Besides the radio, every guard always keeps and regularly uses binoculars, mostly 10x40 mm, and a telescope, usually a 30x60 mm. Use of zoom telescopes was discontinued because they made it difficult to realize the true size of the animals watched. A heavy alpenstock is also used and serves also for supporting the telescope instead of a tripod; the head of the stock is not put on the ground but on the abdomen, one hand holds the stock and the telescope near the lens, the other hand holds the telescope ocular. That is why most guards prefer long, old-fashioned scopes to short modern models with prisms.

Dogs are valuable aids for the guards, both for smelling out tracks or carcasses of killed animals and for helping to confront poachers. Moreover, they help their masters to bear solitude. If a dog can be trained, which is generally costly, it can perform other useful jobs, such as retrieving people under avalanches, etc. Unfortunately, one cannot force unwilling guards to keep dogs, because they would keep them badly. Every park guard keeps a diary in which he writes when he leaves and comes back, where he goes and what he has seen or done. If he is on duty alone, he puts it in a known place after leaving his hut, in order that some colleague may learn where he is. Before going to bed, he must complete the page of that day. I have read some fresh and very beautiful pages in these simple and often naive notebooks.

There are very few rules to be followed by the guards to do an efficient job. The rules are very old and simple to understand, which does not mean they are easy to implement. I do not maintain they are universally valid: they proved so on the particular ground, wildlife and human environment of the Gran Paradiso—and probably would in similar areas.

The first and most important rule is: to see without being seen. The guard should not be spotted, as far as possible. Old guards used to go out of their homes or huts in the dark and come back in the dark and the best present guards still do so. In fact, today most poachers work in pairs, both with a radio: one of them follows up the guard and by radio directs the other one to shoot the animals (with a silencer). For the same reason,

regular changes of duties and regular service beats should be carefully avoided.

A patrol which works in different zones is bound to be less efficient than a patrol which stays in a single zone. The fact is that whoever always watches his territory and his animals can best detect whatever happens. If some animals are displaced from their pastures or in any way disturbed, a shepherd can perceive it; a newcomer cannot. Of course fixed patrols require more people than mobile patrols; however, their results are also greater, at least in an environment with prey and poachers like that of the Gran Paradiso.

Dawn and sunset are the favorite times for most poachers, and so are snowfalls, rain and periods of fog, because they help to conceal their presence and their tracks. For the evening twilight we tried some commercial light amplification devices, but they proved not much better than conventional binoculars—and much heavier. I presume that more perfect and less expensive future devices will be powerful tools more for poachers than for guards. As I said before, the guards of the GPNP used to work from dawn to sunset, i.e. up to 18 hours per day in summer. An agreement was reached by which they still retain this timetable, but work fewer days per year. Should they work 8 hours per day, one can be sure that two duty periods for two guards per day would not be equivalent to a double duty of one guard.

Since the existence of armies and garrisons, everybody knows that soldiers are apt to be lax among their fellow-countrymen: the same holds true for guards. Gran Paradiso has two main sides, one in Piedmont and one in Valle d'Aosta, two regions scarcely communicating. Therefore Piedmontese guards were sent to work in Valle d'Aosta and Valdostani in Piedmont. Exceptions to this rule often proved its validity.

I could now expand on the techniques of intelligence gathering, anti-poaching interventions and police activities. Even more room could be devoted to poachers' activities, whose ways of catching animals and fooling guards are almost infinite. Books were written on this subject and I must admit that it can be exciting. However, this would lead us too far away from the purpose of this article.

I would conclude with some remarks and personal records. Good park guards are not easy to find, because they are not ordinary people. They are gifted people, with the qualities of both the policeman and the naturalist, which are similar (but not identical) only in their theoretical part. A good guard can stop while accompanying you along a steep mountain path to spot a tiny blood drop on the ground, then an almost invisible trace of a dragged chamois corpse on the nearby grass, then a small herd on a far slope, that would take you many seconds and some direction to see. He can show you an eagle circling high above you when you are busy finding your way on a coarse scree, or he can tell the cry of a rare chough in the choir of a flock of Alpine choughs. He can wait for the poacher he heard shooting many hours earlier, then, catching him without his prey, he will force him to go back up the mountain, recover the hidden animal (25 kgs) and bring it down. (In revenge, he will later lose his beautiful dog — poisoned.) I personally know several guards like these and I am proud of working with them.

Francesco Framarin is Director-Superintendent of the Gran Paradiso National Park. His headquarters are in Turin.

Guards of the old royal hunting preserve of Gran Paradiso.

Patrick J. Cotter

Barbados' New Marine Reserve

Barbados is a small oceanic island, approximately 417 km², situated in the North Equatorial current 475 km north of South America at 13°N, 59°W (Figure 1) (Emery, 1972). The island is located within the Atlantic-Antillean sub-province with offshore environments consisting of coral and algal reefs (Ray, 1975).

The Ministry of Housing, Lands and Environment first began thinking of a marine park in early 1973, as a result of a paper by Sander (1972). The Parks and Beaches Commission, a statutory board within the Ministry, was delegated as the agency that would administer the park. The Commission sought advice from government agencies, scientific groups and private individuals having an interest in the near-shore environment. Influenced by this need, the Underwater Park Committee was formed in mid-1974 to advise the Commission on technical matters. Meanwhile, in anticipation of the project, the Ministry passed the "Marine Areas (Preservation and Enhancement) Act, 1976." This act allowed the Minister to declare areas of the sea restricted for purposes of preservation, protection, recreation and scientific study.

Through much discussion and research, the Underwater Park Committee recommended that Holetown, a village 12 km north of Bridgetown (Figure 2), should be selected as the area where the Marine Park would be established. Holetown is the location of the first landing of English colonists in 1625, and it is, therefore, of some historical importance. This is also a tract of land that is still in the possession of the government. The reef chosen for the marine attraction was the Vauxhall Reef, just south of Holetown, having an area of 250 ha (Figure 3).

As a part of the Underwater Park Project, the Parks and Beaches Commission obtained possession of the *M. V. Stavronikita* in late 1977. This was a 118 metre-long, (387-foot) freighter that burned at sea and was towed to Bridgetown. On November 22, 1978, the ship was finally towed to a point approximately 1 km offshore near the village of Prospect on the west coast and sunk in 43 metres of water where it has become an artificial reef and sport diving attraction; the main decks are at depths

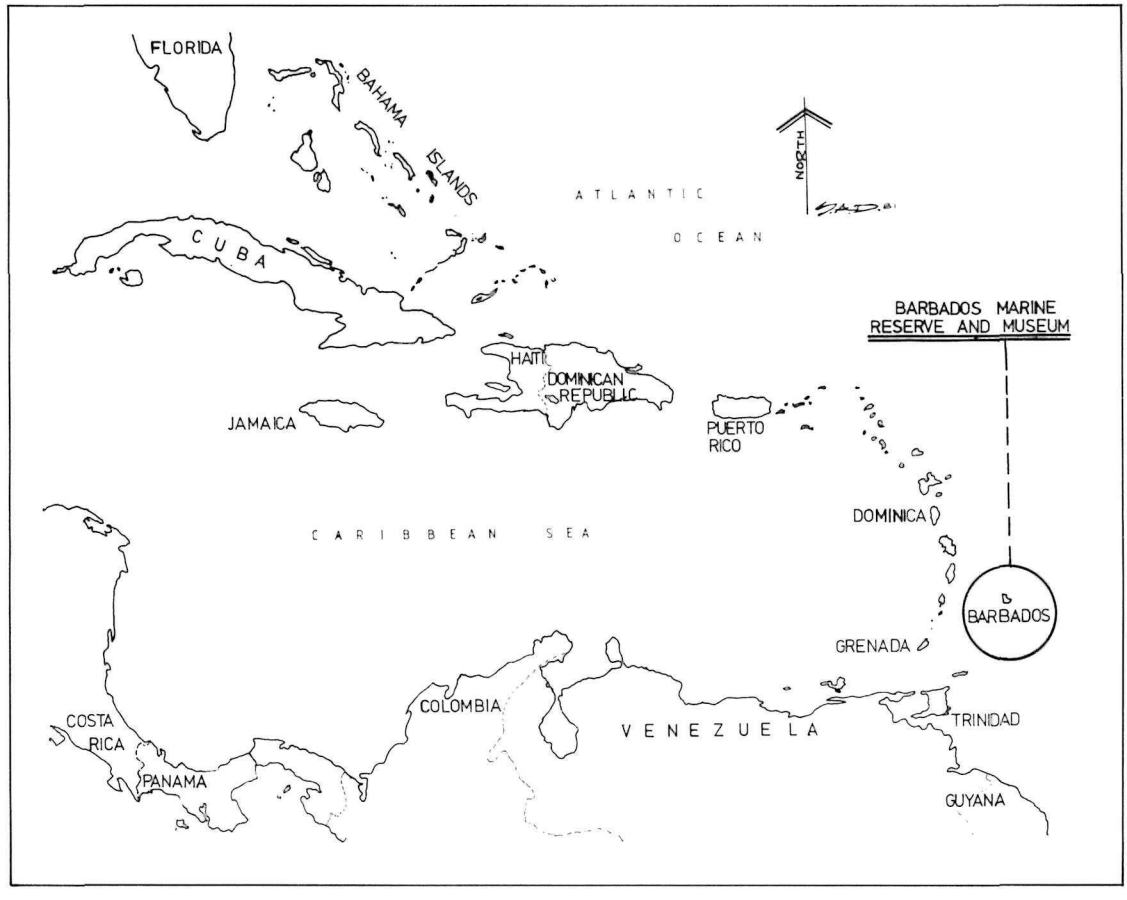


Figure 1. The Lesser Antilles and the Caribbean Sea.

between 21 and 27 metres.

In early 1979, the Commission approached the United States Peace Corps for help in the technical aspects of marine biology and parks establishment. A volunteer was assigned in October 1979, and preliminary work began in earnest. Recommendations and subsequent approval by the Commission produced several changes in the initial plan. The name was changed to the Barbados Marine Reserve to reflect the larger authority envisioned by the Commission and to conform with existing literature on the subject (Ray, 1976). The overall size of the park was increased by a factor of ten in order to include the offshore bank reef, known as Dottin's Reef, the Bellairs Fringing Reef and two large bays on either side of Vauxhall Reef—Discovery Bay in the north and Sandy Bay in the south; this increase served to protect the coral reef ecosystems and not just the physical structure of the fringing reef itself. Within the expanded area, four zones were set up to be coordinated with a management plan.

As the above work was progressing, a Marine Museum was also being planned. This facility was designed to house specimens collected from the nearby reefs as well as material for environmental education. On November 29, 1980, the Barbados Marine Museum was officially opened to the public by the Deputy Prime Minister, Hon. Bernard St. John.

Two major pieces of legislation were drafted and presented to Parliament by then Minister of Housing, Lands and the Environment, Hon. Lionel Craig. On February 16, 1981, the laws were gazetted. The first order was the "Designation of Restricted Areas Order, 1981," which established the boundaries of the marine areas. The second order was the "Marine Areas (Preservation and Enhancement) (Barbados Marine Reserve) Regulations 1981." This package of laws established regulations to govern the use of the zones within the marine area and the enforcement policies. The orders were patterned after United States laws and suggested regulations for the Key Largo Coral Reef Marine Sanctuary, the proposed Flower Gardens Marine Sanctuary, the proposed Looe Key Marine Sanctuary and the proposed St. Thomas U.S.V.I. Marine Sanctuary (U.S.D.C., 1976, 1978, 1979, 1980), (Dept. CCA, USVI, 1979).

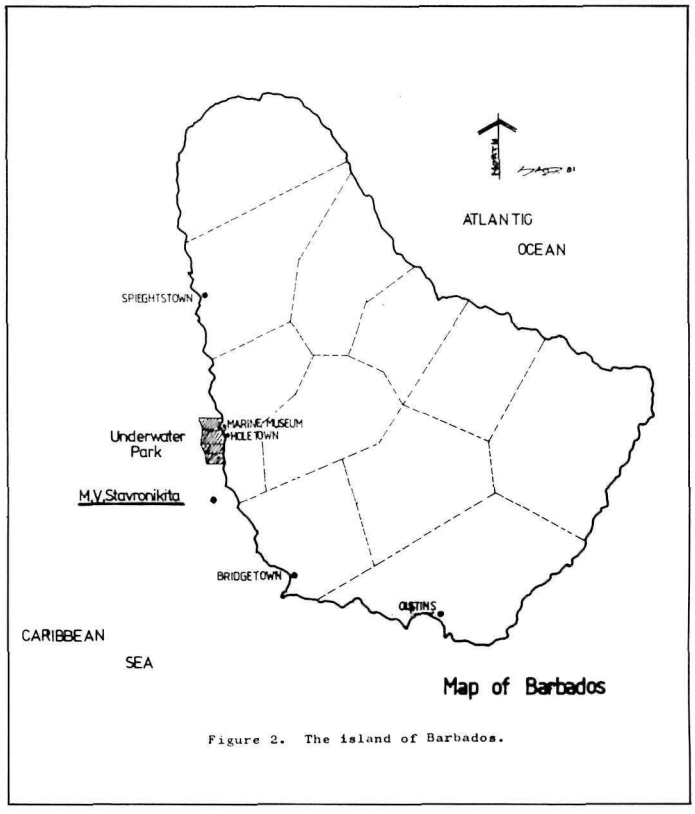


Figure 2. The island of Barbados.

Management Plan

The progressive stages for the establishment and administration of marine parks have been documented by Wallis (1971) and Ray (1976). For the most part these steps and management plans for the Buccoo Reef National Park (CCA, 1979) were followed as a guideline where applicable in Barbados. The park is now in the operation and management stages which require on-going monitoring of the reefs and enforcement of the regulations.

The Marine Reserve is composed of three sections: the *M. V. Stavronikita,* the Underwater Park and the Marine Museum. The government authorities have suggested that dive boat operators and private citizens attempt a dive on the *Stavronikita* wreck only under experienced supervision because of the depths involved. A four-man recompression chamber is being sought to provide emergency service in the event that a diving accident should occur. The marine life is being qualitatively monitored to give indications of the progress and succession of the floral and faunal colonization. A need still exists for regulations concerning this wreck and all other wrecks around Barbados; in the future, as problems relating to the administration of the Marine Reserve are solved, attention will be turned toward this urgent matter.

The Underwater Park is by far the largest and most significant part of the Marine Reserve. It is 2500 ha in area, ranging from 0 to 46 metres in depth on the seaward sand flat off Dottin's Reef. The reefs in the area are of two main types. The nearshore reefs, Bellairs Reef and Vauxhall Reef, are fringing reefs that have formed on headlands where old coral formations are exposed (MacIntyre, 1967). The offshore Dottin's Reef, also

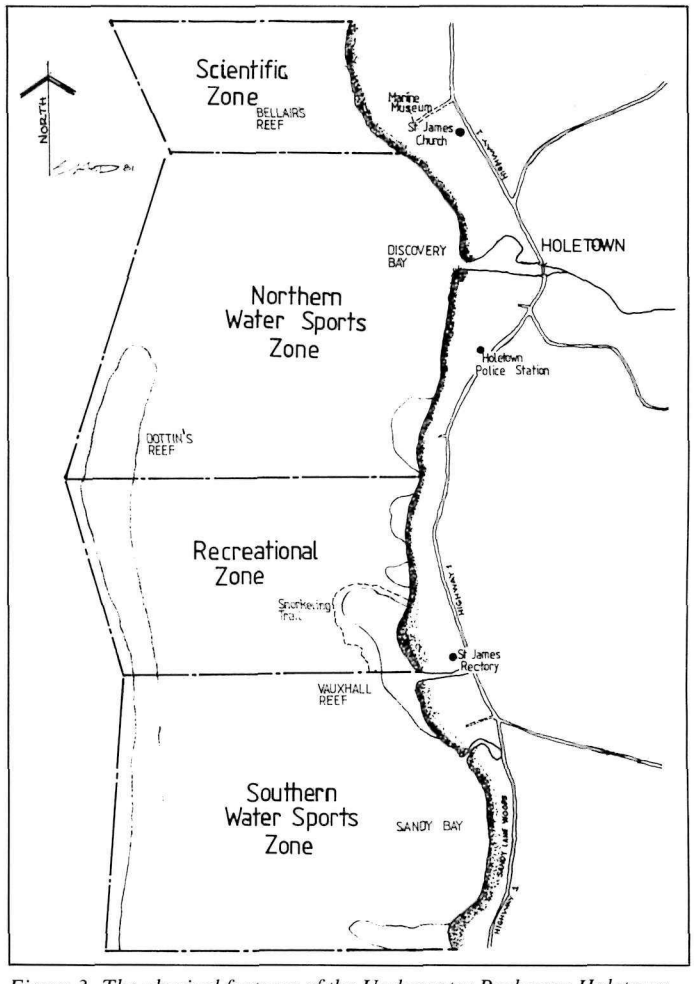


Figure 3. The physical features of the Underwater Park near Holetown, St. James.

discussed in MacIntyre's geological treatment of the West Coast, is a bank reef that rises to within 11 metres of the surface and drops to sandy flat at 46 metres. The fringing reef ecosystem and the associated faunal components have been described by Lewis (1960) and Stearn, Scoffin and Martindale (1977), while the species composition and zonation of the bank reef has been described by Ott (1975). The systems are so defined because a trough, 38 metres deep, separates the reefs. Some 35 species of coral have been found to inhabit the nearshore waters of Barbados.

There are four zones within the Underwater Park. The northern-most area is the Scientific Zone, which includes the Bellairs Reef. This is intended to be the area where educational projects and research work will be carried out and tourism will be minimized; controls in the form of permits and boating restrictions will be enforced to maintain the safety of the reef and the researchers. It is hoped that as specimen collections are made, representative specimens will be donated to the Marine Museum.

Directly south of the Scientific Zone is the Northern Water Sports Zone. This area and the southern-most region, the Southern Water Sports Zone, are the largest areas of the Underwater Park. Before the establishment of the Marine Reserve the largest attraction to the sea in the Holetown area was the water sports concessions. It is the intention of the Parks and Beaches Commission to promote water sports and manage them in a controlled fashion, compatible with other park activities. Here one can find water-skiing, para-sailing, jet skiing, wind surfing, sailing and boating of all types.

Between the two water sports zones lies the Recreational Zone. This area includes the Vauxhall Reef as well as a large section of Dottin's Reef. The fringing reef will be the site of 20-marker snorkel trail. Each marker will demonstrate information concerning certain types of reef animals or an oceanographic phenomenon. The inshore reefs will be used by snorkelers, beginning and advanced scuba divers and glass bottom boats. The offshore reef is only intended for use by scuba divers because the reef is located 600-800 metres from shore and is 15 metres deep at the shallowest point. The laws governing these zones, as referred to above, allow for reasonable recreational and educational uses while prohibiting the many stresses which can occur in the nearshore marine environment.

The Park Supervisor/Marine Biologist is responsible for the day-to-day running of the Marine Reserve. Park naturalists and receptionists aid the supervisor in administrative responsibilities to the Marine Reserve headquarters. Ultimate authority over major issues such as permits, research projects and related cooperation with governmental and public agencies is channelled through the Parks and Beaches Commission. This is a statutory board responsible for the administrative decisions which are passed on to the Minister of Housing, Lands and Environment for his final approval. Enforcement of the regulations passed by Parliament is under debate at this time. Authority for arrest and issuance of citations may be assigned to the coast guard, a division of the Barbados Defence Force. Other agencies involved include the Harbour Master's Office, the Royal Barbados Police Force and the Sea Rangers and Wardens of the Parks and Beaches Commission authorized as Island Constables.

The Marine Museum is the land-based facility and headquarters of the Marine Reserve, located at Folkestone Park, St. James. It contains office and laboratory space for the Park Supervisor, the team of park naturalists and the receptionists. The laboratory is used for identifying and preserving specimens and for maintaining the museum displays in good order. A conference room has been provided within the building for use by visiting lecturers, student groups or meetings of special committees. The major attractions for the public are located on the upper floor. A projection room, which was furnished by Jolly Roger Ltd., contains seating for 25 people as well as two slide projectors and a 16 mm film projector. Three slide shows have been organized, including a recorded narration for each programme. Very soon three films donated by the Canadian Broadcasting Corporation, the British Broadcasting Corporation and the Mayo Film

A quiet beach in the Recreational Zone south of Holetown. From here one has access to the reefs and the snorkel trail. Areas north and south of this zone are set aside for water sports. Photo: P.J. Cotter

A museum display room and projection room seating 25 people are located in the Marine Museum, Folkestone Park, St. James. Headquarters of the Reserve is here as are a conference room, laboratory and reception facilities. Photos: P.J. Cotter

Corporation will be shown to audiences. These films cover the biology of the Barbadian reefs, man's influence on the Caribbean and a documentary on the *M. V. Stavronikita,* respectively.

The largest room for public viewing is the Museum Display room. There are 28 different displays including showcases with dried specimens of reef invertebrates, artifacts from local waters, portholes and a pictorial essay on the *M. V. Stavronikita,* photographic scenes of the reefs, a mural depicting the inshore reef and a central display of cetacean bones. To offset the static display cases, three 120-litre aquaria have been constructed to give the visitor some idea of the living organisms of the sea.

The Future

The future goals of the Marine Reserve include monitoring of the reef ecosystem and the accessment of other areas on the west and south coasts for annexation and protection. Also legislative action regarding the many shipwrecks and related marine archeological finds should come under consideration as well. Examination of fishing practices, particularly spearfishing, should be monitored around the island to note the extent of the damage to the more passive territorial reef fish populations.

A major thrust of the Marine Museum will be to educate the Barbadian public and its many visitors about the need for marine conservation. Through lectures, slide presentations, films and news media support, the message illustrating the needs of the delicate marine ecosystem will be taken to many groups of all ages to enlist their support for the programme.

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Patrick J. Cotter, a marine biologist, served as a U.S. Peace Corps Volunteer in Barbados during the planning of the marine reserve described in this article. He is now working on a reef fish population project as a graduate student at McGill University's Bellairs Research Institute in Barbados.

Dennis Glick

Ancient Tools for Contemporary Land Use

For millenia, native peoples of the tropics have successfully co-existed with their fragile natural environment — an environment which today is being ravaged by many instances of inappropriate development. Their sustainable land use practices are the result of years of trial and error, culminating in a vast storehouse of ecological wisdom (NAS 1980:35). Only recently have natural resource managers recognized the value of this indigenous knowledge and its relevance to the dilemma of development without destruction in the humid tropics. As "spillover" impacts of regional land use become as serious a concern to wildland administrators as disturbance within their parks, the need to promote appropriate resource utilization adjacent to reserves is imperative (Soule and Wilcox, 1980). Indigenous technoloogy could provide the tools for meeting this challenge. And equally as important as the identification of these "tools" is the need to formulate a strategy for implementing them on a wide scale. While several such efforts are being attempted independently by some concerned with environmental deterioration in the tropics, most activities have been limited in scope and lacking in scientific cooperation. However one international conservation endeavor, the UNESCO "Man and the Biosphere Program" (MAB), could serve as the ideal coordinator for putting this theory into global practice. Not only is MAB capable of carrying out detailed investigations of this nature but it is also designed to facilitate experimentation and field trails and later incorporate knowledge gained into regional, national and international development. Thus the "rediscovery" of forgotten technologies and their dissemination by MAB associates may represent one of the most feasible and logical strategies for arresting widespread destruction of tropical biomes (Glick, 1981).

Indigenous Technology

Much like the ecosystems in which they reside, traditional indigenous peoples occupying tropical moist forests are characterized by their extreme diversity (Hutterer, 1976). Tribal groups sharing the same linguistic stock or even family ties may be widely distinctive in resource utilization if their habitat is even slightly varied. The Amerindians of the Amazon basin are a good example of this divergence in land use. Though once thought of as homogeneous, the forests of this region are actually composed of an amalgam of distinct ecological zones. This is reflected by the wide array of life-styles and technologies demonstrated by the natives of the region (Ross, 1978). In a sense their resource management techniques may be used as an indicator of ecological conditions. Sweeping generalities which have been directed at their cultures can be as erroneous as generalizations about their forested environment.

In response to varying habitat, indigenous peoples often utilize environmentally sophisticated agricultural systems and diversified food gathering techniques (Conklin, 1957). Slash and burn farming in the hands of non-traditional populations has destroyed vast areas of tropical rain forest. Yet the manner in which it is often practiced by the indigenous groups can impart minimal ecological disruption. While this may be attributed in part to limited population size, many aspects of indigenous agriculture not practiced by the immigrant farmers are the very factors which mitigate long term resource impacts. Agroforestry and intercropping, terracing and irrigation, regulated burning, erosion control, composting and many other techniques prescribed by modern tropical agronomists have been implemented for centuries by indigenous groups. The Hanunoo tribe of the Philippines, for example, recognizes a variety of soil types and indicator species and will not plant in areas that do not demonstrate certain "signs." When land is cleared the Hanunoo take great care to facilitate a "good burn" but one which does not run out of control. One and sometimes several fire lines are dug around agricultural plots and special techniques such as backfiring are used to direct the flames (Conklin, 1957). Several tribes of the Congo area burn vegetative refuse under piles of dirt to produce a type of compost that is rich in nutrients and is later spread on fields (Miracle, 1976). The planting stock used by native agriculturalists usually includes several varieties of each cultigen. The Iban peoples of Sarawak plant literally dozens of strains of rice which insures not only the survival of at least some of the varieties but also continual year-round production (Freeman, 1955). Cultivated plants are often supplemented with wild edible species. The aboriginal Tsembagas of New Guinea can name 264 varieties of palatable wild plants. This same tribe, as well as several others, use intercropping and agroforestry techniques which mimic canopy statification and diversity of primary tropical forest, making it less susceptible to insect pests or plant diseases. The Tsembaga actually promote reforestation in their agricultural plots by protecting tree seedlings which become established. A Tsembaga gardener "is almost as irritated when a visitor damages a tree seedling as when he heedlessly tramples a taro plant," even though the tree may cause premature abandoning of the plot (Rappaport, 1971).

In addition to providing models for sound agricultural development in the humid tropics, native peoples generally possess a wealth of knowledge on: edible and medicinal wild plants, construction qualities of naturally occurring materials, and techniques for managing wildlife on a sustained yield basis. Considering that over 50 percent of our pharmaceuticals are derived from plants (most of these tropical) it is not surprising that indigenous groups provide botanists with countless insights into the potentiality of utilizing plants for medicine (Myers, 1979). The Bayano Cuna of Panama use plants for treating maladies ranging from toothaches to back pains as well as birth control and abortions (Bennet, 1962). Natives of the Congo commonly cure injuries and illnesses of their domestic stock with remedies derived from local flora (Miracle, 1967).

Hunting has reached a high degree of specialization and regulation among the aboriginals. Hunting taboos which prohibit the harvesting of

certain creatures are common and most often placed on rare species or those with low reproductivity rates (Ross, 1978). Investigation of hunting magic and taboos could give wildlife managers a fair idea of which game populations can tolerate harvesting. Though domestication of rain forest fauna is not commonly practiced, some indigenous cultures, such as those of northern Panama, artificially increased game populations by permitting wildlife to forage on horticultural plots (Linares, 1967).

The value of these and myriad other native land use practices to the resource manager is to provide subtle guidelines for insuring low impact, sustainable land use in areas adjacent to reserves. This would prevent not only increasing incursions upon park resources but also the biogeographical isolation of protected areas which may be as disruptive as internal habitat alteration. It is becoming increasingly apparent that wildland administrators must extend their scope of concern beyond park boundaries if genetic diversity of natural areas is to be perpetuated (Soule and Wilcox, 1980).

Transfer of Indigenous Technology

Until recently the term "technology transfer" in development nomenclature generally denoted the vertical exchange of information from northern industrialized countries to the lesser developed nations of the tropics. These practices are often ill-suited to the distinct ecological and social characteristics of tropical zones and have contributed to widespread environmental and cultural degradation (Farver and Milton, 1972). Although extensive information on indigenous technologies exists in anthropological and archeological literature, little has been assessed in terms of its potential application to regional development. But because of the unique organization and infrastructure of MAB—specifically MAB Project 8, Biosphere Reserves—such a global effort could be launched. As mentioned previously MAB is capable of not only facilitating research but also applying the insights gained to natural resource-related problems of development. One of their major goals is to provide the heretofore "missing link between scientific disciplines and application of resultant knowledge and technology" (Franklin, 1977).

The Biosphere Reserve Program in particular is designed to develop an international network of protected wildland units encompassing representative samples of the Earth's biological provinces. As of December 1981, 209 Biosphere Reserves had been officially designated by 55 nations. In contrast to a national park which may exclude non-staff residents, these reserves often allow inhabitants to remain in specified areas if their environmental impacts are negligible. This generally applies to the traditional native cultures. Ecological research, education and training are important components of the MAB program. Thus the collection and assessment of data on aboriginal land use would justifiably be a management priority.

The zoning scheme for Biosphere Reserves as suggested by the International Union for Conservation of Nature and Natural Resources (IUCN), and illustrated in Figure 1, includes a core (natural) zone which frequently consists of a national park. Where conditions permit, it may also include a cultural zone where native peoples are allowed to continue their traditional life styles, and a manipulative and restoration zone where ecologically appropriate land-use practices—indigenous technology—can be implemented. Thus not only could these reserves maintain the integrity of pristine environments but they also potentially could serve as experimental and demonstration areas for sound land-use practices.

Unfortunately, at the field level, indefinition or overlap of responsibilities for administration and management of areas designated as MAB Reserves have often precluded realization of this potential.

In detail some of the more salient features of the MAB Biosphere Reserve Program which directly relate to the transfer and implementation of indigenous technology are the following:

1. The MAB program represents a consortium of agencies and individuals from many nations with the technical expertise needed to manage

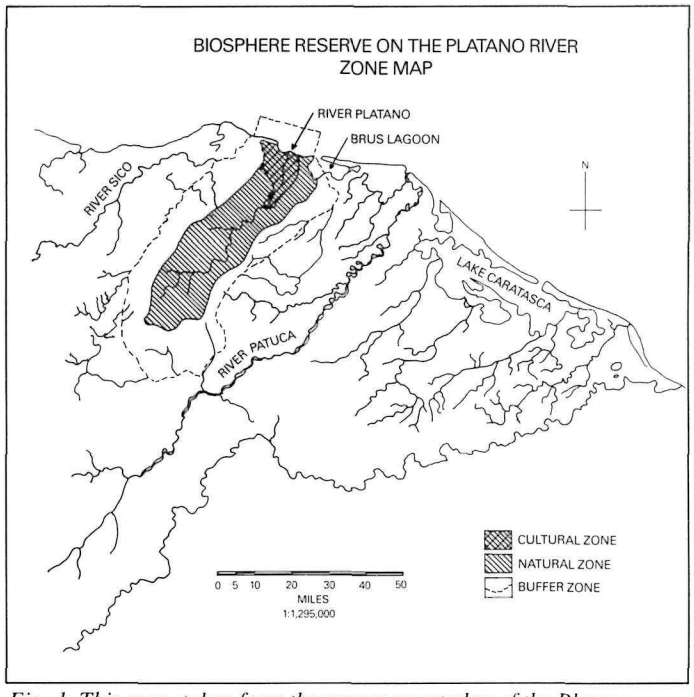
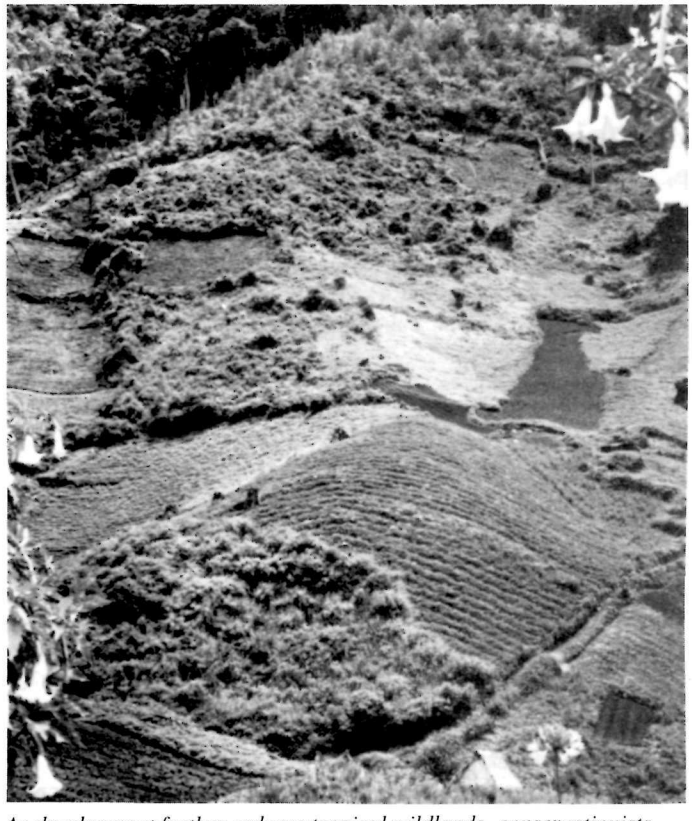


Fig. 1–This map, taken from the management plan of the Platano River Biosphere Reserve, illustrates the zoning scheme of these protected wildland units. Not only does a "Natural" Zone completely protect pristine ecosystems but a "Cultural" Zone is included to preserve the wisdom and heritage of native peoples. Manipulative experimentation and demonstrations are allowed in the buffer zones and will theoretically serve as sites for extension work with non-indigenous rural peoples living adjacent to the reserve.



As development further reduces tropical wildlands, conservationists are becoming actively involved in the promotion of sound land-use practices adjacent to parks. Hillside agriculture such as this farm adjacent to Panama's Volcan Baru National Park has isolated the reserve from other expanses of natural habitat. Photo: Dennis Glick

Many tropical agricultural methods practiced today are ecologically and socially devastating. Techniques used by some indigenous farmers, however, may give agronomists clues for mitigating much of this impact. Photo: Dennis Glick

these Indigenous Technology Transfer Programs: wildland planners and administrators, anthropologists, foresters, agronomists, archeologists, environmental educators, psychologists and sociologists, biologists, community developers, etc.

2. MAB stresses an integrative approach to solving natural resource problems. And though emphasis is on local solutions to local problems, MAB also supplies the technical backstopping of the global scientific community through the organization of an international communications network.

3. The Biosphere Reserve Guidelines contain several elements related to the development of native technology activities. Through zoning and management programs, indigenous peoples are allowed to remain within a protected wildland unit and participate in its development. Study of native use of natural resources is encouraged, as is the assessment of their ecological impact. The educational and research aspects of Biosphere Reserves, including the options of manipulative zones, cultural zones and recuperation zones, would indicate that activities needed to collect, analyze, demonstrate, and disseminate native skills could all be carried out within the management framework of a biosphere reserve. Even if indigenous populations did not reside in an area or if they were not practicing sound technologies, the MAB link with other reserves and information sources could insure adequate technical input needed to launch such projects.

4. Finally, the Man and the Biosphere Program falls under the auspices of UNESCO, perhaps the international organization most capable of collecting and globally distributing educational materials. Education, science and culture, the three target subjects of UNESCO's efforts, are also the essential elements of indigenous technology transfer programs (Glick, 1981).

Progress and Problems

While still in its infancy, the concept of using aboriginal skills in national development programs is gaining attention. In Mexico, for example, ancient Mayan irrigation canals are being mapped while in Peru similar systems constructed by the Incas are actually being rebuilt (Donald Skillman, pers. comm.). This represents a notable attitudinal change on the part of the anthropological field which has generally not applied its storehouse of documented indigenous knowledge towards contemporary environmental problems. Several tropical science institutes such as the Tropical Agricultural Research and Training Center, the National Amazon Research Institute, the Mexican Institute for the Study of Medicinal Plants and others have recognized and are assessing the potential of native land-use techniques (AMARU IV, 1980). International conservation programs such as IUCN's World Conservation Strategy have incorporated the protection and study of native peoples into their global protection efforts (IUCN, 1979). The National Academy of Sciences (US) recently issued this statement in relation to research priorities for tropical biology: "Another major gap in our scientific information concerns the functioning and adaptation of human populations in the tropics. Aboriginal populations have long existed in tropical forests and possess considerable knowledge about them. Human diversity as well as biological diversity is being reduced world-wide, and the rich variety of conceptual and agricultural expression that characterizes the thousands of people living in the tropics is of great theoretical interest" (NAS, 1980). Finally, in several Biosphere Reserves plans are being initiated which will lay the groundwork for possible future indigenous technology transfer activities. In the Rio Platano Reserve in Honduras a management program which incorporates native populations into the protection and development of the area has been formulated and is being carried out. Indigenous land use is monitored in the reserve and cultural and manipulative demonstration zones have been established in addition to the protected core zone.

However, several problems still plague this fledgling effort. An important factor which has weighed heavily into the failure of North/South technology exchange, and could be equally relevant to indigenous technology transfer, is that a well-adapted, appropriately structured social organization is needed to adequately realize development goals (Freeman, 1955; Neitschmann, 1973). Many indigenous cultural practices depend upon these specialized social systems for their maintenance. For example, communal efforts are often needed to harvest crops or wildlife. Imposing communal development strategies in established capitalistic social systems may be strongly opposed.

There may also be opposition to a perceived "devolution" in resource utilization techniques. Third world societies striving to erase their archaic image may not willingly sacrifice the supposed advancement of modern technological development, regardless of whether there is really an advantage over more traditional practices. The general attitude of prejudice against indigenous peoples may inhibit many from adapting land-use techniques, which natives are known to have perfected. Consequently,

A Paya Indian capturing an iguana in a Honduras river. Native peoples often possess a wealth of knowledge related to sustained yield harvesting methods for tropical wildland resources. Photo: Dennis Glick

information gleaned from aboriginal populations will have to be interpreted and presented in such a manner as to make it more acceptable to non-Indians. And, an adequate environmental knowledge base will have to be established in the minds of recipients before it will be intelligible.

Because this program links the anthropological sciences with the field of natural resources, it will need professionals and technicians versed in both disciplines. They must be able to integrate the wide range of needed expertise into their orientation towards regional development. In addition, communication skills are essential as extension work will play an integral role. Universities and training institutions will in most cases have to broaden their scope of integrated curriculum to include this new approach.

In relation to the MAB program, the future management orientation of these reserves still remains clouded. After initial establishment, development of many sites has stagnated. This is due in part to funding problems but it is also hampered by lack of direction. Further clarification of the MAB program and assistance for the oftentimes financially and technically deprived third world reserves is needed if the program is to become firmly established. Reserve administrators, generally burdened with insufficient human and financial resources, may be tempted to consider such projects of secondary importance. However, a thorough analysis of benefits accrued from these activities should in most cases warrant their high priority.

Perhaps the greatest and most tragic obstacle in the collection and utilization of native technology is the fact that their originators and propagators — the indigenous people themselves — are rapidly being physically and culturally destroyed. Their land-use practices, which have evolved over thousands of years and are still evolving, face obliteration unless concerted steps are taken to conserve these cultures and their wealth of knowledge.

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Dennis Glick served as Regional Conservation Officer at Centro Agronomico Tropico de Investigacion y Ensenanze (CATIE) at Turrialba, Costa Rica. He recently completed graduate studies at University of Michigan. Copies of his master's thesis, "Indigenous Technology Transfer and the MAB Program," are available from University Microfilms International, 300 N. Zeeb Road, Ann Arbor, Michigan 48106 USA.

PARK TECHNIQUES

Alternate Energy Sources for Sagarmatha National Park *Broughton Coburn*

When Sagarmatha (Mt. Everest) National Park was gazetted in 1976, the authorities of Nepal's Department of National Parks and Wildlife Conservation recognized that they would face some challenging management problems.

Several threatened wildlife species share the park with 3,000 native Sherpas, related to Tibetans, and an equal number of yaks and yak cross-breeds. In addition, over 4,000 visitors who come for trekking or climbing each year have combined forces with these permanent residents to severely stress the environment and resources of the park.

Yaks are grazed to altitudes over 16,000 feet (4836 m), and many of the traditional pasture areas are deteriorating, or stable at best.

Most noticeable in terms of visible human impact on the park, however, is the lack of trees within a one to three kilometer radius of each village—trees cut chiefly as firewood for cooking. Many visitors to settlements within the park assume they have climbed well above treeline, and are shocked to find large-diameter tree stumps in some cut-over areas, thought-provoking reminders of the size of the forests of only 30 years ago.

Translocation of park residents is not a viable management option in Sagarmatha National Park. The Sherpas, aside from their importance in attracting and promoting tourism, Nepal's chief source of foreign exchange, have inhabited the park for over 3000 years, and retain rich cultural and religious tradition in the Nyingmapa sect of Tibetan Buddhism. Intensive reforestation plans have been implemented as a first priority, but the development of alternate sources of cooking fuel is now being pursued as an important partial solution to the firewood crisis burdening villages of the park.

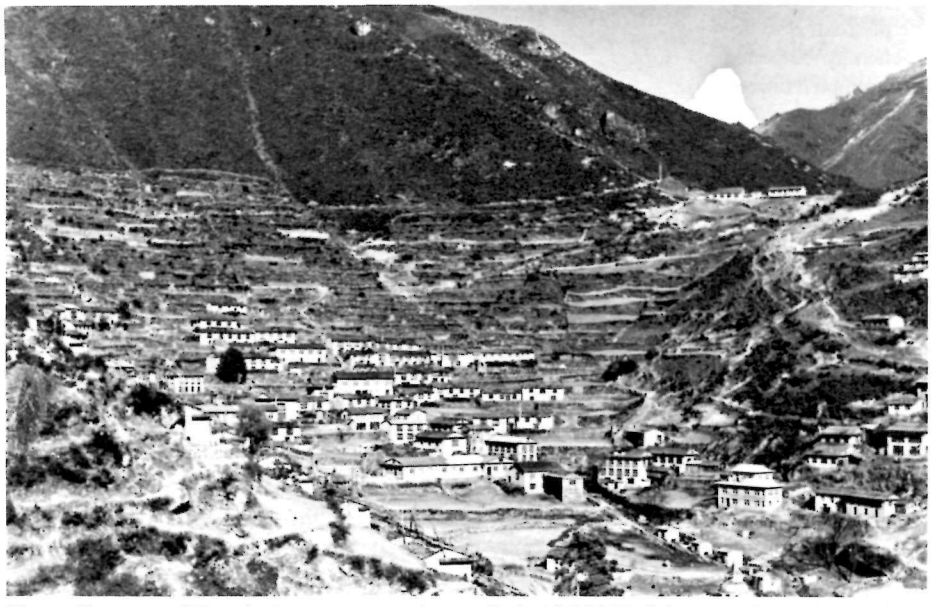
In 1980, UNESCO designated Sagarmatha National Park a World Heritage Site, with the intention of further protecting the unique environmental and cultural features of the park. UNESCO is now supporting the following activities as part of their preliminary technical cooperation with the Department of National Parks:

1 *Fencing;* funds have been allocated for extending traditional stone fences around areas that have been replanted in native fir, pine and willow species under ongoing reforestation programs.

2 *Temple restoration;* partial support has been offered for reroofing, courtyard reconstruction and some interior restoration work on five village *gompa* (monastery-temple) complexes within the park. Gompa restoration committees have been established in each village, and are supplying the bulk of the financing and labor for this work.

3 *Visitors' Center;* relief maps, educational displays and materials, and a hydraulic ram for the delivery of drinking water are being supplied to the visitors' center at the park headquarters in Namche Bazaar.

4 *Alternate energy;* as a pilot scheme, the World Heritage Project is implementing a wide range of alternatives to firewood and assessing their potential for adoption on a larger scale. Highlights of some of these technologies are covered here.



The trading town of Namche Bazaar, soon to be supplied with 25 kW of electricity for cooking and lighting from a micro-hydroelectric generator. Note the almost total lack of trees on the surrounding hillsides.

ALTERNATE ENERGY TECHNOLOGIES

Micro-hydroelectricity

At their quarterly meeting in Sydney, Australia, in October of 1981, the World Heritage Committee approved $31,000 for the construction of a prototype 25-kilowatt micro-hydroelectric (less than 100 kW) facility for Namche Bazaar. The electricity from this initial system will supply cooking and lighting for the National Park staff quarters and offices, quarters for the army guards who are posted in the area to control poaching and illegal firewood cutting, and several houses and lodges of the village. In accordance with guidelines established for development activities within the park, the intake and powerhouse of the system will not be visible from the main trekking routes; electricity for the entire network will be distributed through underground wiring.

The Banki cross-flow design turbine will be made locally in Nepal. Most other materials and skills required for construction, exclusive of electrical components, are also available in the country. It is expected that this initial plant will generate the technical skills and financing for subsequent facilities. In addition, an estimated one tree per day will be saved from consumption for firewood. Further, the Namche Bazaar spring has remaining sites for future plants to be installed in series.

Hydroelectric power generation capability of this spring was initially assessed with a hand level — used to measure available head, or water drop—and a streamflow measuring weir. To collect streamflow data with a measuring weir, the streamwater is passed through a notched barrier; the height of the water above

the weir notch is then measured at periodic intervals and engineering formulas are applied to determine streamflow. Further information on streamflow measurement and the calculation of hydroelectric potential can be found in the references.

Solar Water Heaters

Inexpensive 60-litre flat tank (non-circulating) solar water heaters, manufactured in Kathmandu, have been installed in several locations within the park. They are currently being fitted in buildings of the National Park and sold to the local inhabitants on a revolving fund basis. For those installations where the owners are currently paying cash for firewood, solar water heaters have been distinctly cost-effective. Most importantly, they have effected some firewood savings.

The flat tank design was chosen for its greater resistance to freezing temperatures, a significant problem in the higher-elevation villages, and its lack of need for a separate, and often expensive, hot water storage tank.

Photovoltaic cells

At over US $1.00 per litre of kerosene, many large houses and lodges in Sagarmatha National Park spend over $170 per year on fuel for lighting alone. Conservatively assuming financing at 15 percent annually, no fuel cost escalation, and replacement of batteries at four-year intervals, durable photovoltaic solar cell arrays can eco-

A 60-litre flat tank solar water heater, installed at a lodge in Namche Bazaar. The insulated doors, closed at night to retain heat, are opened during daylight hours and angled to reflect heat onto the collector tank.

Preparations for installation of the hydroelectric generator at Namche Bazaar required collection of streamflow data with a measuring weir, shown here under construction. When installed, the intake system and powerhouse will not be visible from main trekking routes, and distribution wiring will be underground. Additional generators can be installed in series in the same stream in future.

nomically compete with kerosene for domestic as well as commercial lighting in the park.

The National Parks Department and the World Heritage Project will be installing three demonstration PV systems of 37 watts capacity in houses and lodges within the park, to charge 12-volt automotive batteries. This system will be used to light 20-watt and 30-watt fluorescent lamps. Channels for encouraging their adoption through the private sector are also being investigated, since capital does not appear to be a constraint, and the convenience of solar cell-generated electricity is readily visible to the local villagers. Because of the length of time required to recover the initial investment, however, it may be several years before the Sherpas will be willing to risk their capital against a product of unproven lifespan.

Replacement of kerosene with alternative lighting fuels would appear to have little effect on forest conservation, but ultimately fewer porters would be required to carry the necessary kerosene into the park. Also, improved lighting may check the burning of pine torches destructively cut from the cambium of mature standing trees.

Improved Cooking Efficiency

Many of the Sherpa households within Sagarmatha National Park have in the last few years converted their traditional open floor-level firepits to stand-up hearths, for reasons of convenience, smoke control and to achieve firewood savings. But because of the cold climate and the religious and cultural importance of having a central fire, many households prefer the open firepit, which provides immediate radiant warmth. Airtight stoves must be carefully operated to achieve real firewood savings, and National Parks Department officials have noted that due to the intense heat they are capable of creating, draft-controlled stoves may actually encourage the burning of green wood, an illegal practice within the park.

Most permanent park residents appreciate space heating, but do not consider it to be a priority. Contrary to some other Himalayan regions, such as Ladakh, where the inhabitants burn coal to heat their houses, currently in Sagarmatha National Park little firewood or money is expended for space heating.

An improved version of the "volcano cooker," a water-jacket tea kettle, has been developed from a British prototype by a local blacksmith in Namche Bazaar. When set on the hearth or firepit tripod, the heat and flames travel up the central hole of the tall kettle, heating the surrounding jacket of water. The first model brought two liters of water to a boil within five minutes. Several villagers have privately ordered the volcano cooker, and the blacksmith is now constructing a large built-in model which will be used to heat water for bathing and for washing clothes and dishes at a large lodge within the park.

Improved cooking efficiency is expected to save fuel. Here Ang Duli, a Sherpa resident of the Park, uses the "volvano cooker" water jacket tea kettle to heat water for tea.

Kerosene depot

In order to discourage the indiscriminate consumption of firewood by trekking parties, the National Parks Department has begun to enforce the regulations that all visitors to the park planning to stay outside of lodges and houses must carry fuel sufficient for their own cooking purposes. Visitors have also been prohibited from burning wood in outdoor campfires.

In order to effectively implement these rules, a small kerosene distribution depot has been established at the southern entrance to the park to assure the supply of cooking fuel, at a reasonable price, to visiting trekkers. The committee formed to manage the concession for the depot is comprised of representatives from the National Parks Department, a large trekking company, the German Alpine Club and the Nepal Oil Corporation.

In light of increasing visitation to Sagarmatha National Park, a careful balance between environmental protection and the need and demand for development activities must be maintained. In Sagarmatha's case, micro-hydroelectricity, solar power and other improved energy sources can help satisfy the Nepalese residents' demands for alternatives to firewood for cooking, and simultaneously preserve the rich environmental integrity of this unique National Park.

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Broughton Coburn is UNESCO's Alternate Energy Advisor to the National Parks and Wildlife Conservation Department, Kingdom of Nepal.

Atlantic Ridley Marine Turtle Reintroduced At Padre Island, USA

Milford R. Fletcher

The Atlantic ridley turtle *(Lepidochelys kempi)* has long been recognized as an endangered species, possibly the most endangered of all sea turtles. It was formally listed by the U. S. Fish and Wildlife Service (USFWS) in 1970 as evidence accumulated showing an alarming population decline. A 1947 film made from aircraft showed a nesting aggregation of approximately 40,000 females on an isolated Mexican beach. Estimates in the 1970s were considerably less than this number, and by 1981 indications were that there may be no more than 1,000 individuals of this species on the planet.

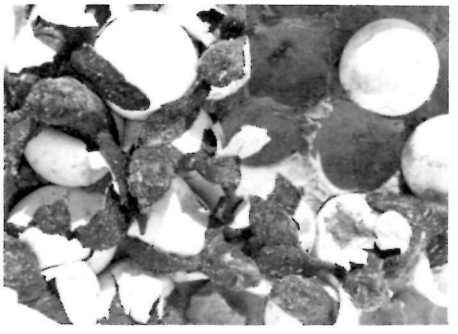
In 1977, a joint effort between the Audubon Society, the State of Texas, the National Marine Fisheries Service, the USFWS, the U. S. Coast Guard and a number of other private, State and Federal agencies, including the National Park Service and the Republic of Mexico, met to explore avenues to help this animal make a comeback.

In meetings with the world's leading turtle authorities it soon became evident that little was known about the biology of the Atlantic ridley; obviously we were exploring new ground. However, officials of Mexico were eager to assist the turtle in its plight as were all contacted in the U.S.A. Thus, the Atlantic ridley turtle restoration project began.

We began with several assumptions that are yet to be tested in a satisfactory manner. Some of these were:

1. It would be desirable to have a breeding population of the turtle in an area in the United States where they had been known to nest in historic times. The logical area was Padre Island National Seashore (NS) in south Texas where the animal was known to nest in the past, although infrequently. In addition, the NPS would be able to afford some protection in the event that a new breeding population became established. The animal is particularly susceptible to predation by humans since it is one of the few turtles to lay its eggs during the daytime.

2. Although the mechanism is unknown to us, even after four years of research, we believe that the turtles, in some way, imprint to the beach where they hatch and to which they return as adults to lay their eggs. We feel that this imprinting may be olfactory, as in salmon, which return to spawn in the stream where they hatched.



Atlantic ridley turtles tumble out of their shells and into Padre Island sand.

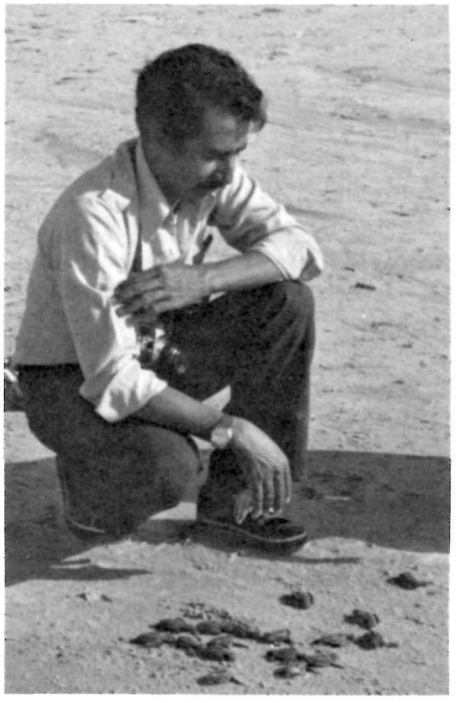
3. Mortality of hatchling turtles is quite high in other species studied. We assumed this would be so for the Atlantic ridleys as well. It appeared that mortality would be greatly decreased if we could release turtles somewhat larger than hatchlings (which are about 1½ inches or 3.5-4 cm in diameter.) Hatchling turtles are avidly sought by predators such as crabs and sea birds; mortality of yearling turtles appears to be primarily by sharks. Also, the eggs are highly prized; adult turtles are used as meat and their shells for jewelry.

With these things in mind, we began the project. Rather than enumerate the frustrations, lost tempers, late permits, and other problems we faced and solved, I will outline the steps we now go through to raise a turtle to approximately one year of age.

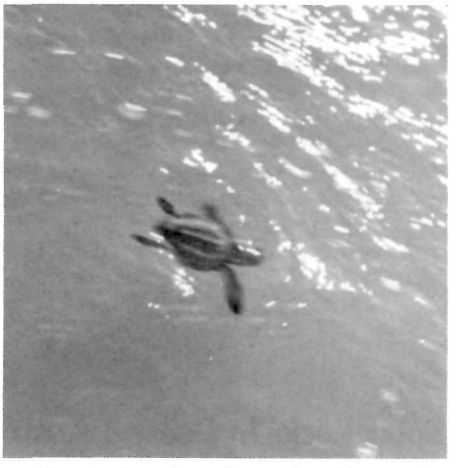
First, Styrofoam boxes are filled with sand from Padre Island and relocated to the only known nesting beach which, in the Mexican State of Tamualipas, is called Rancho Nuevo. We felt that if the imprinting process is olfactory, then the eggs should not be exposed to sand other than that from Padre Island. The turtle eggs are gathered in plastic bags from a laying turtle. The eggs are then transferred to the boxes of Padre Island sand and flown to Padre Island where they are placed in an insect- and predator-proof hatching facility. They are incubated in the Styrofoam boxes for approximately 50 days until they hatch.

The hatchlings then are transported a short distance to an isolated beach where they are released and allowed to make their way down the beach and a short distance into the surf. This is done to approximate the conditions that would exist if the animals actually had hatched on the Padre Island beach. As soon as they enter the surf, the young turtles are caught, placed in boxes, and flown to the National Marine Fisheries Service in Galveston, Texas. The U. S. Coast Guard has been most helpful in the transportation phase of this operation. The catching of the turtles in the surf is always attended by the news media and a host of visitors who appear to enjoy the activities immensely. The publicity has been favorable and the visiting public has been very supportive. The turtles are held at the laboratory in Galveston for approximately one year, during which time they reach dinner plate size.

Because of a conflict between the turtles and the Texas shrimping industry, the first two releases of yearling turtles were made off the west coast of Florida. Shrimp trawlers operating off the Texas coast had frequently caught adult sea turtles, which substantially interfered with their operations. Recently, the National Marine Fisheries Service and the Texas Department of Parks and Wildlife, working with shrimping industry, has tested "excluder nets" that allow shrimp but not sea turtles to enter. Because of the progress and the good faith evidenced in this effort, yearling turtles were released in the spring of 1981 off Padre Island. The University of Texas Marine Station at Port Aransas provided use of its research vessel for this release.



Hatchling turtles being released on Padre Island beach to make their way to the surf.



Surf imprint is made on this tiny hatchling, under careful human supervision.

After their taste of ocean, these hatchlings are on their way to the Galveston laboratory for a year of growing up.

SUMMARY OF ATLANTIC RIDLEY TURTLE PROJECT

Year	Number of Eggs Received from Mexico	Hatchling Percent at Padre Island	Number of Hatchlings Released
1978	2191	88.1	2019
1979	2053	85.7	1439
1980	2976	84.1	1530
1981	2284	83.3	

To date, nearly 5,000 yearling turtles have been released in the Gulf of Mexico. Each turtle is tagged for identification purposes, in the event of future recovery. Numerous turtles have been re-caught, from the east coast of Florida to Chesapeake Bay. The table above indicates the number of eggs received and hatching success.

The many unknowns that still exist in this project may influence our actions in the future. For example, we are still not sure at what age these turtles reach sexual maturity. Speculations range from 8 to 14 years. We are far from sure that the animals will return to Padre Island NS to nest and, if they do, whether we will be able to protect them. The State of Texas has an open beach law, and one very popular pastime is driving 4-wheel drive vehicles on the beach at Padre Island. It is conceivable that we may have to close the beach to vehicles for a period of two or three months, which is certain to cause some controversy, although the public has been very supportive of the project to date.

Research of green and Pacific ridley turtles indicates that the temperature at which the eggs are incubated greatly influences the sex of the hatchlings. It appears that the early part of the middle third of the incubation period is critical in determining the hatchlings' sex. If the temperature at this critical time exceeds 29.5 degrees Celsius (85 degrees F.), there seems to be a preponderance of females hatched. If the temperature is less than 29.5 degrees Celsius during this critical period, the preponderance of hatchlings will be males. Sometime in the future, if this proves true of Atlantic ridleys, we may decide to take advantage of this phenomenon. On the surface, it seems that adding females to the wild population would be advantageous, but this must be approached with great care since so little is known about the breeding biology of Atlantic ridleys. In the wild, females seem to nest twice each season with an average of about 100 eggs per clutch. Males do not come ashore during the breeding season, so little is known about their behavioral role in the breeding process.

Outstanding cooperation and support of numerous agencies and individuals has spelled the success so far of this project. Four National Park Service regional directors and three Padre Island superintendents have staunchly supported the reintroduction. Republic of Mexico officials and U.S. Federal, State and private organizations have shown a spirit of cooperation that is astonishing, with so many agencies involved. The Southwest Parks and Monuments Association has generously donated funds to support travel of officials from Mexico to the U.S. for strategy meetings. Without the continuing support of all these organizations, the project would have failed.

Numerous agencies are committed to continue this project but funding is always uncertain. Indications are that the National Marine Fisheries Service may undergo budget cuts which could reduce the "head start" program. The USFWS and NPS are under tight budget constraints which also could affect the program. Ultimately, our objective is to reintroduce enough turtles to establish another breeding population of the animals and provide another habitat in which they can breed and reproduce.

Milford R. Fletcher is Chief Scientist for the U.S. National Park Service's Southwest Region, Santa Fe, New Mexico. This article was reprinted from PARK SCIENCE, *Vol. 2, Number 2, a resource management bulletin published by the National Park Service.*

Dinner plate size, these year-old Atlantic ridley turtles are now big enough, it is hoped, to keep from winding up as the main course on some larger critter's dinner plate. Here they are released in the wild.

Solar Parks in Central Australia

Andrew Mitchell and Bill Brookes

The Conservation Commission of the Northern Territory has developed a solar-powered ablution block (a wash house and toilet) on one of its more remote National Parks in an effort to reduce the dependence on fossil fuels. Diesel-powered generators normally supply electricity in remote locations.

Located at Ormiston Gorge & Pound National Park, 130 kilometres west of Alice Springs, the ablution block has its hot water and lighting systems powered totally by solar energy.

Lighting

Three "Solarex" solar collector panels (photovoltaic panels) are located on the roof. They have a combined output of 182 amps/hour/week. The peak demand calculated for continuous use of all lights, discharge of the batteries due to cloudy conditions, etc. is 175 amps/hour/week. The panels are inclined at 30 degrees facing due north. Charge is stored in six 2-volt 225 amp/hour lead-acid batteries connected in series to form a 12-volt storage system.

To prevent the batteries over-charging and to prevent leakage of stored power through the collectors at night, an in-line charge regulator has been installed between the batteries and collectors.

A charge regulator is necessary because the high solar radiation experienced in Central Australia can lead to excess voltage running to the battery, resulting in a type of "thermal runaway" which has a quite drastic effect on the life of the battery.

The regulator also senses a fall to below 1 volt from the panels. This is interpreted as nightfall, and the external lights are illuminated, while power is supplied to the internal light switch. The batteries and voltage regulator are located within the service section of the structure.

Switching for the internal lighting is by a vacuum time delay switch, which can be adjusted to a maximum period of 20 minutes. The switch, operated manually by a person entering the block, powers twin 8-watt bulkhead fluorescent lights fitted on the ceiling of each side of the ablution block. Single 8-watt fluorescent lights located at each entrance provide external lighting.

In calculating specifications, it was estimated that the inside lights would be used 3 hours a day, and the outside lights 10 hours a day.

Total cost (including labour) for the installation of the solar lighting system only was $3,900.00 (August 1980).

Solar equipment used was manufactured by

Ormiston Gorge shower and toilet block showing the photovoltaic panels on the roof and eight flat plate solar collectors, right background.

Solarex Pty. Ltd. of New South Wales, and the general package was put together by Gardener Industrial Distributors of Adelaide.

Hot Water

Water is heated by eight solar flat plate collectors with a total collection area of 6.4 square metres, inclined at 28 degrees. The collectors and 500 litre storage tank are located on concrete slabs on the hillside behind the wash house. This was necessary to maintain the convection cycle of the system, without detracting from the aesthetics of the building. The storage tank and hot water pipes are heavily insulated.

Obviously, the 500 litre tank has limited capacity, and a public education programme has been designed to encourage water and power conservation in the ablution block.

It is hoped to install another 500 litre tank and a solar tracking system at a later date.

Cost of the system was approximately $1,000, plus installation.

Water Supply

A wind pump draws water from an underground aquifer and pumps it to a storage tank located on a rise out of general view. Water is then gravity-fed to the solar heater and the ablution block.

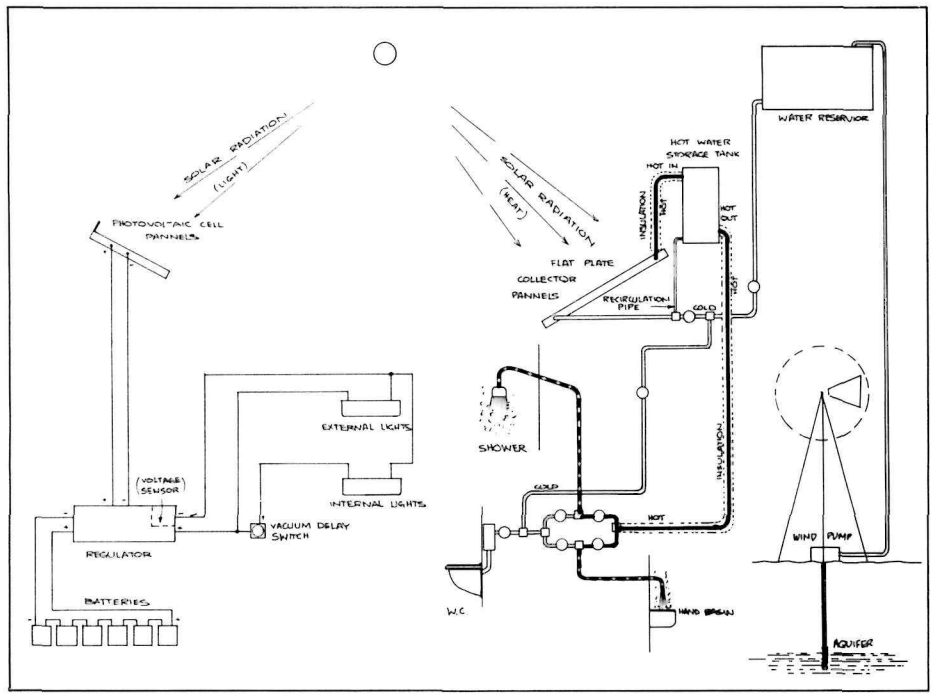
Other Solar Applications

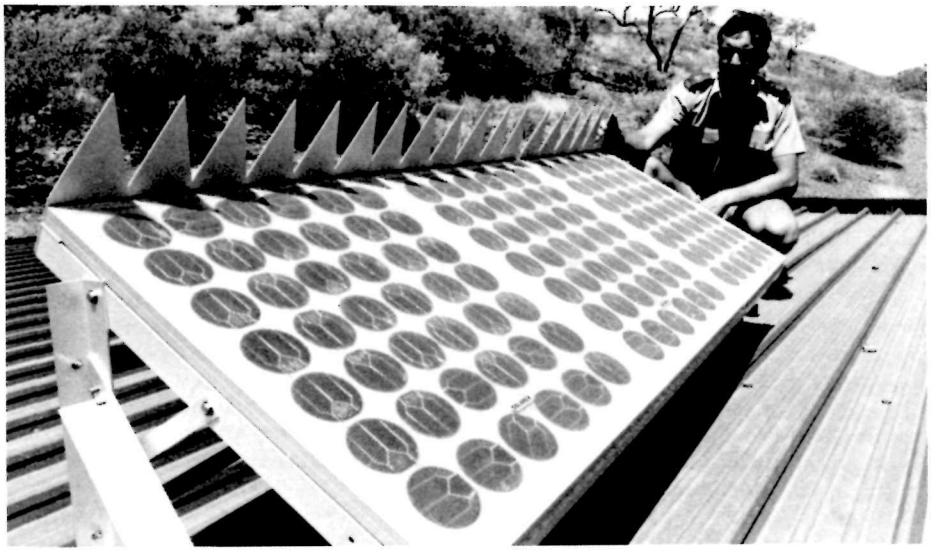
The Commission is also undertaking a number of experimental projects to reduce dependence on fossil fuels.

Pit or vault showers with solar hot water systems have been built at a number of Parks in Central Australia.

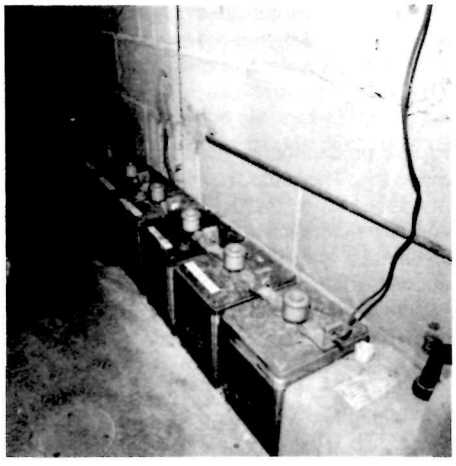
Further information on these projects is available from the Commission.

Andrew Mitchell is Planning Officer for the Southern Region, and Bill Brookes is Manager of the Technical Services Unit. Photos by Bob Barford, Publications Officer. All three are employees of the Conservation Commission of the Northern Territory, Alice Springs, P.O. Box 1046, Northern Territory, 5750 Australia.





Photovoltaic cell panels on the roof. The panels are inclined 30° and face north to get maximum exposure to the sun. The Ranger is Peter Egan.

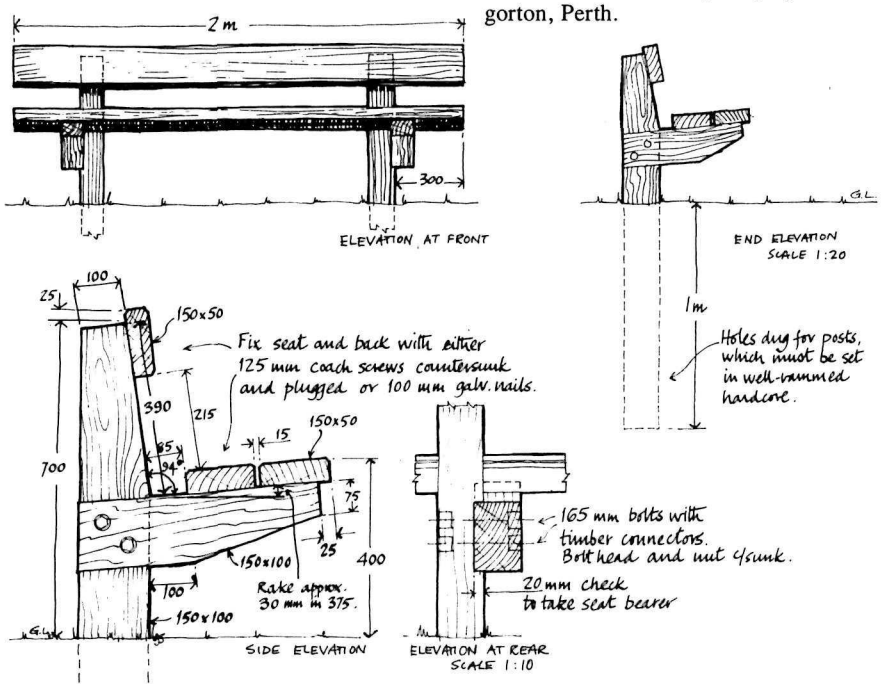


Six 2-volt lead-acid batteries connected in series form the 12-volt electricity storage system.

A wind-powered pump supplies water to a storage tank on the hill (not in view). Water is fed by gravity to the solar heater, the flat plate collectors, and to the facility fixtures.

Seat With Backrest, and A Demountable Stile

Here are two more items from the treasury of practical facility designs developed and displayed by the Countryside Commission for Scotland at its Battleby Display Centre, Redgorton, Perth.



Notes from Information Sheet 5.13

An elegant seat, easy and cheap to make.

It is important to set the posts a minimum of 1 metre into the ground.

All timbers should be pressure treated against fungal attack.

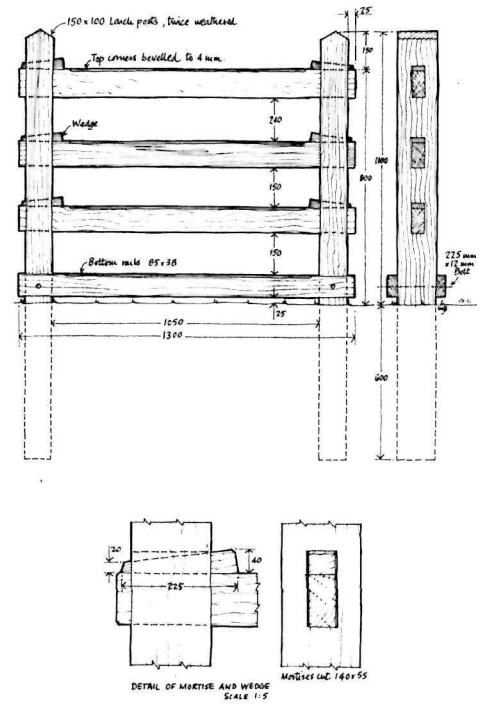
The posts and seat-bearers may be off-saw finish, but the seat and back planks should be planed and their exposed corners bevelled or rounded.

The seat looks well with the posts and seat-bearers in a darker finish than the seat and back. Do not use creosote since it remains oily and will stain clothing.

Notes from Information Sheet 4.9.6

A demountable ladder-type stile used on the Offa's Dyke Long Distance footpath. It is designed to allow access to maintenance machinery from time to time by removing the wedges and the top three spars.

The posts must be dug in and made firm with well-tamped hardcore.



BOOKS AND NOTICES

Information Signs for the Countryside. 1981. Compiled by John Allwood. Countryside Commission (England and Wales). John Dower House, Crescent Place, Cheltenham, Glos. GL50 3RA, England. 84 pages. £ 6.10

Signs in parks and recreation areas are important, indeed often essential, for the proper use and management of the property and its facilities. Unfortunately, adequate attention to decisions about the need for signs as well as their design, production, siting and maintenance is far too often neglected by area planners and managers.

As stated in the title subhead, this is a *guide* for the production of signs, and a very good guide it is. The compiler, an expert whose work has appeared in PARKS in the past (Vol. 5, Number 1), drew heavily on the experience of signmakers and sign users, and this guide sets out the advantages and disadvantages of the various production techniques, methods and materials.

The book is arranged in two major sections. The first, entitled "Sign Production," starts with planning checklists which cover the process stage by stage, and progresses to the preparation of a detailed plan before discussing actual production; layout, lettering, legibility, text preparation, colors, support panels and structures, siting and fixing are among the topics covered. The last portion of Part 1 covers maintenance and coping with vandalism.

Section 2 deals with techniques and materials, going into considerable detail and providing comparative data on such factors as cost, availability, weather resistance and vandal resistance. Separate data sheets cover each technique. This section should be of particular interest to anyone having little experience with the graphic arts or signage since it provides basic information on 12 techniques, e.g. casting, routing, engraving, surface printing, etc., and many materials normally used.

Appendixes, designed primarily for readers

in the UK, give sources of data, expert assistance and grant aid. A bibliography follows.

The book is spiral-bound to lie flat when open, a thoughtful decision, and is in the A4 size (210 x 297 mm) so widely used in Europe. Illustrations are adequate in number and are excellent.

This guide is not intended as a teaching manual to instruct park people how to do the actual work. Rather, it provides the information needed for proper planning and design and how to work with professional signmakers. However, many parks have skilled personnel on their staffs and these people too can find great areas of interest between its covers.

While designed for use in England and Wales, the book can find wide application throughout the world. —*R. I. Standish*

Architectural Photography. Techniques for Architects, Preservationists, Historians, Photographers and Urban Planners. 1981. Jeff Dean. The American Association for State and Local History, 708 Berry Road, Nashville, Tennessee, 37204 USA 144 pages, 127 illustrations. US$ 19.95 ($14.96 to members of AASLH)

This book, written by the Director of the Historic Preservation Division of the State Historical Society of Wisconsin, is an exposition of techniques that can be employed in photographing historic structures. The author writes in a readable and generally chatty style — though sometimes too chatty, such as, "Of course, if you still choose to pop for the Bronica PCS lens, you can be pretty certain you'll be the only kid on the block to have one." These instances, however, are mercifully rare. The book is highly readable and the author does not get bogged down in the technical jargon of photography.

The author discusses cameras, lenses, filters, and the other equipment used in photography and the purposes, advantages and disadvantages of each. He goes into the virtues of various types and sizes of film including color, black and white, and infrared. In the process of these discussions he discloses many techniques for photographing structures. The book is liberally sprinkled with illustrations appropriate to the text.

This is a most useful book that will be exceedingly helpful to the individual interested in architecture — historic and modern — who wants to improve his/her skills in photographing buildings. It is the kind of book that will be read through and digested, and kept on hand for reference in the future. —*F. Ross Holland*

The Monster Book of Environmental Education. 1981. Don Aldridge. Published for the Council of Europe by Geo. Abstracts, Ltd., Norwich, England.

Most discussions of that fashionable word "environment" seem to follow the premise that good medicine must be hard to swallow. Here is a delightful and thought-provoking introduction which explains how to communicate the significance of a place to those who visit it (sometimes called interpretation) — and much more besides.

The chapters are based on 15 cartoon-illustrated talks, mostly given by the author at Council of Europe meetings. There are wry and hilarious commentaries on art in environmental education, the semantic swamps of museology, the wonderful world of environmental research, and practically everything else worth poking fun at. It ends with detailed tongue-in-cheek instructions on how to organize an enormous world conference on environmental education in the Soviet Union. Behind each humorous thrust is a serious point, useful to both beginners and old hands.

The artist/author is Assistant Director of the Countryside Commission for Scotland, heading the Conservation Education Branch. He is well known in Europe and USA as a leader in this field.

The book is available by mail for £4.50/U. S. $10.50 from: Geo.Abstracts Ltd., Regency House, 34 Duke St., Norwich NR3 3AP, England.

A French edition is available for the same price. —*Marc Sagan*

Conservation of Historic Landscapes in the Peak District National Park. 1981. Jonathan F. Wager. Peak Park Joint Planning Board, Aldern House, Baslow Road, Bakewell, Derbyshire DE4 1AE, UK. 77 pages, £ 2.00 plus 30 p. postage.

The Peak District National Park, Britain's first, has been a settled place almost as long as recorded history. Today, remains of Neolithic, Bronze Age, Medieval and 19th Century activity are clearly visible and give rise to an exceptionally rich and diverse history in the landscape. Much of the field evidence of pre-Saxon landscapes has already been lost in lowland England, much of it lost in the last 30 years or so. The Peak District, however, still retains many of the features obliterated in other parts of the country. The area is thus of particular national significance.

This study explores the implications of a policy to designate and promote the positive management of these historic landscapes. Six areas within the Park are examined in detail, and proposals for protection are made. The report concludes with specific conservation recommendations.

It should be remembered that the Peak District National Park, as with all National Parks in England and Wales, is largely in private rather than state ownership, and as a consequence various properties are under considerable pressure as the owners, not unreasonably, seek to make the most of their holdings. This poses difficult problems for protection of the British cultural (and often, natural) heritage.

The lessons learned in examining the options for management of these cultural resources will have relevance for planning and management authorities in other parts of the world. — *R. I. Standish*

Nominations for the Fred M. Packard International Parks Merit Award

Forms for submission of nominations for the Fred M. Packard International Parks Merit Award, which is given annually by the IUCN Commission on National Parks and Protected Areas, have been distributed widely. Some areas, however, still may not have them. For the convenience of park people in such areas we are pleased to publish the following outline of the data that should be submitted for any person nominated for the award. The complete information should be airmailed to the Executive Officer, CNPPA, IUCN, 1196 Gland, Switzerland.

Nominations for 1982 will close September 15.

MERIT AWARD NOMINATION

1. Nominator (individual or institution making the nomination):
a. Name of individual_____
b. Institution_____
c. Address_____
2. Candidate proposed for nomination:
a. Name_____
b. Position_____
c. Address_____
3. Act of Valor (precise description of the event and circumstances, including date, place, individuals involved, eyewitness evidence by local and governmental personnel): (use additional sheets if necessary)

_____

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_____

4. Documentation (attach or enclose photographs, newspaper articles, legal depositions, etc.)
5. Approval (enclose or attach letters from nominee's employer, civil authorities, etc.)
6. I certify that this declaration is true and complete.

_____
Signature of Nominator

_____
Date

_____
Signature of Nominee

_____
Date

Audiovisual Presentations. 1982. WWF/IUCN International Education Project, Greenfield House, Guiting Power, Glos.GL54 5TZ, England, UK.

This is a new catalogue listing 57 audiovisual presentations on conservation and the environment. Subjects range from general topics such as "Why Conserve Wildlife" to specific programs on animal species: whales, marine turtles, orang-utans, parrots, rhinos, elephants, mountain gorillas, Komodo dragons and many others. Endangered habitats, countries and regions, and broad problems such as desertification, vanishing forests and famine are also program subjects.

Programs are available both as filmstrips and as 35mm slide-packs. Most presentations have pre-recorded commentaries on international compact cassettes that can be played on any standard cassette player/recorder. Standard scripts and commentaries are in English but many programs are also in French, and a few other languages.

Write for the catalogue and order forms, or further information.

Environmentally Sound Small-Scale Water Projects — Guidelines for Planning. 1979. Guss Tillman. VITA (Volunteers for Technical Assistance, Inc., 3706 Rhode Island Avenue, Mt. Rainier, Maryland USA 20712. 100 pages, illustrated. US$5.95 (For orders from outside the US add 60 percent for airmail delivery).

This little book is intended for anyone involved in planning, supervision or construction of small water projects but it should be of particular benefit to urban and rural communities which are short on financial resources.

Basic ecological principles of water resource development are discussed, as are low-cost ways to prevent adverse ecological or public health impacts of water development, distribution and waste treatment projects.

PARK VIEWPOINTS

Thoughts On Intrepretive Planning *Marc Sagan*

Whatever interpretive methods you use will have more chance of success if you follow a logical sequence of steps in selecting them. These steps seem so obvious and elementary that we are inclined to shortcut them, and hence often fall into traps that should also have been obvious.

I talked with the director of a large zoo recently and he told me that he had just submitted his fifth master plan for review and that it had been rejected. I asked if any of the five had started with a statement of the objectives of his zoo. He gave me a strange look and I know that he thought, "Well, everyone knows what zoos are for." I wasn't so sure that I knew what a zoo today should try to accomplish and I doubt that interpreters really know what an interpretive center or an exhibit or a film is to accomplish until they force themselves through the exercise of defining their objectives. That definition is the beginning of sound planning. It should say how you want people to be changed as a result of your efforts. Do you want them to feel differently about something? To understand something? To become interested in something? To do something? To stop doing something? And if so, what? If you have different objectives for different groups of visitors, list them.

To tell people about a subject is usually not your objective, but a means of reaching it. Let's call it your message. Outline your message. What do you want to communicate that will accomplish your objectives? Now, take a good look. Do you really believe that that kind of a message can accomplish those objectives? At this stage, if you can get someone outside the interpretive field to take a critical look at your objectives and your message you would do well. Someone with experience in advertising or in educational psychology might be ideal.

Once you're satisfied that the message or messages you want to communicate have a good chance of accomplishing your objectives, it's time to assign the messages to media.*

Now to the heart of interpretive planning. Each of us has his own set of prejudices about which media are the best choices for which communication jobs. If most of your experience in interpretation has been as a tour leader, you'll probably lean too heavily towards that means of communication. Realizing that you can't afford to hire enough people to lead all those tours or give all those talks, you may automatically resort to the printed word . . . on pages in a publication or on exhibits, indoors or out. If you've worked mainly with films, certainly you'd have some strong ideas about what that medium should or should not be expected to do. If you are a full-time interpretive planner you're probably prejudiced in favor of assigning jobs to media the way you did it on your last project. One solution to this problem is to assemble a small team, perhaps three or four people, with backgrounds in different media. In this way, their biases tend to balance out.

Having assigned jobs first on the basis of which messages and media are best suited for each other, you then have to go back over the list, perhaps several times, to be sure that the assignments you made add up to an interesting total experience. Having visitors go from a set of exhibits in a building to another set along a trail and more at an overlook, adds up to monotony. Even though all those jobs might be best suited for exhibits, you need to make some reassignments to introduce variety. There are practical reasons why you might make additional reassignments. You may not be able to afford to produce motion pictures or to build the structures necessary to show them. There may be seasonal use patterns, or climatic problems, or other factors which prevent you from following your theoretical "best" ways to communicate.

After this cutting and fitting process, interpretive planning leads to design and production, but the planner's job isn't finished. He can't simply write up his proposals as if they were a physician's prescription and give them to exhibit producers, writers, editors, illustrators, film makers, architects, and expect to get anything resembling his planned vision. Every production in every medium changes as it takes shape. The planner's job is to let it evolve in order to use the talents of the producers, but to make sure that the evolution doesn't so change the character of the production that it no longer serves its intended purpose as part of a coordinated communicative experience.

The experience of guiding creative designers and producers may be one you'll long remember. Mark Twain said, "On all matters of opinion our adversaries are insane." You may be tempted to adopt that attitude. So might they.

Marc Sagan is manager of the Harpers Ferry Center, a major U.S. National Park Service facility at Harpers Ferry, West Virginia, devoted to the planning, design and production of interpretive facilities, programs and productions in all media.

*The method or medium of communication.

A Miskito Indian and petroglyph in the Rio Platano Biosphere Reserve in Honduras. Both the native peoples and the artifacts and cultural heritage of their ancestors will be studied by managers of the Reserve. Photo: Dennis Glick

Back cover: Abbott's booby (Sula abotti) is the rarest member of the booby family and nests only on Christmas Island. Twenty-one percent of the rainforest nesting habitat of this endangered seabird lies in the park. Photo supplied by the Australian National Parks and Wildlife Service.

Staff

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