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Front cover: The orangutan (Pongo pygmaeus), *photographed in the Gunung Leuser National Park in Sumatra. Although once widely distributed, this great ape is today found only in Sumatra and the island of Borneo (Kalimantan, Sarawak and Sahah). It is an endangered species, particularly vulnerable to loss of its forest habitat through timber operations, and the killing of adult females to obtain live juveniles for the animal trade. Orangs are fully protected in the Park. Photo: Jeffrey A. McNeely*

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Effendy A. Sumardja

First Five National Parks in Indonesia

Indonesia in its "Third Five Year Development Plan" (1979-1983) has formulated its policies for proper development of natural resources and the environment. The policies aim at cultivation of a proper balance between man and his environment in the process of national development, and giving priority in environmental development to forestry protection, soil and water conservation, pollution control, environmental discipline in rural settlements, and stimulation of environmental consciousness among the people of Indonesia.

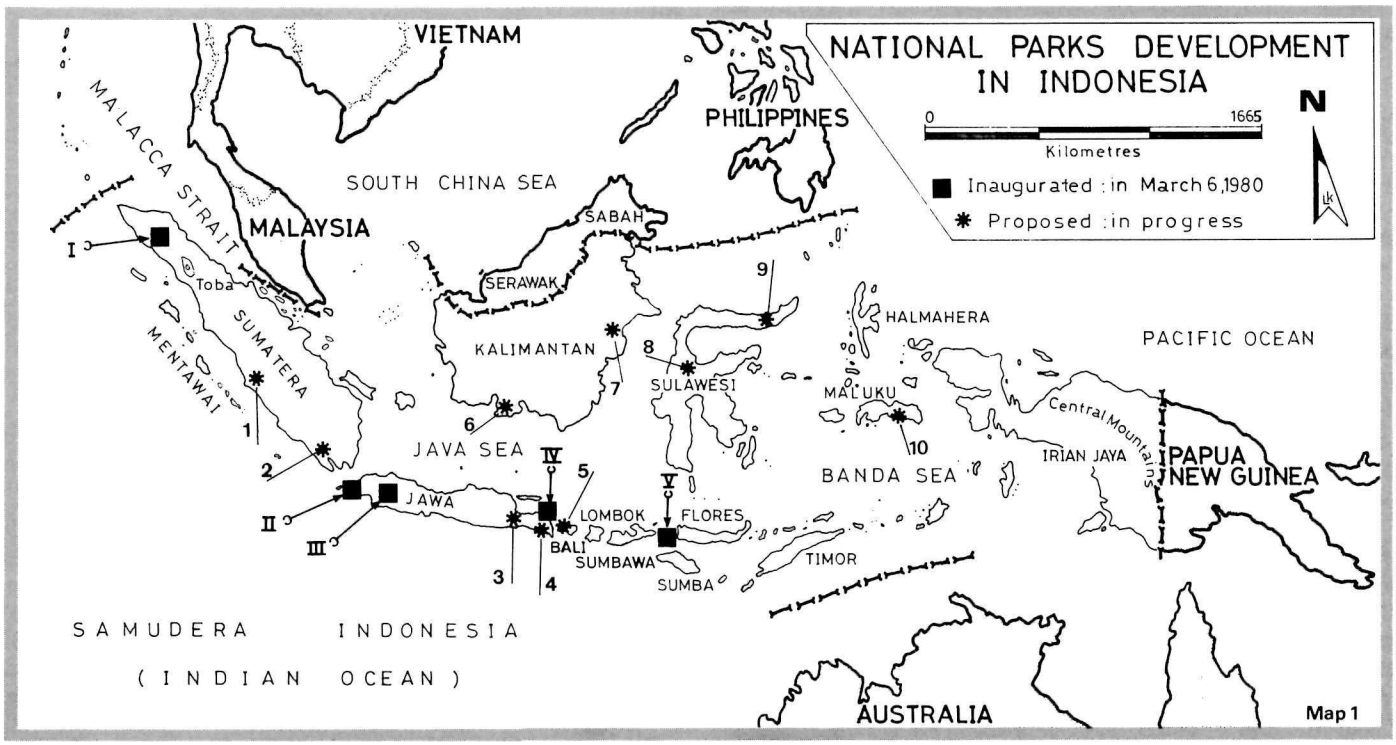
The Directorate of Nature Conservation plans to triple the extent of conservation areas under its management during this third Five Year Development Plan. The expanded system of resources will fulfil three main functions:

1. The conservation areas will safeguard the the environment by ensuring that sufficient land remains under natural vegetation cover to minimize deleterious changes in climate, water availability and soil fertility.

2. They will preserve representative viable samples of all major ecosystem types and living-communities within Indonesia so that their genetic resources and research potential are not lost to mankind. These samples also will serve as a baseline for assessing environmental impact in new development programmes.

3. By establishing a system of National Parks and Recreation Forests, the Directorate of Nature Conservation will provide and manage sites for healthy recreation for the Indonesian people, improve the standard of living of people surrounding the National Parks, attract tourists and foreign revenue and increase the opportunities for education and development of national pride in Indonesia's natural heritage.

Expressed in its simplest form, a nature conservation policy should preserve for posterity the genetic variation of wild plants and animals which can still be found in natural ecosystems. The simplest and probably the only effective way of doing this is by safeguarding samples of these ecosystems as reserves or national parks.



Inaugurated: I. Gunung Leuser National Park (800,485 Ha); II. Ujung Kulon National Park (78,619 Ha); III. Gunung Gede-Pangrango National Park (15,000 Ha); IV. Baluran National Park (25,000 Ha); V. Komodo National Park (75,000 Ha)

Proposed: 1. Kerinci-Seblat (1,484,650 Ha); 2. Sumatera Selatan I (356,800 Ha); 3. Bromo Tengger-Semeru (58,000 Ha); 4. Meru Betiri (50,000 Ha); 5. Bali Barat (77,723 Ha); 6. Tanjung Puting (335,000 Ha); 7. Kutai (200,000 Ha); 8. Lore Lindu (231,000 Ha); 9. Dumoga-Bone (300,000 Ha); 10. Manusela Way Nua/Way Mual (189,000 Ha)

Therefore, the declaration of Indonesia's first five national parks on March 6, 1980, demonstrates the serious willingness of the Government to conserve Indonesia's ecosystems, through the management approach of the national park system. Obviously, Indonesia's system of national parks is in its infancy. However, with continued nourishment from both within the country and from abroad with technical assistance, the system can grow into a fine, mature example of one nation's commitment to conserving its natural heritage for the benefit of its citizens and the world.

The preparatory FAO project, "Nature Conservation & Wildlife Management" in 1974-1978, helped us to identify the priority areas for conservation and for the establishment of national parks. Then, the second phase project, "National Parks Development" 1979-1982, is concerned primarily in helping us implement the recommendations given in the first phase project, and also in preparation of a much needed conservation master plan for the whole country. Furthermore, the World Wildlife Fund has an agreement with the Government to support the preparation of management plans, particularly for the establishment of national parks and conservation education from 1977 until the end of this year; 1981. This agreement covered more than 25 separate projects and US $1.5 million in all parts of the country.

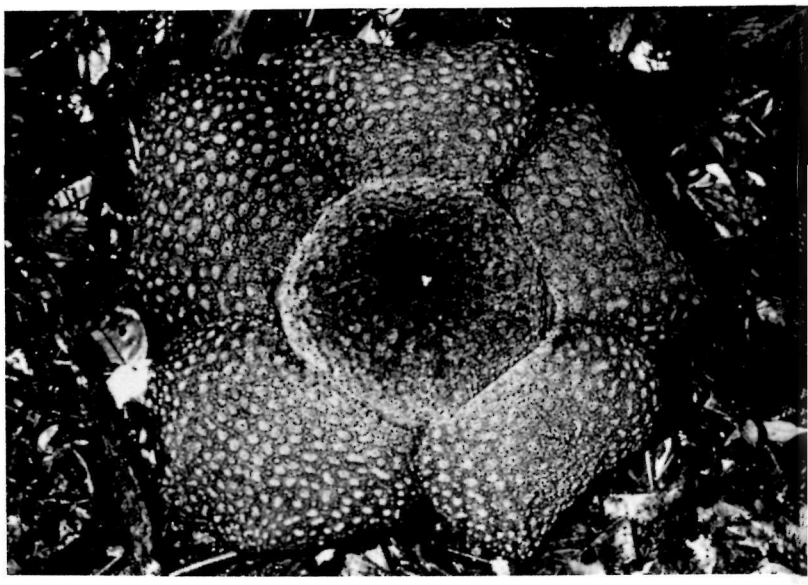
At the least, 15 national parks will be declared within the near future, as shown on the map on page 1, and it is hoped that at least the first five national parks will be ready to be visited by the participants of the Third International Congress on National Parks, which will be held in Bali, Indonesia, in 1982. The first five national parks are:

I. Gunung Leuser National Park (800,485 ha)

The new Gunung Leuser National Park combines several existing reserves plus some new areas into a very large U-shaped reserve which stretches north to south about 150 km along the backbone of northern Sumatra's Bukit Barisan Range, and about 135 km from the low coastal plains of Sikundur in the east to the beaches of Kluet in the west. The geology is very complex; the mountains are composed of Paleozoic metamorphics added to by a long series of sedimentary and volcanic events throughout the Cenozoic. Numerous geologic formations have been described. The mountains are rugged and, in many places, inaccessible. The populated Alas Valley, which pierces the heart of the reserve, is the largest of several major rift valleys, capped by the Kappi Plateau, a slightly undulating volcanic plateau with two small volcanic cones. As is to be expected in such a large reserve, the climate is widely variable, with average annual rainfall ranging from 1,300 to 4,600 mm/year, depending on location and local topography.

The vegetation is widely variable, from the pine *(Pinus merkusii)* of the north to the blangs (low vegetation including grasses and sedges, with herbs and dwarf shrubs) to the magnificent rainforest (475 trees/ha over 15 cm diameter, with *Aglaia, Mastixia, Walsura,* and *Ficus* most common; dipterocarps are relatively uncommon). The montane flora includes many north temperate genera: *Rhododendron, Vaccinium, Parnassia,* and *Gentiana.* Rare plants include *Rafflesia,* the "stinking corpse lily," a root parasite whose 1-meter flower is the world's largest.

The Park contains Indonesia's richest recorded fauna, with 105 species of mammals, 313 of birds, and 94 of reptiles and amphibians, in total covering some 54 percent of Sumatra's vertebrate terrestrial fauna. Red Data Book species include the orangutan *(Pongo pygmaeus),* siamang *(Symphalangus syndactylus),*, tiger *(Panthera tigris sumatrae),* golden cat *(Felis temmincki),* clouded leopard *(Neofelis nebulosa),* elephant *(Elephas maximus),* Sumatran rhino *(Dicermoceros sumatrensis),* and serow *(Capricornis sumatraensis).* For the orang and rhino at least, Leuser is the best remaining habitat in Sumatra. The bird fauna includes 10 hornbills *(Bucerotidae)* and 5 pheasants: great argus *(Argusianus argus);* crested fireback *(Lophura ignata);* Salvadori's *(L. inornata);* red jungle fowl *(Gallus Gallus);* Malaysian peacockpheasant *(Polyplectron malacense).*



The world's largest flower, a meter in width, is the Rafflesia sp., *the "stinking corpse lily." It is found in Gunung Leuser National Park.*

II. Ujung Kulon National Park (78.619 ha)

The rainforest of Ujung Kulon, on the western tip of Java, has been disturbed in the past by human clearing and by the disastrous Krakatau eruption in 1883, so only about 50 percent can be considered primary. The rainforests are characterized by an abundance of palms, particularly *Arenga, Oncosperma,* and *Salacca; Ficus, Lagerstroemia, Dillenia* and *Diospyros* are canopy trees. The reserve has four grassy clearings totalling some 64 ha, and these are superb places for viewing the Park's rich wildlife.

Ujung Kulon also contains the last habitat of the endangered Javan rhinoceros *(Rhinoceros sondaicus),* with a population of about 50. Other Red Data Book mammals include leopard *(Panthera pardus)* Javan gibbon *(Hylobates moloch),* banteng *(Bos javanicus),* and wild dog *(Cuon alpinus);* the Javan leaf-monkey *(Presbytis aygula)* is present, but seriously endangered throughout Java. Pigs *(Sus scrofa* and *S. verrucosus)* and deer *(Cervus timorensis* and *Muntiacus muntjac)* are common and easily seen. Two-hundred fifty species of birds have been recorded, including green peafowl *(Pavo muticus),* two species of jungle fowl *(Gallus gallus* and *G. varius),* 14 herons and egrets, 3 storks, 11 pigeons, 16 cuckoos, and 8 kingfishers. The estuarine crocodile *(Crocodylus porosus)* still occurs, and the west coast beaches are a prime nesting area for green sea turtles *(Chelonia mydas).*

III. Gunung Gede—Pangrango National Park (15,000 ha)

Located between two of Java's major cities—Jakarta and Bandung—the reserve is dominated by the twin Quaternary volcanoes Gunung Gede (2,958 m) and Gunung Pangrango (3,019 m—the highest point in West Java), connected by a high saddle at 2,400 m; the older Pangrango is now extinct, while Gede is semi-active with a well-defined crater, hot water springs, and several active fumaroles. There are many small and more recent craters, most notably Kawah Lanang, which produced lava beds as late as 1748, and erupted stones and ash in 1947. The slopes are steep, with many deep gullies corrugating the volcanoes, carved by rushing streams. Cibodas is in the wettest part of Java, with annual rainfall averaging between 3,000 and 4,200 mm, falling mostly between October and May; the higher slopes are often cloud-covered but have less than 100 mm of rain during the 2-3 month dry season.

The montane rain forest is characterized by conifers *(Podocarpus)*, laurels *(Litsea)*, oaks *(Lithocarpus* and *Quercus)*, chestnuts *(Castanopsis)*, and *Schima* (often dominating the canopy at middle elevations). *Leptosperma flavescus* is dominant in the upper areas. There is a rich understory, with herbs, shrubs, and ferns; many epiphytes, including some 208 species of orchids, festoon the trees. The cloud forest includes many north temperate genera: *Ranunculus, Viola, Sanicula,* and *Primula,* often with endemic Javan species. There are also Javan edelweiss *(Anaphalis javanica)*, Javan rhododendron *(Rhododendron javanicum)*, several *Vaccinium,* and many Zingiberaceae. The forest floor is covered in moss, as are the trees and rocks; the volcanic activity of Gunung Gede makes the cloud forest there much sparser, with less moss and fewer epiphytes, The forbland is typified by *Anaphalis, Gentiana,* the terrestrial orchid *Thelmymitra javanica, Rubis* spp., and the grasses *Isachne pangerangensis, Agrostis infirma,* and *Calamagrostis australis.* Four orchids are endemic to Gunung Gede: *Corybas mucronatus, Liparis bilocurlata,* and *Malaxis sagittata,* and *Pachycentria varingiaefolia.* Other rare plants include the orchid *Platanthera blumii,* the tree *Ormosia pengangensis,* and *Dendropthoe magna,* a parasite of *Castanopsis* elsewhere found only on Mt. Kinabalu in Sabah.

Red Data Book species include the Javan gibbon and Javan leaf monkey, both confined to the lower slopes; the Javan leopard is found throughout the park, including the crater rims. Other interesting mammals include the Javan stink badger *(Mydaus javanensis)* and the yellow-throated marten *(Martes flavigula)*. Two-hundred forty five species of birds are recorded from Cibodas and surrounding regions, including the pygmy tit *(Psaltria exilis)*, a genus endemic to West Java, the peregrine falcon *(Falco peregrinus)*, the vernal hanging parrot *(Loriculus vernalis)*, and Reinwardt's trogon *(Harpectes reinwardti)*.

IV. Baluran National Park (25,000 ha)

On the northeast corner of Java, immediately opposite Bali, Baluran is roughly a square reserve, dominated in the center by the extinct volcano which gives the Park its name; the crater wall varies in height from 900 to 1,247 m, enclosing a caldera some 600 m deep. There is a broad lowland mantle 5 to 7 km wide at the north and east side of the volcano, flat to gently undulating but becoming much steeper above 200-250 m elevation. A low saddle links Baluran with the much larger Ijen/Raung massif to the south. There are a few limestone cliffs at the Mesigit area at the coast; the coastline is about 40 km long, with corals, sandbanks, mudflats, and shallow bays. This is the driest part of Java (average annual rainfall: 900-1,600 mm with most rain from November to April), with numerous streams only in the rainy season. Soils are primarily volcanic, with small areas of alluvials along the coastlines. In dramatic contrast to the forested Ujung Kulon and Gunung Gede-Pangrango, Baluran is covered in savanna vegetation reminiscent of East Africa.

From east to west in the savanna area there is a gradual transition from open grassland with *Borassus* palm to secondary bush/grass/creepers to bush/forest, indicating a gradually-diminishing influence of fire to the west; the grass *Dichanthium caricosum,* is dominant, with *Heteropogon contortus* and *Sorghum nitidus* also important; *Scherachne punctata* is much more common in flat savanna than in undulating savanna. Savanna trees include *Acacia leucophodoea, Schleichera oleosa,* and *Zizyphus rotundifolia.* The monsoon forest of Baluran is the only known habitat of *Erythrina eudophylla.*

This park has 24 species of mammals (other than rats, bats, or shrews); the Africa-like savanna of Baluran is unique in Java and provides optimal conditions for viewing big-game animals, including large herds of rusa deer (population 300), banteng (population 150), and feral water buffalo *(Bubalus bubalis*—population 250). Large mammal biomass in savanna is about 4,500 kg per km^2. IUCN Red Data Book species include wild dog, leopard, and banded linsang *(Prionodon linsang)*. One-hundred forty seven of Java's 455 species of birds are recorded in Baluran, including about 50 confined to savanna or secondary bush/forest; some of these reach very high densities, including spotted doves *(Streptopelia chinensis)*, a green peafowl *(Pavo muticus)*, and green jungle fowl *(Gallus varius)*. It is very rich in insectivorous birds, including the rare silver rumped swift *(Rhaphidura leucopygialis)* and white-throated needletail *(Hirundapus caudacutus)*.

Baluran National Park in East Java is dominated by this extinct volcano. Its savanna areas are reminiscent of East Africa. Photo: Jeffery A. McNeely

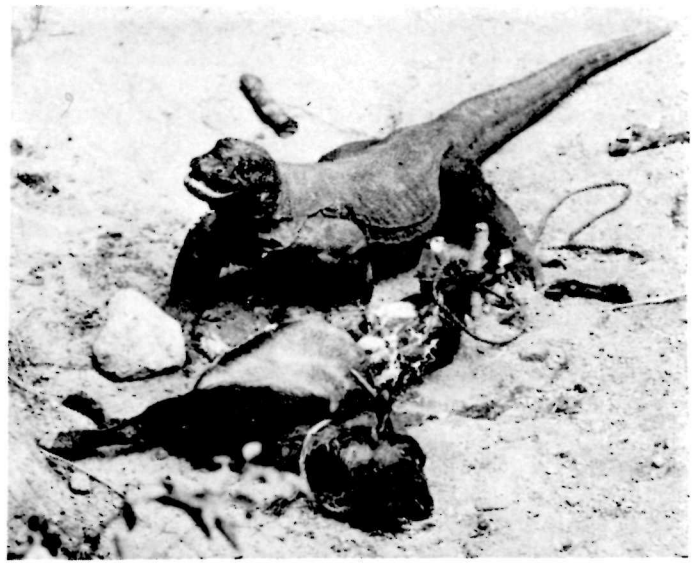
V. Komodo National Park (75,000 ha)

Lying in the straits between Flores and Sumbawa, the National Park covers the three islands of Komodo, Rinca, Padar, and smaller surrounding islands, plus the straits between the main islands and all seas within 1,000 m of shore. The reserve lies in an active geological zone, the inner volcanic arc of the Lesser Sundas; this is a geological "shatter belt" between the Australian and Sunda tectonic plates, formed primarily from Pleistocene and recent deposits. The islands are generally rugged, with sheer cliffs, numerous small bays and inlets, plentiful surrounding coral reefs, and powerful offshore currents. Komodo (33,937 ha) has a chain of generally rounded hills along the north-south axis, averaging 500-600 m; Gunung Toda Klea in the northeast is precipitous and crowned by deep, rocky, and dry gullies. Padar (2,017 ha) is a narrow, low island with rocky peaks rising to 300 m from the surrounding grassland. Rinca (19,625 m) is just 250 m from Flores; it is mostly rolling hills, but the south is dominated by the sprawling Doro Ora (667 m) and the north has the low steep peaks of Gunung Tumbah (187 m) and Doro Raja (351 m). The reserve is in one of the driest parts of Indonesia, having just 800-1,000 mm rainfall, with 11 months having less than 200 mm; the wettest period is December to March, during the northwest monsoon.

The monsoon forest is thorny and rather open, often secondary due to effects of fire; it survives mostly on upper parts of hills and in moist valley bottoms. Common species include *Sterculia foetida, Oroxylum indicum, Tamarindus indica,* and *Zizyphus horsfieldii.* The dominant tree in the savannas is the Lontar palm, *Borassus flobellifoer,* often in scattered clumps. Grasses include *Setaria adhaerens, Chloris barbata, Heteropogon contortus,* and, in the higher areas, *Themeda* spp.; *Imperata cylindrica* is conspicuous by its rarity. Mangroves occur in the sheltered bays, sometimes bounded on the landward side by large stands of *Avicennia marina.* Along the beaches are areas of typical beach vegetation, including *Ipomoea pescaprae, Spinifex littoreus,* and *Cassytha filiformis.*

The park is famous for the Komodo dragon, *Varanus komodoensis,* locally called, "ora." Not scientifically described until 1910, it is the most massive living lizard, with large males often weighing over 90 kg and exceeding 3 m in length. It occurs in all habitats, scavenging or hunting its own prey. The large adults feed on pigs, deer, monkeys *(Macaca fascicularis),* or feral domestic animals (dogs, goats, buffalo, and, on Rinca, horses) while the immatures content themselves with birds, eggs, carrion (including fish on beaches), and rats (including the endemic *Rattus rintjanus.)* The breeding season is June-July; the 25-30 eggs in a clutch are buried in sand or dead leaves and hatch after an 8-month incubation period. Other fauna is rather poor, with just 7 species of terrestrial mammals and 72 species of birds; noteworthy birds include the lesser sulphur-crested cockatoo *(Cacatua suplhurea,)* the megapode *(Megapodius freycinet),* and the noisy friarbird *(Philemon buceroides),* all with closer affinities to Australia than to mainland Asia.

These first five national parks have been established particularly for the benefit of the local people. Since the parks are considered to be in the national interest, the establishment of a national park should be followed simultaneously with surrounding regional development, as well as overall development which should include such things as better schools, new health centers, improved irrigation systems, new and improved communications systems, and more agriculture extension efforts. To protect the major part of the park while offering the local people at least some compensation in the way of firewood, some forest produce, and, in appropriate areas, perennial tree crops, the development of buffer zones — which benefit the local people — is due to be implemented in each of these parks.



The unique and fearsome Komodo dragon, found only in Komodo National Park, is a huge, cold-blooded reptile which often weighs 90 kg and exceeds 3 meters in length. The dragons prey on deer, wild pigs, monkeys and other animals. Photo: World Wildlife Fund. © Charles Parr

To support improved management of the parks, conservation education is needed at a number of levels: the general public around the park, to acquaint them with boundaries, rules and reasons for the park; government officials, so that they know which areas have been zoned for conservation and why; students, at all levels from primary to university, with conservation being inwoven throughout the curriculum rather than as a separate subject; and visitors to the parks, so that they know the importance of what they are seeing and the reasons for any restrictions placed on their actions in the parks. Steps are being taken to improve education in each of the parks, though very much more needs to be done.

In the Third International Congress on National Parks in 1982 we expect to discuss more problems, particularly in solving the complexities of protecting natural areas in our changing world. Indeed, Indonesia is facing tremendous problems in the establishment of national parks; experts from all over the world will be welcomed to advise and contribute their expertise for the improvement of Indonesia's national parks system.

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Gary B. Wetterberg, Ghillean T. Prance and Thomas E. Lovejoy

Conservation Progress in Amazonia: A Structural Review

Examples abound in scientific journals and popular literature of the threats confronting the world's tropical forests; and of likely results of deforestation such as reductions in genetic diversity, loss of soil productivity, and possible macro-climatic changes due to increased atmospheric carbon dioxide. Many of these are well documented and unquestionably valid. Unfortunately, the incremental advances made by individual countries in preserving segments of their forests often go unnoticed, but they also deserve recognition.

When taken together, these advances are indeed significant. For example, few people realize that between 1977-1981, new national parks and protected areas totalling more than 11,830,000 ha were formally established in the tropical forest areas of Bolivia, Brazil, Ecuador and Venezuela. This is a land area larger than Austria or the German Democratic Republic (East Germany), or an area about equivalent to that of Cuba or the U.S. State of Mississippi.

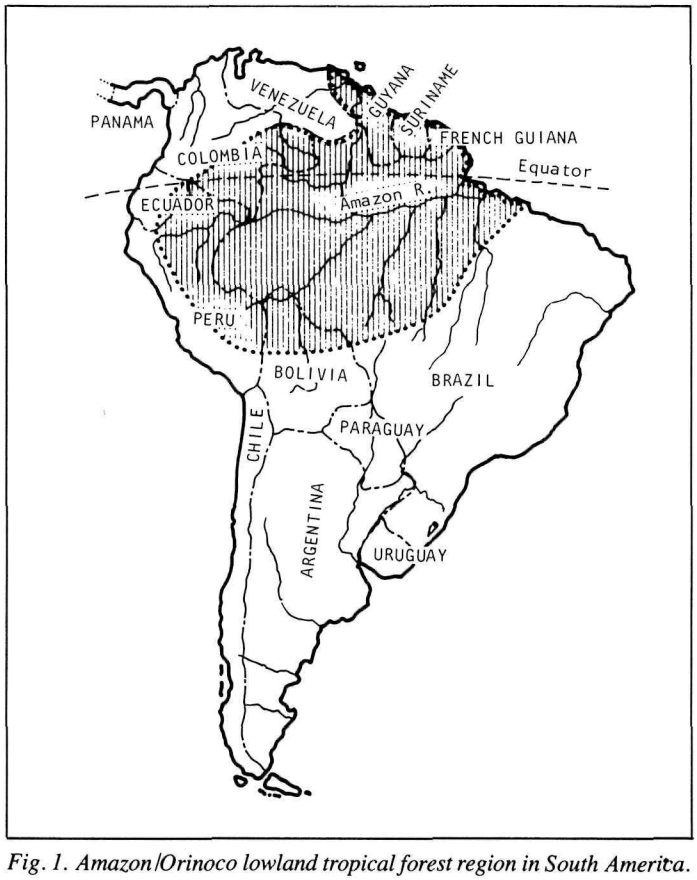


Fig. 1. Amazon/Orinoco lowland tropical forest region in South America.

Admittedly, many of these parks and other protected areas ("conservation units" in regional terminology) are generally unstaffed and so far exist "on paper only." This can be expected initially when new areas are established by any country. For example, early national parks in the United States, such as Yellowstone and Yosemite, indeed were poorly staffed and generally unprotected. Yellowstone, 14 years after it was established, was finally manned by members of the 1st United States Cavalry, which eventually ran that park for the next 30 years. Many of the new Amazonian conservation units are in remote areas and the lack of staffing does not constitute a threat at this stage of development.

Our intention here is to review recent efforts to maintain representative samples of lowland tropical forest ecosystems by the countries which make up the Amazon/Orinoco region of South America (Figure 1). Although the bulk of the region lies within Brazil, the countries whose political boundaries include portions of this biological unit are Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname and Venezuela. While we do not wish to encourage unfounded optimism about the status of these tropical forests, we believe that due recognition for recent achievements may go further towards influencing continuation of such positive efforts than persistent denunciations.

We focus on this area because it is the largest continuous block of tropical forest in the world. Its significance is highlighted by Dr. Norman Myers' 1980 report to the U.S. National Academy of Sciences entitled *Conversion of Tropical Moist Forests* in which he indicated this area is, biologically, the richest on earth. Myers points out that Amazonia contains some 50,000 species of higher plants or one fifth of all such species known to mankind. Included in its highly diverse animal life are about one seventh of all known bird species, as well as a profusion of as yet unclassified fishes and insects. Furthermore, a major portion of the area has been identified in the IUCN/UNEP/WWF *World Conservation Strategy* as a high priority for establishment of national parks or equivalent reserves.

Phytogeographic Subdivisions

In 1975, G. Prance prepared a paper on the phytogeographic subdivisions of Amazonia (Fig. 2) which was subsequently published in 1977 by the New York Botanical Garden in the book *Extinction is Forever.* In this document, which updated and modified works published on this subject 20 years earlier by A. Ducke and G. Black, he demonstrated that the Amazonian rain forest is not a uniform mass of vegetation as it popularly is perceived. He also argued for adequate preservation of segments of each of the subdivisions identified. This study served as the basis for a 1976 "Analysis of Nature Conservation Priorities in the Amazon" (hereafter referred to as the "Amazon Analysis") which was published

Table 1. Proportional allocation of recommended conservation units by Amazon phytogeographic region.

Phytogeographic Region	*Percentage of Total Area*	*Recommended Minimum Number of Conservation Units*	*Units Established by 1976*	*Units Established by 1981*
1. Atlantic Coastal	13.4%	6	5	8
2. Jari-Trombetas	8.3%	4	6	7
3. Xingu-Madeira	19.2%	10	1	1
4a. Roraima	2.6%	2	0	1
4b. Manaus	5.1%	2	0	2
5. Upper Rio Negro	7.9%	4	1	7
6. Solimões-Amazonas	9.4%	4	1	3
7. Southwest	34.1%	16	4	12
Totals	100 %	48	18	41

cooperatively by the Brazilian Forestry Research and Development Project (PRODEPEF) of the Food and Agriculture Organization of the United Nations (FAO) and the Brazilian Forestry Development Institute (IBDF). One recommendation in the Amazon Analysis was that each of Prance's phytogeographic regions should contain an average of at least six parks or other protected areas to be adequately represented; and, that their distribution be allocated proportionally according to the relative size of each region (Table 1). This would result in a minimum of 48 units.

In 1976, 18 conservation units existed, not counting Brazil's 8 Forest Reserves which were considered by IBDF as a transitory land use category and were afforded little or no protection. The regions which had the best coverage were the Atlantic Coastal and Jari-Trombetas, mainly due to Suriname's conservation program.

By 1981 the situation had improved considerably (Table 1) although many gaps still existed. Furthermore, as discussed below, some of the regions included several small parks and reserves but lacked designation of major (500,000 ha or larger) conservation units.

The phytogeographic approach was favored over Miklos D. F. Udvardy's 1975 "Classification of the Biogeographical Provinces of the World" (International Union for Conservation of Nature and Natural Resources [IUCN] Occasional Paper 18) since the former enabled a more detailed review of what might constitute representative samples. However, the Udvardy system (Figure 3), which is currently being refined, permits a coarse indication of protected area coverage, and is now being used for comparisons on a global scale. To ensure compatibility with ongoing worldwide surveys by the Commission on National Parks and Protected Areas (CNPPA) of IUCN, a review of Amazonia in terms of the Udvardy system is presented later in this article.

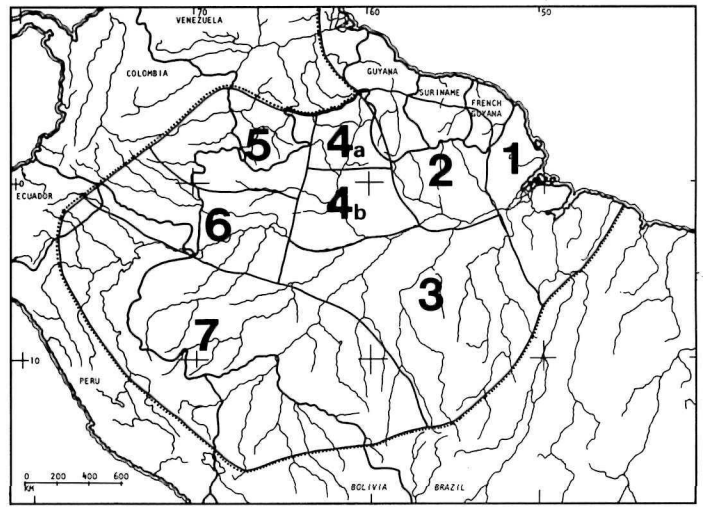


Fig. 2. Amazon phytogeographic regions. 1. Atlantic Coastal. 2. Jari-Trombetas. 3. Xingu-Madeira. 4a. Roraima. 4b. Manaus. 5. Upper Rio Negro. 6. Solimões-Amazonas. 7. Southwest.

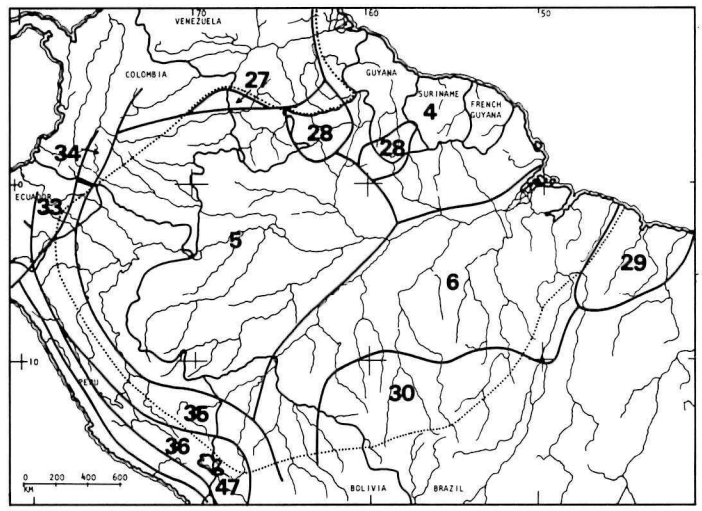


Fig. 3. Approximate boundaries of M. Udvardy's Biogeographical Provinces in the Amazon Region. 4. Guyanan, 5. Amazonian, 6. Madeiran, 27. Llanos, 28. Campos Limpos, 29. Babaçu, 30. Campos Cerrados, 33. Northern Andean, 34. Colombian Montane, 35. Yungas, 36. Puna, 47. Lake Titicaca.

Size Requirements

The 1976 Amazon Analysis reviewed questions of minimum size, shape, existing and planned conservation units and general location of areas to be considered as samples of each phytogeographic region. In 1975, Princeton University's Dr. John Terborgh had concluded studies which in summary suggested that neotropical bird species in lowland rainforests require a minimum area of about 2,500 km^2 (250,000 ha) in order to keep extinction rates at less than 1 percent of the initial species complement per century. Reserves of this size, equivalent to a square 50 km on each side, would be necessary if maintenance of the normal diversity of bird species were among the objectives. Most of the 2,000-plus areas listed for over 100 countries in the 1980 *U.N. List of National Parks and Equivalent Reserves* are smaller than the 250,000 ha minimum suggested for lowland neotropical forests.

Minimum size for protected areas, however, varies with the plant and animal communities involved. Smaller reserves serve useful functions, such as providing multiple evolutionary opportunities (Lovejoy, *Designing Refugia For Tomorrow,* in press) and preserving taxa of highly restricted ranges, nesting sites, and unusual microhabitats. Appropriate size would also be related to other factors such as legal enforcement and land uses outside of the protected areas. Even a 2,500 km^2 area would likely be unstable if it were an isolated patch surrounded by deforested land. In the Amazon Analysis, Terborgh's guideline was followed and preference was indicated for continuous segments of land in roughly circular shapes where topography and other factors permitted. At the same time, it was recommended that research be encouraged to further refine knowledge of minimum size requirements for biologically viable conservation units in representative ecosystems. A long-term study in this regard is now underway (Lovejoy, *PARKS* 5(2)).

Because of the above considerations, it was suggested that the goal of 48 areas consist of: (1) 24 "major conservation units" on the order of 5,000 km^2 (500,000 ha) each, including a core of 2,500 km^2, plus a 10 km wide buffer strip which would in effect double Terborgh's recom-

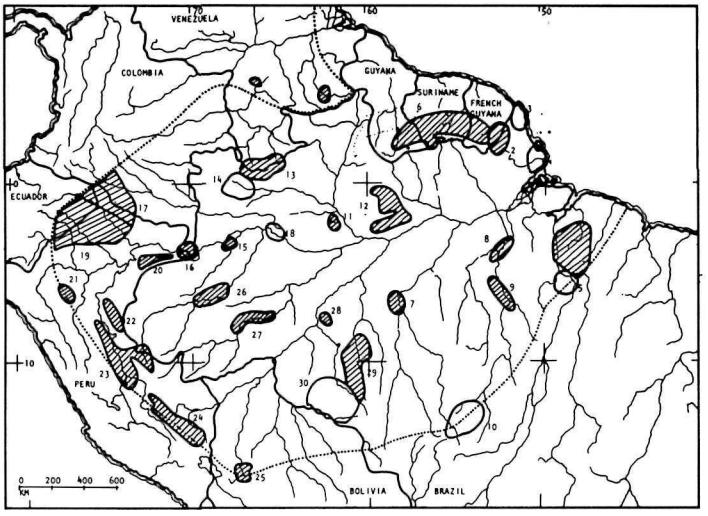


Fig. 4. General areas recommended for preservation in the Amazon. 1. Bacia do Capim. 2. Oiapoque, 3. Cabo Orange, 4. Cabo Norte, 5. Maraba, 6. Guiana, 7. Ponta do Flechal, 8. Altamira, 9. Caxinduba, 10. Upper Xingu, 11. Jau, 12. Jatapu, 13. Pico da Neblina, 14. Cuxiauia, 15. Cutiuaia, 16. Loreto, 17. North Napo, 18. Panaua, 19. South Napo, 20. Javari, 21. Huallaga, 22. Serra do Divisor, 23. Ucayali, 24. Inambari, 25. Yungas, 26. Eirunepe, 27. Purus, 28. Marmelos, 29. Serra das Onças, 30. Parecis.

Pleistocene refugia overlap

Diverse vegetation formations

mended area; and (2) 24 "other conservation units" on the order of 1,000 km², or smaller depending on local circumstances. That is, half of the areas recommended in Table 1 would be larger than prevailing world standards yet flexibility would be retained to account for unique local situations.

Existing and Planned Coverage

Existing and planned coverage was determined by superimposing a map of parks and protected areas on maps of the phytogeographic regions and known vegetation formations. Since detailed boundary maps did not exist, and because the map scales inhibited precise work, it was not possible to determine whether the parks and protected areas were truly representative. But, it was possible to determine likely gaps which in 1976 included the Solimões-Amazonas, Upper Rio Negro and Roraima Regions, as well as several major vegetation formations.

Criteria for Selecting Areas

The general location of areas to be considered for future parks or reserves within each phytogeographic region was also confronted from various points of view. So-called "Pleistocene refugia" for birds, lizards, woody plants and butterflies were derived from the respective publications of four scientists and mapped on overlays. These refugia, where they overlap, are believed to have a high degree of endemism. During cold dry periods when the Amazon was not completely forested, many plant and animal species are likely to have been isolated genetically in these refugia which later served as repopulation centers for the Amazon. This information was further refined considering priority rural development plans, and other factors, to identify some 30 general areas in the region in which efforts to establish parks or reserves appropriately could be concentrated (Figure 4). Each location was identified by number and briefly described in the Amazon Analysis. To maintain consistency, the same numbers are retained here since reference is made to several when discussing the current status of protected areas in the region. All of these locations exceeded 5,000 km² and provided only a "first cut" for directing additional field expeditions toward biologically important areas to make more refined evaluations, including boundary definitions for subsequent legislation.

Of the existing or planned conservation units in 1976, few coincided with the locations shown in Figure 4. These were Kaysergebergte (also known as Eilerts de Hann Gebergte) and Tafelberg Nature Reserves in Suriname and the following national parks: Canaima (Venezuela), Isiboro Secure (Bolivia), Sangay (Ecuador), Manu and Tingo Maria (Peru), and Amacayacu (Colombia).

Implementation

The Amazon Analysis was circulated widely, with requests for critical public review and comments. In 1977 it was presented to the participants of the Second Meeting of the "Intergovernmental Technical Group on Protection and Management of Amazon Flora and Fauna" (CIT) which met in Brasília. The group, consisting of official representatives from Bolivia, Brazil, Colombia, Ecuador, Peru, and Venezuela, adopted a recommendation agreeing to take into consideration the areas proposed in the Amazon Analysis when planning new parks and reserves within the Amazon/Orinoco segments of their respective countries.

Since the largest portion of the study area lies within Brazil, it is particularly useful to review subsequent steps taken there. The relevant portion of the document was incorporated into that country's "National System Plan for Conservation Units" which was officially approved by President João Figueiredo on June 5, 1979, in honor of World Environment Day. The *1979-1985 Brazilian Forest Policy Guidelines* prepared by the Ministry of Agriculture's Forestry Planning Office (COPLAN), included the goal of establishing 21 million hectares of new parks and reserves of which 17.5 million hectares would be located in the Amazon. A high level of collaboration was established between IBDF, the National Indian Foundation (FUNAI), the National Colonization and Agrarian Reform Institute (INCRA), the National Institute for Amazonian Research (INPA), the National Radar Inventory and Land Use Project (RADAMBRASIL) and others. Under the coordination of IBDF and the Brazilian Nature Conservation Foundation (FBCN), some ten major field expeditions have been undertaken with participants representing the above organizations as well as FAO, the New York Zoological Society and various museums and universities. As a result of these efforts, Brazil established, by mid-1981, Amazonian national parks and biological reserves totalling more than 8 million ha, most of which do coincide with areas recommended in the Amazon Analysis.

Current Status

A list of existing and planned conservation units by country is shown in Table 2, including the name, management category in local terminology, date of establishment and land area for each. Units meeting the criteria for inclusion in the *1980 United Nations List of National Parks and Equivalent Reserves,* including World Heritage Sites and Biosphere Reserves, are indicated. The location of each is shown in Figure 5 with corresponding numbers for identification.

A comparison of the conservation units existing in 1981 with the previously recommended coverage (Table 1) for each phytogeographic region is shown in Table 3. This structural review reveals the following situation which is summarized in Figure 6:

Table 2. Existing and planned conservation units by country. (Bold face numbers are keyed to Figure 5)

Country	*Existing Conservation Unit (Year Established; Size)*	*Area Under Study*
Bolivia	**01** Isiboro Secure NP[1] (1965; 1,100,000ha) **02** Huanchaca NP (1979; 541,200ha) **03** Manuripe WR (1975; 1,540,000ha) ***04** Ulla Ulla WR, MAB[2] (1972; 240,000ha) **05** Bella Vista NP (1946; 90,000ha)	***06** Pilón Lajas NP, MAB[3] **07** Caquiahuaca RP **08** Rogoaguado-Roguagua WR
Brazil	***09** Tapajós (Amazonia) NP (1974; 1,000,000ha) ***10** Pico da Neblina NP (1979; 2,200,000ha) ***11** Paácas Novos NP (1979; 765,000ha) **12** Rio Trombetas BR (1979; 385,000ha) **13** Jaru BR (1979; 268,150ha) **14** Cabo Orange NP (1980; 619,000ha) **15** Lago Piratuba BR (1980; 500,000ha) **16** Jau NP (1980; 2,272,000ha) **17** Maraca-Roraima ES (1977; 92,000ha) **18** Anavilhanas ES (1977; 350,000ha) **19** Iquê-Aripuanã ES (1977; 480,000ha) **20** Piria-Gurupi ES (1978; 15,000ha) **21** Gurupi FR (1961; 1,674,000ha) **22** Gorotiri FR (1961; 1,843,000ha) **23** Mundurucania FR (1961; 1,377,000ha) **24** Parima FR (1961; 1,756,000ha) **25** Rio Negro FR (1961; 3,790,000ha) **26** Pedras Negras FR (1961; 1,761,000ha) **27** Jaru FR (1961; 1,085,000ha) **28** Juruena FR (1961; 1,808,000ha)	**29** Oiapoque BR **30** Marajó BR **31** Xingu BR **32** Guaporé BR **33** Apiacás ES **34** Maracá-Amapá ES **35** Japurá-Solimões ES (Auati Paraná)
Colombia	**36** Amacayacu NP (1976; 170,000ha) ***37** El Tuparro FT (1970; 290,000ha)	
Ecuador	***38** Yasuní NP (1979; 750,000ha) **39** Cuyabeno FPR (1979; 380,000ha)	
French Guiana		
Guyana	***40** Kaieteur NP (1929; 11,650ha)	
Peru	***41** Manu NP, MAB (1973; 1,532,800ha) ***42** Pacaya-Samiria NIR (1972; 1,387,500ha) ***43** Tingo Maria NP (1965; 18,000ha)	**44** Loreto NP **45** Cutibireni NP **46** Pampas del Heath NIR **47** Machu Picchu NP Sira San Carlos NP, Pajaten NP, Noreste NP
Suriname	***48** Eilerts de Haan Gebergte NER (1966; 220,000ha) ***49** Raleighvallen-Voltzberg NER (1966; 56,000ha) ***50** Tafelberg NER (1966; 140,000ha) ***51** Wia Wia NER (1966; 36,000ha) ***52** Coppename River Mouth NER (1966; 10,000ha) ***53** Brinckhuevel NER (1961; 6,000ha) ***54** Brownsberg NEP (1969; 11,200ha) ***55** Galibi NER (1969; 4,000ha) ***56** Sipaliwini NER (1972; 100,000ha) **57** Hertenrits NER (1972; 2,000ha)	
Venezuela	***58** Canaima NP (1962; 3,000,000ha) ***59** Serranía La Neblina NP (1978; 1,360,000ha) ***60** Yapacana NP (1978; 320,000ha) ***61** Duida-Marahuaca NP (1978; 210,000ha) ***62** Jaua-Sarisarinama NP (1978; 330,000ha) **63** Piedra del Cocuy NM (1978; 15ha) **64** Cerro Autana NM (1978; 30ha)	**65** Orinoquia NP **66** Delta del Orinoco NP

[1]Abbreviations used are as follows: NP, National Park; WR, Wildlife Refuge/Reserve; RP, Regional Park; BR, Biological Reserve; FR, Forest Reserve; ES, Ecological Station; NIR, National Reserve; NER, Nature Reserve; NEP, Nature Park; FT, Faunistic Territory; NM, Natural/National Monument; FPR, Fauna Production Reserve; WH, World Heritage Site; MAB, Biosphere Reserve.

[2]Areas marked with an asterisk (*) met the criteria for inclusion in the *1980 United Nations List of National Parks and Equivalent Reserves*. The number before each area identifies it on Figure 5.

[3]Bolivia's Pilón Lajas is listed as both a National Park (1977; 100,000ha) and a Biosphere Reserve in the 1980 UN List, however, more recent surveys by P. Freeman and B. Cross for USAID indicate the area remains only under study for possible future designation.

1. Atlantic Coastal Region

The Atlantic Coastal Region includes Brazil's Cabo Orange National Park and Lake Piratuba Biological Reserve as well as several smaller units in Suriname. However, the large Belém Refugium in the Capim watershed and the Oiapoque Refugium (Figure 4, Nos. 1 and 2) are still unrepresented. The former lies within one of the areas undergoing extensive alteration according to maps prepared by Brazil's National Space Research Institute (INPE) and IBDF (Figure 7) and published in 1980 by Latin American Newsletters of London (RB-80-03). As such, the Belém Refugium deserves priority attention, if it has not already been too altered for conservation unit status.

2. *Jari-Trombetas Region*

The Jari-Trombetas Region includes Brazil's Rio Trombetas Biological Reserve, Guyana's Kaieteur National Park and several reserves in Suriname. According to the criteria suggested in 1976, it still lacks two conservation units of 500,000 ha or larger.

3. *Xingu-Madeira Region*

The most seriously deficient Phytogeographic Region is the Xingu-Madeira, which includes only Brazil's Tapajós (Amazonia) National Park and the tentatively classified Gorotire and Mundurucania Forest Reserves (Figure 5). As future surveys are made in this region, particular attention might be paid to such areas as Ponta do Flechal, Altamira, Caxinduba and Upper Xingu (Figure 4, Nos. 7,8,9,10). Brazil's proposed Apiacas Ecological Station and Xingu Biological Reserve would both partially fill the gaps in this region (Figure 5).

4a. *Roraima Region*

The Roraima Region is still underrepresented, containing only Brazil's Maraca Ecological Station. A sample of the Region should include part of the Roraima Savanna.

4b. and 5. *Manaus and Upper Rio Negro Regions*

The Manaus and Upper Rio Negro Regions now meet the minimum

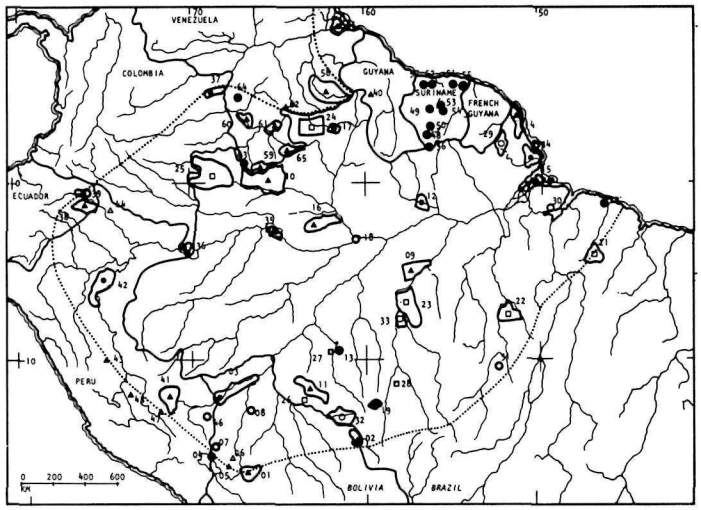


Fig. 5. Location of existing and planned conservation units in the Amazon.

▲ *National Park*
△ *Under Study for Nat'l. Park*
□ *Brazilian Forest Reserve (Transitory Destination)*
● *Other Existing Reserve**
○ *Other Units Under Study**

**Includes: Wildlife Refuge/Reserve, Ecological Station, Nature Park, Natural Monument, National Reserve, Biosphere Reserve.*

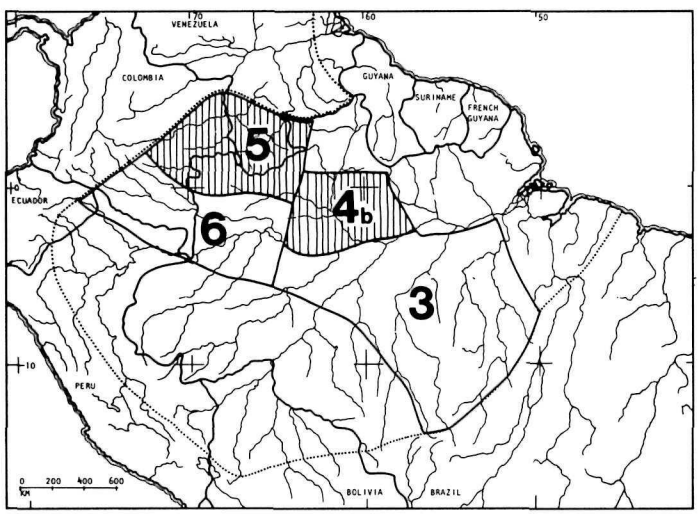


Fig. 6. Summary of protected area representation by Amazon phytogeographic region. 1. Atlantic Coastal, 2. Jari-Trombetas, 3. Xingu-Madeira, 4a. Roraima, 4b. Manaus, 5. Upper Rio Negro, 6. Solimões-Amazonas, 7. Southwest.

▭ *Most adequately represented*

⬭ *Least adequately represented*

recommendations made in 1976, primarily due to several large national parks recently established in each by Brazil and Venezuela. However, no portion of the Jatapu area (Figure 4, No. 12) has yet received protected status. INPA has several small scientific reserves near Manaus, including Ducke, Egler, Campina and other experimental areas, which receive varying degrees of protection.

6. *Solimões-Amazonas Region*

After the Xingu-Madeira, the Solimões-Amazonas Region is the next

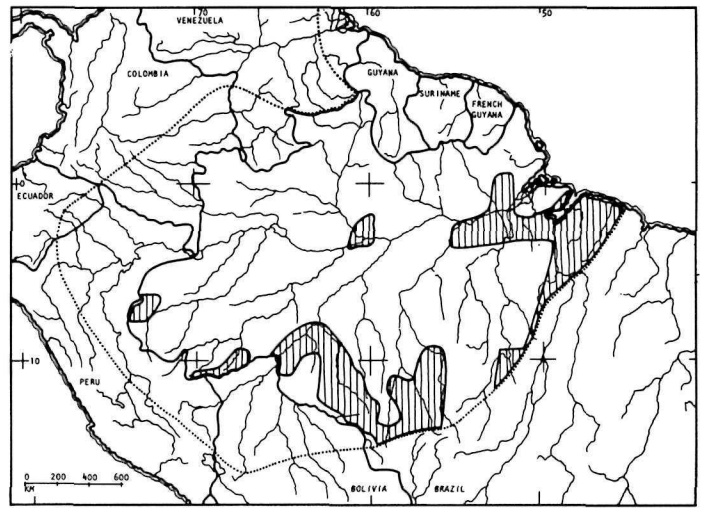


Fig. 7. Approximate location of altered Amazon forest lands within Brazilian national territory. (INPE/IBDF 1980)

most precariously represented and includes only Colombia's Amacayacu National Park, and portions of Ecuador's newly established Cuyabeno Fauna Protection Reserve and Yasuní National Park. Peru's proposed Loreto National Park and Brazil's Japurá-Solimões (Auati Parana) Ecological Station both are located within the Region. Among others, attention might be directed to the areas identified in Figure 4 as Cuxiauia, Cutiuaia, Loreto, North Napo, and Panaua (Numbers 14-18). The latter area overlaps precisely with the location of the proposed Japurá-Solimões Ecological Station.

7. *Southwest Region*

The Southwest Region is both the largest and the one that contains the greatest number of conservation units. Recently established large national parks include Bolivia's Huanchaca and Brazil's Paácas Novos. Major geographical gaps within the Region are the upper watersheds of the Juruá, Purus and the Madeira Rivers; and, future surveys might be directed towards such areas as Eirunepe, Purus and Marmelos (Figure 4, Nos. 26, 27, 28).

Udvardy Classification

By comparing the existing conservation units (Figure 5) with the map showing Udvardy's Biogeographical Provinces (Figure 3), it becomes apparent that, in contrast to what was believed at the time of writing the *World Conservation Strategy,* parks or protected areas do now exist in each Province. The Madeiran Province (Figure 3, No. 6), which was not believed to contain any conservation units, includes the Trapajós (Amazonia) National Park, most of Paácas Novos National Park, the Piria-Gurupi Ecological Station and the Jaru Biological Reserve, all in Brazil. This does not mean that protected area coverage for each Province is adequate or even representative. Universal criteria in this regard, that is, "How much is enough?", have yet to be established and will undoubtedly be a focal point of discussion during this decade.

Future Orientations

Within the past five years many new parks and protected areas have been set aside by the various governments in the Amazon region of South America. The process of preserving samples of this vast and important area seems to have gathered momentum. We have reviewed these efforts and analyzed them by one variable, phytogeographic representation,

Table 3. Existing conservation units by phytogeographic region in 1981.

Phytogeographic Region	*Percent of Total Area*	*Proportional Allocation of Major Conservation Units*[1] *Recommended*	*Existing*[3 4]	*Proportional Allocation of Other Conservation Units*[2] *Recommended*	*Existing*
1. Atlantic Coastal	13.4%	3	*Brazil:* Cabo Orange NP Lago Piratuba BR (Gurupi FR)[5]	3	*Brazil:* Piria-Gurupi ES *Suriname:* Coppename R. Mouth NER Wia Wia NER Brinckhuevel NER[5] Galibi NER Hertenrits NER
2. Jari-Trombetas	8.3%	2		2	*Brazil:* Rio Trombetas BR *Guyana:* Kaieteur NP[5] *Suriname:* Sipaliwini NER E. Gebergte NER Tafelberg NER Brownsberg NEP[5] Raleighvallen-Voltzberg NER[5]
3. Xingu-Madeira	19.2%	5	*Brazil:* Tapajós (Amazonia) NP (Gorotire FR) (Mundurucânia FR)	5	
4a. Roraima	2.6%	1	*Brazil:* (Parima FR)[5]	1	*Brazil:* Maracá-Roraima ES
4b. Manaus	5.1%	1	*Brazil:* Jau NP	1	*Brazil:* Anavilhanas ES (INPA has several small reserves near Manaus including Duke, Egler, and Campina)
5. Upper Rio Negro	7.9%	2	*Brazil:* Pico da Neblina NP (Rio Negro FR) (Parima FR)[5] *Colombia:* El Tuparro FT[5] *Venezuela:* Serranía La Neblina NP	2	*Venezuela:* Yapacana NP Duida-Marahuaca NP Piedra del Cocuy NM Cerro Autana NM
6. Solimões-Amazonas	9.4%	2	*Ecuador:* Yasuní NP[5] Cuyabeno FPR[5]	2	*Colombia:* Amacayacu NP
7. Southwest	34.1%	8	*Bolivia:* Isiboro-Sécure NP[5] Manuripe WR Huanchaca NP *Brazil:* Paácas-Novos NP Ique-Aripuanã ES (Pedras Negras FR) (Jaru FR) (Jurueña FR) *Ecuador:* Yasuní NP[5] *Peru:* Manu NP Pacaya-Samiria NIR	8	*Bolivia:* Bella Vista NP[5] Ulla Ulla WR[5] *Brazil:* Jaru BR *Peru:* Tingo Maria NP[5]
TOTALS	100.0%	24 Recommended	17 (+8)[3] Existing	24 Recommended	24 Existing

[1] "Major Conservation Unit"—one on the order of 5000 km² (500,000 ha) including a core of at least 2600 km² with a designated or *de facto* buffer 10 km wide.
[2] "Other Conservation Unit"—one on the order of 1000 km² (100,000 ha), or smaller, depending on local circumstances.
[3] Brazil's Forest Reserves are a transitory land use category only tentatively included but not counted in the totals.
[4] Units located on a Phytogeographic Region boundary are counted as a single unit in the totals.
[5] Partially located within the region or on its boundary.

which is consistent with past regional analyses and provides a means for quantitatively measuring progress.

While phytogeographic representation is a useful structure for periodic review, continual refinement is desirable, as knowledge expands. The approach to date has concentrated on the tropical moist forest vegetation type which constitutes 90 percent of the Amazon and provides the conceptual basis for both the refugia and the phytogeographic subdivisions. Future orientations should appropriately include analyses by other Amazon vegetation types such as the grassland savannas, liana forests, bamboo forests, aquatic grasslands, mangroves, montane forests, "igapó" or permanently flooded forests, the seasonally flooded or "várzea" forests, and the "campinas" or "high caatingas" which are generally forested areas on washed sands scattered in some sections of the rainforests. These vegetation types were identified and tentatively reviewed in the Amazon Analysis. However, radar surveys in both Brazil and Colombia, as well as additional studies in other Amazon countries, are reaching the point where a more accurate assessment of the distribution of vegetation types and the extent of their inclusion in conservation units will soon be possible. Samples of the rich floral and faunal diversity in this other 10 percent of the Amazon should be included, where appropriate, within the parks and protected areas representing the phytogeographic regions. Likewise, the adequacy of these plans to protect the freshwater systems of the Amazon should be examined explicitly, giving particular attention to the relationships recently described by M. Goulding (*The Forest and the Fishes,* University of California Press, 1981) between the flood plain forests and freshwater fish.

We hope the momentum which has been generated continues to fill in gaps, especially in the Xingu-Madeira and Solimões-Amazonas Regions as well as in those areas of the southern and eastern Amazon where expanding agricultural or other activities are rapidly diminishing land use options. Such action by individual Amazonian countries would further the goals of the 1980 Amazon Treaty which include balancing economic growth with environmental conservation. It would also further the 1980 "Charter of Belém" in which the foreign ministries of eight Amazon nations stated that "... the development of the Amazon region and the preservation of its environment cannot be considered separately; they are the exclusive responsibility of the Amazon countries."

Dr. Gary B. Wetterberg, who has worked for FAO for several years in South America, is the Western Hemisphere Program Coordinator in the International Park Affairs Branch of the National Park Service in Washington, D.C.; Dr. Ghillean T. Prance is Vice President and Director of Botanical Research of the New York Botanical Garden in Bronx; and, Dr. Thomas E. Lovejoy is Vice President for Science of the World Wildlife Fund (U.S.) in Washington, D.C. Each has been personally involved in his respective professional capacity for several years in the Amazon and has published numerous technical articles concerning Amazonian conservation.

Richard Flenley

Derelict Land Becomes Parkland at Stoke-on-Trent

In England, the City of Stoke-on-Trent is one of the pioneer authorities to remove industrial eyesores in a major reclamation programme. This article looks at the problems faced by the City some dozen years ago when the programme started and traces the progress of one of the early projects — the Central Forest Park — to the present day.

Stoke is a linear city of about 260,000 people in the North Midlands (about halfway between Birmingham and Manchester). Its mineral resources of coal, iron and clays made it a centre for 18th and 19th century heavy industry, although the area is better known as 'the Potteries' — the home of Wedgwood, Spode, Minton and Doulton. This industrial legacy finally caught up with the City in the early 1960s when more than 10 per cent of the area was recognised to be derelict. It seems that people were really "voting with their feet" for during the 1960s, with increasing awareness of environmental deprivation, the City population started to shrink. In 1966 The Minister for Housing and Local Government was persuaded to visit Stoke but he came away quickly and confided in his diary that evacuation would be more realistic than rehabilitation.

Some 12 months later, the disaster of Aberfan in South Wales, where a colliery tip slipped down a hillside onto a school with horrific consequences, brought the derelict land problem into focus. Such problems could not be left unresolved. Reclamation was necessary on public safety grounds. But in Stoke-on-Trent the planners suddenly woke up to the opportunities of spare land which could be used to bring into play some broader planning strategies. Part of Stoke's environmental problem was the density of eyesores which dominated life and to some extent attitudes. At the other end of the scale the City was very deficient in public open space of all types. Add to this the legacy of chronic atmospheric pollution of the Potteries during the last 150 years, which had significantly limited the establishment of street trees and vegetation generally, and the bleak picture of Stoke-on-Trent is complete.

Now, with pollution being brought under control, the planners recognised the basic land equation which could change the image of the City and perhaps also the attitudes of its citizens. In the first place, reclamation had to be shown to be feasible. Stoke listed more than 2,000

Before and after: In the winter of 1968-1969, the two main tips, or dumps, of the Hanley Deep coal mine (top) contained about 3 million cubic yards of waste material and were a blight on the landscape through the center of Stoke-on-Trent. The same area (pictured in 1975, below), graded and grass-covered, is the heart of Central Forest Park.

November 1980: the Park is an informal haven for rest and recreation.

acres (809 ha) as derelict from many different processes — colliery tips and pit heads, pottery waste tips, domestic refuse dumps, marl holes of the clay extraction, abandoned iron and chemical works, and many "pocket handkerchief" sites which were no more than left over lots now dragged down by trash dumping. Such a scene invited little public respect — or hope — for the environment.

Furthermore in the late 1960s there was precious little technical expertise on reclamation matters. In Stoke the nature of dereliction was highly varied and the range of technical problems was broad. There was no book of standard treatments to adopt. It was a question of researching, trying out solutions and monitoring. Then in 1967 limited grants were made available from Central Government to undertake reclamation works and, with the Aberfan disaster on the public conscience, the planners made a determined effort to start.

The site which was chosen to symbolise this process was that of the 'Central Forest Park.' This was the Hanley Deep Pit site, right on the edge of the City's new shopping centre. With its 88 acres (35.6 ha) of colliery spoil, slurry lagoons, decaying buildings and twisted steel, it represented a massive challenge in full public view. It was essential to capture both public and political imagination with this pilot scheme if there was to be hope for a major programme through the City. The plan was to turn this desolate scene into a major public park. But in contrast to Stoke's fine Victorian parks (designed by Thomas Mawson in the finest traditions of that style), the Forest Park would be low-key, low maintenance, informal and natural. It would provide a refuge for wildlife in the City and stand in sharp contrast to the surrounding urban scene — topography, trees, meadows, glades and at last — fresh air!

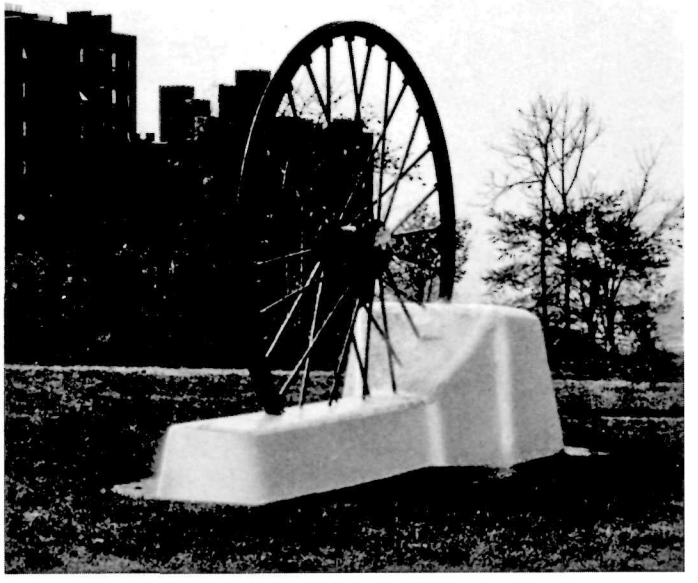
The technical problems were considerable. Massive spoil tips to shape or move with the risk of spontaneous combustion; highly acidic ground conditions and strictly limited opportunities to import any soil cover; mine shafts to locate, prove and make safe; drainage systems to be developed and installed and a wide range of artefacts to be buried. In fact the basic substrate conditions have been used to advantage, for although their harshness and tendency to weather rapidly to an acid condition was hazardous at the establishment stage, it has in the longer term supported a fairly fine open sward which has enabled maintenance to stay at a low level and has at the same time encouraged a limited range of flowering plants to become established.

The main treatments were obviously in earthmoving, to form new spaces and shapes, although two of the massive colliery spoil heaps were kept in something like their original shapes as a symbol of the park's legacy and of its own wild and rugged character. Elsewhere, reshaping provided new spaces and opportunities — football pitches, kickabouts, a golf course, an informal pool and valley, a car park and a whole series of paths winding informally through the site to link home and school, work and shop. Here and there treatments were varied with a little more soil introduced, or a spring-line exploited, to diversify potential habitats. Planting was undertaken generally with two year old forestry stock of indigenous trees, using alder as a nurse crop, with a few larger standard trees at significant locations for immediate impact. Again, every opportunity was taken to include a handful of wild-flower seeds in the mixtures to encourage diversity and detailed interest. Local materials were salvaged to provide limited site furniture and the burnt shale out of the colliery tips was used to form informal path surfaces.

Work started on a two acre corner of the site in 1969 and the main works were completed by 1973, when the Queen came to Stoke and officially opened the Forest Park. It had worked. The grass was green; there were even primroses on the old colliery tip and for a moment Stoke was the "Eighth Wonder of the World."

The enthusiasm for reclamation was infectious and much assisted by Government grants being raised, firstly to 75 percent and later to 100 percent for basic works. By 1970, the City had developed a 5-year reclamation programme and, as other award-winning projects were realised, the programme was extended to ten years.

So in 1981, it is possible to stand back and take stock of the revolution. Some 2,153 acres (871 ha) have been reclaimed in 108 contracts; a further 455 acres (180 ha) under 43 contracts are currently in the capital programme. The majority of land has gone over to public open space and the City has at least achieved its target of 7 acres (2.83 ha) per thousand of population in line with national standards. However, about 12 percent of the land has been reclaimed for industry and 1 percent has been prepared for housing. In addition, some of the reclaimed areas are temporarily given over to open space on a "land-bank" principle while awaiting longer term development for schools, housing or industry. There are other successes — Westport Water Park, the Greenways (a network of reclaimed railway corridors) and, more recently, the impressive Parkhall Country Park — and all achieved for the all-in-cost of about £2,000 per acre (£4,940 per hectare).



Legacy and prospect: The old winding wheel from the mine pit is all that remains to remind the visitor of the vast industrial works that once stood on the Park site. Behind it new apartment buildings rise on the edge of the Park.

Entrance detail: Reclaimed bricks, railway ties, or sleepers, and other materials were used for this construction.

There have, however, been the failures as well. Occasionally the technical problems have required further attention, but sometimes it has been the planning and design which have lacked the essential imagination. In such cases there appears to have been a belief that the statistic of more green acres was more important than detailed consideration of the site, its resources and opportunities. And as reclamation through Government grants is essentially a one-off opportunity, such schemes will gradually become derelict again as they fail to meet community expectations.

Back in the Forest Park, however, these expectations have been more than realised. Not only is it now taking on the textures of woodland and glade with all the associated ecology but it has already moved into local folklore. There are songs, films, even a radio play about the Forest Park. People recognise it as their territory, use it, and talk with a certain amount of pride about it. But the real success of the Forest Park can best be seen by walking around the edges. There is the confidence to paint up the old houses looking across the former derelict wastes; new flats have been built at the Hanley end overlooking the park and in the most recent and ongoing phase, the Forest Park extension package includes new housing, conservation of older housing, and some more open space connections into the main part of the site. At last reclamation is weaving a rich and varied tapestry in place of planning blight.

Richard Flenley is a Principal of Land Use Consultants of 731 Fulham Road, London, SW6, and was actively involved in design and/or supervision of some 40 projects in Stoke-on-Trent since 1972. In general, the consultants were involved in the earlier schemes and since 1974 the City has gradually built up its own reclamation team.

Dale L. Taylor

Fire Records: Their Importance and Use in Documenting Fire History

Fire records are necessary to document fire frequency, seasonal fire occurrence, size, cause, location, conditions under which various habitat types burn, manpower requirements, management techniques, and other factors. This is an impressive and important list of information that is required for developing prescribed natural fire, and prescribed burn programs, as well as for maintaining traditional fire suppression and fire prevention programs.

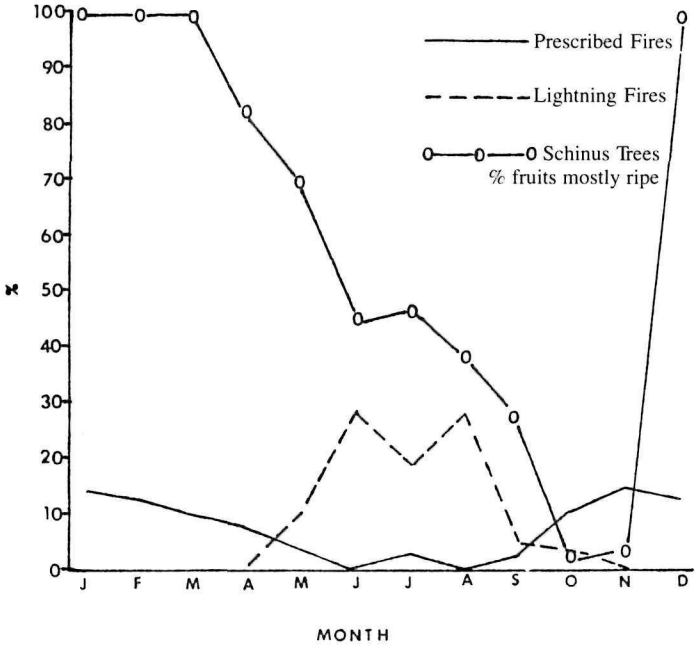
This paper is an appeal for complete and accurate records at the *park level* where they can best be stored and used, but it will take a new awareness of the value of records and a new dedication to protect records that do exist.

Current U.S. National Park Service procedure is for individual fire reports to be filed at the Regional Office with copies forwarded to the NPS Office of Fire Management, Interagency Fire Center, in Boise, Idaho. The Office of Fire Management sends copies to the Bureau of Land Management at its Denver Service Center, where data are stored on computer tape as Department of Interior records.

This is a good procedure for communication, but it does not contribute to a records system. Regional Offices — our Southeast, Southwest, Western, Rocky Mountain, and Pacific Northwest offices were surveyed —keep fire records for a maximum of six years before they are archived or destroyed. It is generally acknowledged that not all fire reports are sent to a Regional Office, consequently, the Office of Fire Management records and Bureau of Land Management records are incomplete. Some Regional Offices have existed for a short time, therefore their records cover only a few years. Retrieval from computer tape storage has not been satisfactory.

I conclude the best place for fire records is at the *individual park* where a fire management officer is charged with responsibility for maintaining them. Anything done on the regional or national level, such as the NPS Office of Fire Management attempt to develop a Service-wide data base, should be supplemental to, and not a substitute for, good local fire records. The records systems at Everglades National Park will be used as an example.

The 1.4 million acre Everglades National Park was created in 1947. During the early years that the NPS was in the Everglades many lightning fires during the wet season were never entered into the records because the fires were often small, or had gone out before being discov-



This graph, based on fire records, shows that in the past prescribed fire occurrence relative to fruiting phenology of an exotic shrub, Schinus terebinthifolius, *was out of sequence with natural lightning fires. This could possibly encourage* Schinus *invasion by opening areas when the plant has maximum fruit. As a result of the study the season for prescribed fire is being changed to coincide with the natural fire season.*

ered. A few fire records have been lost, and it was discovered reports for some prescribed fires were not made. Because offices had been moved, records were scattered.

A technician was assigned to search all known sources for fire records, yearly totals of number of fires and acres burned, and for other hints of fire activity. Sources included the Southeast Regional Office files, mail and general files at the Park, files in the Chief Ranger's office, files and maps available in other offices such as those of the District Rangers, the Resources Management Officer and Research Biologist, and library files and maps. The search turned up considerable useful information, some dating back to 1947.

When all individual fire records were assumed found (or acknowledged to be lost), each report, with all supplemental information such as a fire behavior report, was assigned a folder identified by number for later use in computer storage. For example, the number 7436 would identify the year (1974), and the consecutive fire that occurred that year (36). This simple system will allow a specific fire record to be recalled almost instantly from storage when the computer system is in place. The records are stored in the Resource Manager's office and users must check them out from one of two people: the Resources Management Specialist for Fire, or the Fire Behavior Officer. With numerous fire bosses using records to plan fires on 54 separate units burned by prescribed fire, the records would soon be scattered and lost without care. No duplicate file exists, at present, but plans are to have all records copied on microfilm. An annual report, which contains details on the acreage, location, date, and cause of each fire, is deposited as a permanent acquisition in the park library.

With over 900 fire reports in Everglades fire records, a computerized filing system is envisioned. The resources manager will be able to recall data about a previous prescribed fire and some potential problems that may occur. During a natural prescribed fire, or a wildfire, distance to barriers, location of past fires, fuel loading estimates at the site, and in surrounding areas, and distance to areas/structures/natural features/research that must be protected will be available. This information will assist the manager in making judgements about observation, containment, and suppression activities.

Fire records have been used to determine season and distribution of lightning-caused fires, man-caused fires, and wet-season versus dry-season fires. They are used extensively for planning prescribed fires, and for evaluating the season when prescribed fires are set compared to when lighting fires occur. The impact of prescribed fire on various habitats, and on control of exotics can be analyzed only when good fire records are available. Fire records will have to be used to determine fire frequency because most trees in the subtropical environment do not form annual rings, a condition necessary to date fire scars. Finally, fire records have been used in developing a recovery plan for an endangered species.

Preservation of quality records must be a high priority in each park. A quality record includes a carefully completed individual fire report (in the USA form DI-1201 is used), a detailed narrative that describes actions taken on a fire, a detailed map showing plant community types burned on a daily basis, the fire behavior officer's report detailing prescription parameters, weather forecasts, site description, fuel type and amount, weather occurrence during the fire, and fire behavior observations. Quality records are a useful tool for many years.

Dr. Dale L. Taylor is a research biologist (fire ecologist) at the South Florida Research Center, Everglades National Park, Homestead, Florida 33030/USA.

Fire records are analysed to determine when an area was last burned, the methods used, crew size and equipment needed. This is very important, for example, for specific areas on Long Pine Key in Everglades National Park which are burned at 5- to 7-year intervals to prevent invasion by hardwood shrubs and to encourage endemic herbaceous species that are sensitive to too much shade. This is Block E, burned September 18, 1980.

A typical bear jam in the 1950s and 1960s involved scores of parked cars, clicking cameras, and excited visitors who tried to prolong the event by offering the hungry bears everything from peanut butter sandwiches to sirloin steak. The practice of feeding bears proved dangerous, rather than amusing, in the long run. The days of the roadside bear circus in Yellowstone are over now. As a result of a Park Service management program, bears have returned to their natural backcountry habitat, and visitors to the backcountry are advised to take precautions, like wearing "bear bells," to prevent sudden encounters with bears. Photo: National Park Service

Budd & Debby Titlow

Where Have All The Bears Gone?

Remember when Yellowstone National Park was world-famous for bears? Park visitors by the millions came to gawk and laugh at the antics of these lumbering brutes. Things are different now. The bears seem to have disappeared from the park. Tour bus drivers who have traveled park roads six days a week, ten hours a day, during the past five summers say they have never seen a bear. What has happened to the bears?

Well—it's all part of the National Park Service's effort to keep visitors and bears separated. The reason? Human safety and bear suvival, both threatened as a result of the long, rocky relationship between bears and people in the park.

From the first days of Yellowstone National Park, the mighty grizzly and the smaller black bear reigned over the mysterious, wondrous area in peace and solitude. Boars were loners for the most part, establishing territory through bluffs and shows of strength. Sows and their cubs spent the summer tirelessly foraging for the food that, stored as fat, would allow them to survive winter hibernation.

About the turn of the century, hotels and inns were built in Yellowstone, and garbage from them was dumped in pits nearby. Soon after, bears followed their sharp noses to the feast, and hotel visitors enjoyed the spectacle of the huge creatures congregating to feed.

As early as 1907 the park's first bear-caused fatality was recorded. It was a clear case of provocation. A doughty old codger chased a grizzly cub up a tree, and then—in full view of mama bear—proceeded to prod its backside with an umbrella. He was swiftly demolished by the cub's mother.

In the 1930s, with the advent of rugged "touring" automobiles and portable camping equipment, park visitation sharply increased. This increased visitation created more garbage, and the park became more involved in feeding bears at the dumps. Moreover, black bear beggars at roadsides became a common phenomenon. Conflicts between hungry bears and fascinated tourists skyrocketed.

In the late 1960s most dumps were closed, but by then a severe problem had been created by the combination of a burgeoning visitation (2 million per year) and a prevailing "zoo attitude" toward the park's wildlife. Many visitors seemed to forget — or never realized — that they were guests in a remote wilderness. They acted as if they were on a picnic in a city park, casually approaching bears and bison as they would squirrels and pigeons. One of the most outrageous examples was the gracious gentleman who lured a black bear into the car with his beloved wife—and then tried to slam the door. And there was the clever fellow who put his kids on a black bear's back (just like the plastic "horsey" at the supermarket) so he could snap a "memorable" photo. Frequent "bear jams" along the park's main loop road became a kind of circus.

Meanwhile, after more than sixty years of being accustomed to human handouts, the bears of Yellowstone had learned to be unafraid of people, dependent on human food, and aggressive in pursuing it. So, in spite of early management actions, such as dump closures, too many people were still being hurt, mostly by black bears. In the 1950s an average of fifty-six people per year had been injured by bears. In the 1960s, still, an average

of forty-one people per year were hurt through encounters with bears.

Finally, after two women were killed by bears in Glacier National Park in 1967, the Park Service devised a plan to reduce the likelihood of encounters between bears and people.

- Quickly close all remaining open-pit dumps in the park.
- Enforce existing park regulations against feeding bears.
- "Bear-proof" all park garbage containers.
- Regulate the use of campgrounds and trails in "prime bear habitat."
- Translocate bears that enter developed areas or beg along roadsides.
- Destroy bears that return to developed areas or roadsides after repeated unnatural behavior.

Closing the dumps and preventing feeding by visitors, park managers reasoned, would force most of the mooching bears into the backcountry in search of natural foods — grasses, sedges, berries, pinenuts, roots, insects, small mammals, and carrion. Any bear that didn't move voluntarily would be translocated into the backcountry. If the bear returned to populated areas such as campgrounds, it would be shot or put to sleep with an overdose of drugs by park personnel.

The Park Service rangers did not want to kill bears any more than they wanted visitors to be hurt. But park managers believed that destroying repeat-offender bears would—in the long run—reduce the total number of bears that would have to be killed. Without mooching elders to teach them, most young bears would never learn to seek human-generated food sources. Park Service managers reasoned that within a few generations, highway bumming and garbage-guzzling habits would disappear forever from Yellowstone's bear populations, and the bears would stay in the backcountry.

At first the Park Service had to kill quite a few bears. But by 1979 the number of bears that had to be destroyed dropped dramatically, and the estimated backcountry bear population had increased substantially. Actually, it compared favorably with the number of bears believed to have been in the area in 1872 when the park was founded. And Yellowstone had become safer for its many visitors. During the late 1970s an average of only two visitors per summer were injured by black bears (compared with an average of forty-five per summer during 1931-1969).

Free-roaming, wild-living bear populations. Few encounters between people and bears and even fewer injuries and destroyed bears. In the long run, Yellowstone's bear management program has achieved its twin goals —healthy backwoods bear populations and human safety—and the Park Service is determined to keep it that way. Park literature — hand-delivered to each visitor — offers many guidelines for backpackers, as well as regular campers, for avoiding confrontations with bears. Keep a clean campsite; hang food high in trees far from tents; properly dispose of garbage; pack out what you pack in; don't hike alone. And you had better take these suggestions seriously; you can bet the rangers do!

Yellowstone's celebrated bear circus is gone forever. Visitors can no longer chuckle at a hungry bear cavorting in the middle of the road or somehow getting stuck in a garbage can. Although you may be disappointed at not seeing a bear, the bears of Yellowstone are still around. They are living as wild bears *should* — and the park, the bears, and you are much better off because of it.

Budd Titlow is beginning his seventh year as an ecologist with the U.S. government. Prior to that, he worked summers in Yellowstone National Park. Debby is a former schoolteacher and writer-editor. Both are now free-lance writer-photographers.

PARK TECHNIQUES

Waitangi Mangrove Forest Walkway *Barry Skinner*

Waitangi National Trust is a national historic and recreation reserve of 480 hectares in the sub-tropical North Auckland peninsula of New Zealand. The reserve's focal point is the Treaty House, of imposing Georgian colonial design built in 1833 for James Busby, the British Government's resident representative in the "new" colony of New Zealand.

The expanse of lawn in front of the house was the site on 6 February 1840 of the signing of the Treaty of Waitangi, between the native Maori people and the British colonisers, and this marked the beginnings of constitutional government for the new colony.

Since its donation in 1932 to the people of New Zealand by the then Governor, Lord Bledisloe, the reserve has, in addition to its primary historic role, become increasingly important in regional recreation. Located in the Bay of Islands, site of the newest maritime and historic park in the country, the Waitangi reserve offers facilities for golf, lawn bowls, yachting and power boating, and has a fine tourist hotel as well as its major historic and cultural features—the Treaty House, the Whare Runanga or Maori meeting house and Maori canoe carved by representatives of the Maori people to make the Treaty's centennial in 1940.

In recent years, management trends on the Waitangi reserve have recognised the need to provide broader opportunity for general family recreation, both active and passive, in order to complement the existing structured sporting facilities. Accordingly, a coastal track system, beach picnic and barbecue areas and open spaces have been set aside and developed to meet demands for informal recreation.

This philosophy was extended by the development of a track of 6 kilometres from the Treaty House to the Haruru Falls. This track traverses the reserve and generally follows the northern bank of the tidal estuary of the Waitangi River.

Initial investigations into the track route showed the need to circle around an extensive salt marsh area if the track was to keep to the land. Alternatively, a small inlet off the main estuary, Hutia Creek, could be bridged and the

The boardwalk inside the mangrove forest at high tide, looking toward Hutia Creek. The south end of the bridge is just visible.

The bridge over Hutia Creek photographed at low tide.

walk routed through 250 metres of mature mangrove forest, then rejoining land.

This option was chosen and proved the major bonus in the whole project. Visitors are introduced to the mangrove ecosystem without the need to wade in mud. There is no environmental damage or disturbance, and visitors can appreciate the wealth of positive factors involved in the mangrove community.

It is worth noting that, in New Zealand, mangrove habitat is found only in the frost-free soft mud estuaries of the north. It has been popularly regarded as wasteland, fit only for rubbish disposal sites or for reclamation. This attitude has not been discouraged by the general inaccessibility of mangrove swamps.

In New Zealand only one species of mangrove (black mangrove *Avicennia marina)* grows, from a stunted shrub near the frost-line to 9 metre trees at Waitangi and further north. Their value as buffer zones between land and sea, as a vital part of the marine food cycle, and as a rich habitat for fish, crustaceans and molluscs, is well documented.

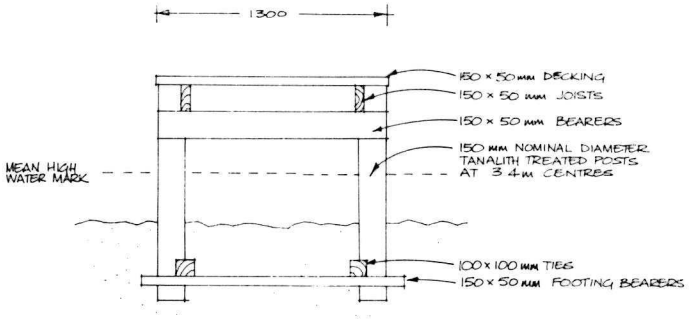
The bridge of 62 metres length, and the boardwalk of 248 metres, were designed by the writer and checked for structual loadbearing capacity by a civil engineer. Construction began in October 1978 and took six months, working between tides, with all materials towed to the site behind small outboard-powered boats. A small barge was used as a working platform.

Early advice that the bridge piles could be driven into solid substrata was incorrect; the soft brown rock underlying the Hutia Creek channel had to be broken out and the piles fixed in place with concrete. At the other end of the bridge, in the deep soft mud of the mangrove forest, the piles were placed inside oil drums to contain the concrete and an 18 mm diameter galvanised steel rod, enclosed in the concrete, used to tie each pair of piles.

I had assumed that not too far beneath the mud on the boardwalk route a firm substrata existed to support this construction. Tests with a steel spear showed the mud to be at least 3 metres deep, even close to land. To drive or place poles every 3.4 metres to this depth was impracticable so I designed a semi-floating support for the boardwalk using the large bearing surface of two 150 x 50 mm boards buried 300 mm beneath the surface.

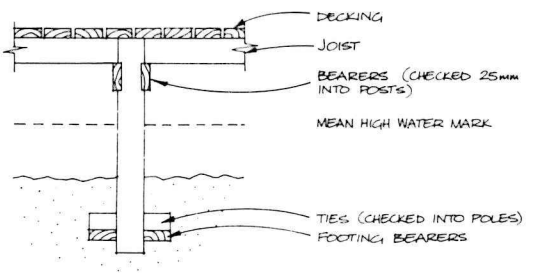
These were not only reasonably quick to prefabricate and place, but have proved rigid and totally firm after 18 months' use. All the galvanised steel fastenings on these footings are buried in the black anaerobic mud layer and (theoretically) should not rust.

Considerable thought was given to whether a handrail should be provided on the boardwalk, but since it would detract from the low profile of the timber walkway, and since it is not more than 900 mm to fall, the idea was dispensed with.



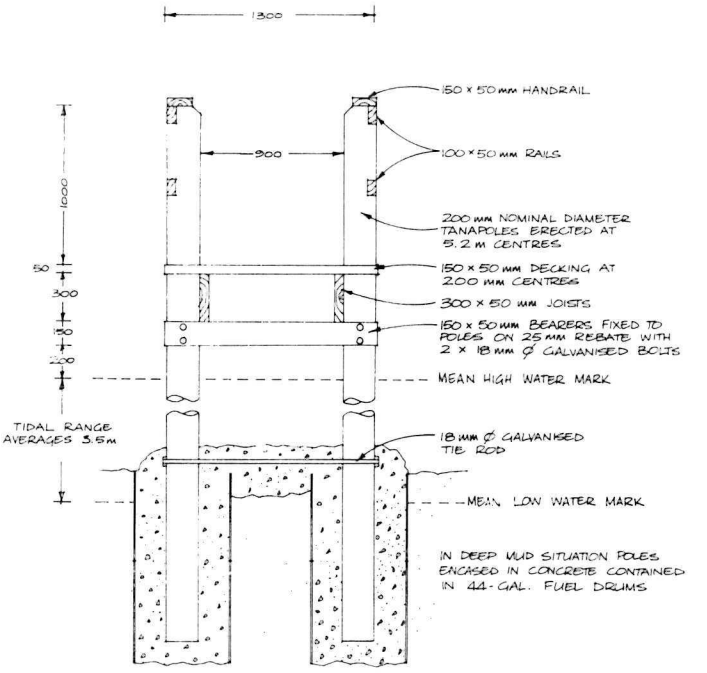
SECTION : BOARDWALK

SCALE 1:20



ELEVATION : BOARDWALK

SCALE 1:20



SECTION : BRIDGE

SCALE 1:20

All timber used was locally grown *Pinus radiata,* pressure-treated with tanalith* preservatives to ground retention specification (10.1 kg per cubic metre), except for the poles, which were treated to the maximum possible retention of 48 kg per cubic metre. Galvinised steel fastenings were used throughout.

Construction of the entire project (including the 6 kilometres of track) was undertaken by the Trust's own workers, including several employed on a Government-funded special work scheme. Their efforts deserve recognition.

On-site interpretation and information is provided by pamphlets contained in boxes at each end of the boardwalk (visitors who do not wish to retain the leaflets are asked to place them in the box at the other end—very few have been found discarded) and a large sign at the specially constructed viewing platform. This metal-photo sign is complex and detailed, but the mangrove ecosystem is not easily explained otherwise.

In addition, a more detailed ecological report on the Waitangi mangrove forest is available free from the Treaty House.

Clearly, the significant benefit is in introducing the visitor to an environment not normally accessible — an environment which is generally maligned and misunderstood. If we can contribute to a better understanding of the value of mangrove zones in New Zealand, then additional hope exists for the preservation of similar areas.

*A proprietary chemical formulation of copper sulphate, chrome arsenate, sodium arsenate and copper oxide.

A metal photo-sign interpreting the forest at a viewing platform on the boardwalk inside the mangrove forest.

This self-closing box, with the lid hinged at the upper edge, holds pamphlets on the mangrove forest. Pamphlet boxes are located at each end of the bridge, which is the entrance to the forest.

Barry Skinner is a Senior Ranger of the Department of Lands and Survey working under the direction of the Waitangi National Trust Board, New Zealand.

Countryside Commission for Scotland's Display Centre *John Foster*

The Countryside Commission for Scotland is a national agency established by government in 1968 to be concerned with conserving the natural beauty of the countryside and providing informal recreational facilities in it, the latter being carried out on the ground by local authorities, voluntary bodies and private individuals with grant aid provided by the Commission towards capital costs.

At an early stage in its existence the Commission realised that in providing grant aid it had an important responsibility to ensure that the recreation facilities fitted satisfactorily into their surroundings in terms of appearance and were robust enough to stand up to weather and whatever use was intended for them. Out of this need the Commission's countryside display centre was born ten years ago in the grounds of its headquarters at Battleby, near Perth.

The facility is in two parts. A conference and training centre, converted from an old farmsteading, houses the reception part of the display centre, containing trade catalogues and technical information sheets about exhibits on site and a large slide library of examples of recreational equipment and construction techniques from many countries of the world. The exhibits themselves are situated in an outside display area nearby and range widely from litter bins to lavatories and from steps to signs. They are in groupings of like kind for ease of comparison.

As well as proprietary products, there are on display examples of construction techniques for items of recreation furniture and equipment, such as picnic benches and viewpoint indicators, and for ground surface treatments, such as car parking areas and boardwalks. Common to all of these techniques is the importance of developing simple and inexpensive construction methods which are in keeping with traditional craft skills as far as possible.

In order to make the knowledge and experience developed in the Centre available as widely as possible, the Commission operates a service based on a series of technical information sheets. This service is available by subscription and consists of the supply of a series of sheets within a loose-leaf folder, each sheet containing detailed working drawings and specifications for a single product or construction technique. The service is provided on an on-going basis and subscribers are furnished with additional sheets as these are developed within the Centre by the Display Centre Manager and his staff.

Recognising that the items on display at Battleby are not being subjected to the wear and tear of use by the public or to the rigours of the more severe climatic conditions which exist in some other parts of the country, the Commission has undertaken, in collaboration with local authorities and private interests, a series of product testing and demonstration projects in a wide variety of locations throughout Scotland. This has yielded valuable information which has led to the development of a number of new designs and the modification of some existing designs so that they are more robust and durable in terms of the job they have to do and, in some cases, more suited to the particular needs of users.

The outdoor exhibition area at Battleby was carefully landscaped at the outset and, as the planting developed, it became increasingly evident from the enquiries received that there was a significant demand for advice on this aspect of countryside recreation provision. The Commission has therefore introduced a series of technical information sheets on planting and planting methods in the countryside covering a

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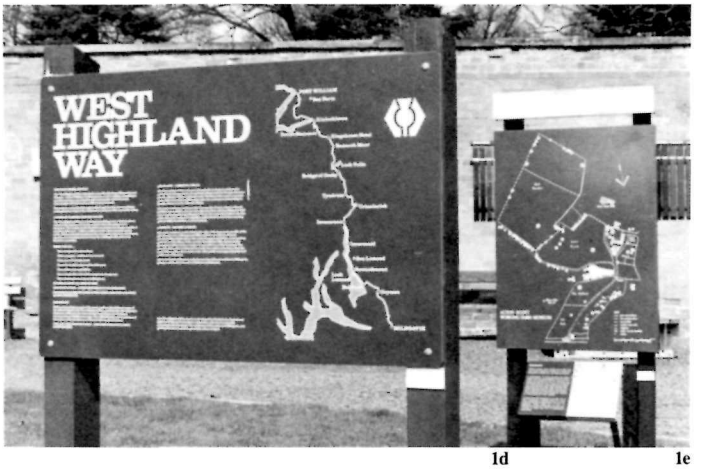

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1. Signs and notices, for direction, information and interpretation, are an important element in the display. (a & b) Direction signs and inspection boards designed for use on the West Highland Way long-distance footpath. (c) A series of direction and information signs developed and used by the Forestry Commission throughout Scotland, demonstrating good design in the countryside. (d) An interpretive device, in metal, one of a series providing information about a variety of topics along a coastal nature trail in a country park. (e) Good design is important in small items, too, such as this waymarker post for trail use. Note the beveled top.

2a

2. Picnicking is a popular recreational activity in the Scottish countryside. (a) Various types of picnic benches and seats are grouped for comparison, along with a picnic fire ring. (b) A picnic bench and seats designed to use only rough-hewn timber.

2b

wide variety of interest, including the factors influencing the choice of plants, the design and implementation of planting schemes, methods of planting and managing individual trees, shrubs and ground cover plants, and sources of seed and hardy nursery stock. These information sheets are available in loose-leaf form as a service similar to that for recreation furniture, equipment and construction techniques.

The experience of the past ten years has demonstrated that the practical problems of design in the countryside are many and varied. The display centre's function of acting as a communication link between the 'producer' and the 'consumer' — with improvement through modification where necessary in between — is undoubtedly helping to provide useful and effective solutions to many of these problems. This is to the advantage both of the quality of people's enjoyment of the countryside in their recreational time and the protection of the character of the countryside itself.

John Foster is Director of the Countryside Commission for Scotland.

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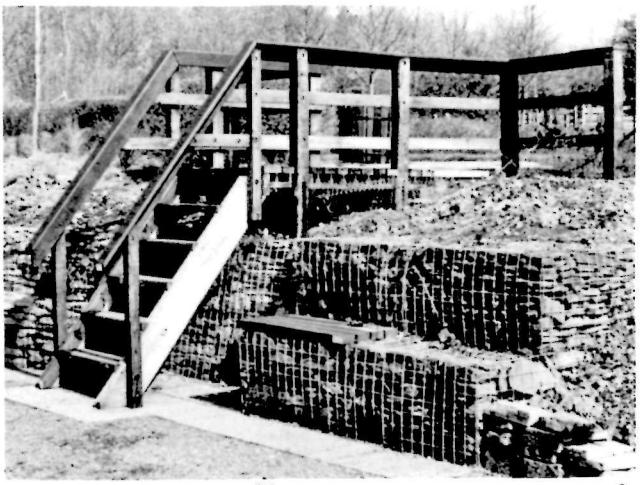
3b



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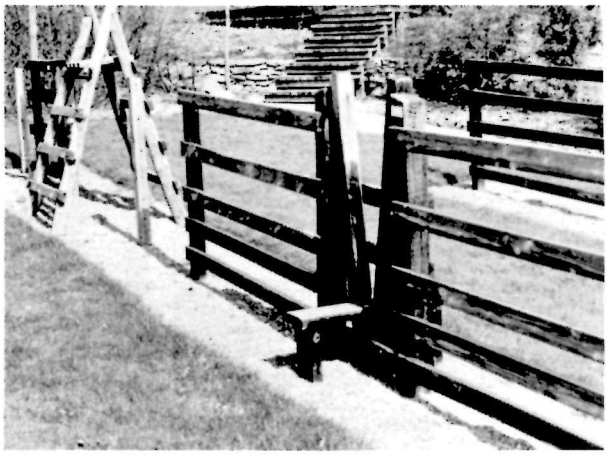

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3. Timber has many uses in the countryside in connection with recreational provision. (a) Steps and raised walkways designed for use over soft ground. (b) A flight of steps and handrail designed with only simple carpentry joints for construction by semi-skilled labour. On either side are gabions for reinforcing steep earth banks such as one finds along a stream. (c) Examples of various types of fencing and stiles. That on the right is for use in sheep country where it is essential to contain young lambs and that on the left is for hill country where high fences are required to keep deer within bounds. (d) Gates come in a wide variety of shapes and sizes. This design is known as a 'kissing gate.' (e) Because of the many uses of timber, a wide range of examples of wood preservatives is on display for comparison both as to colour and durability. Each of the boards has its bottom half left rough off the saw and the top half planed for visual comparison.

4. The main entrance foyer of the Battleby Conference Centre, which also serves as a reception for the Display Centre where visitors can obtain backup information on items they have seen outside in the display area.

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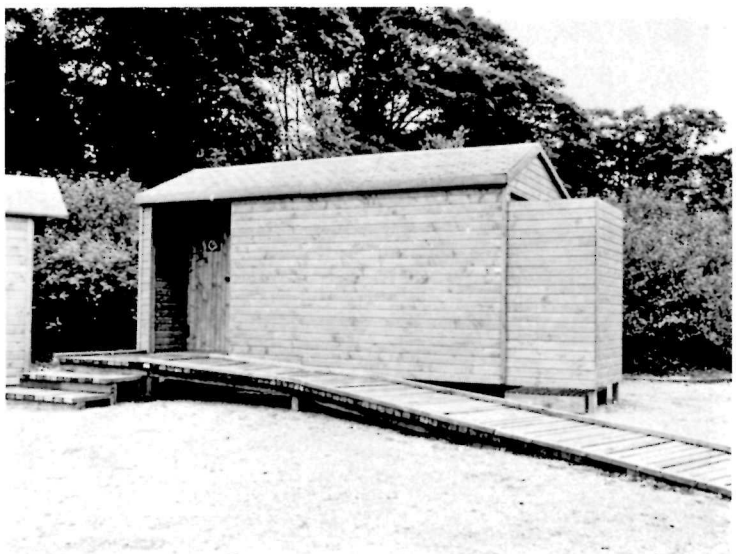
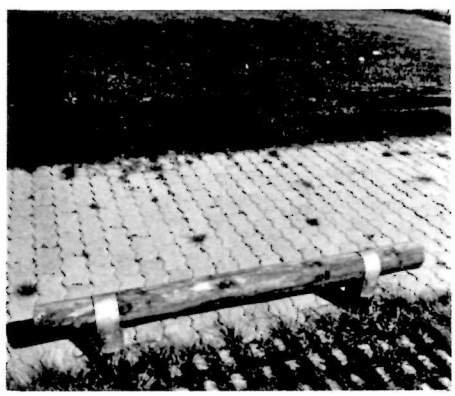


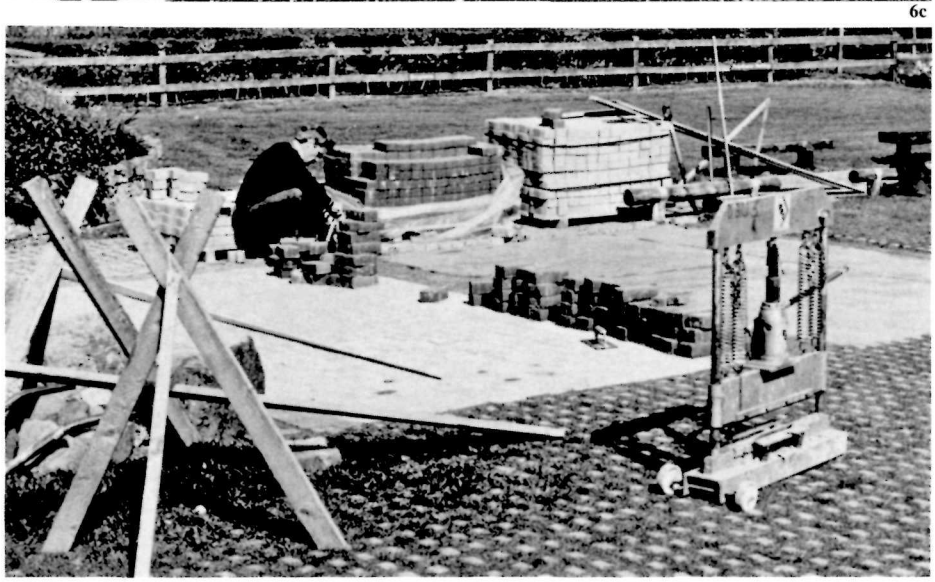
5. Small buildings, transportable and easily erected, are important in countryside recreation for a variety of purposes. (a) A simple hide designed by the Forestry Commission for observing animals. Note the short demonstration length of baffle fence behind the hide. (b) A transportable lavatory building, again a Forestry Commission design, with a ramp for access by wheelchairs.

6a

6b

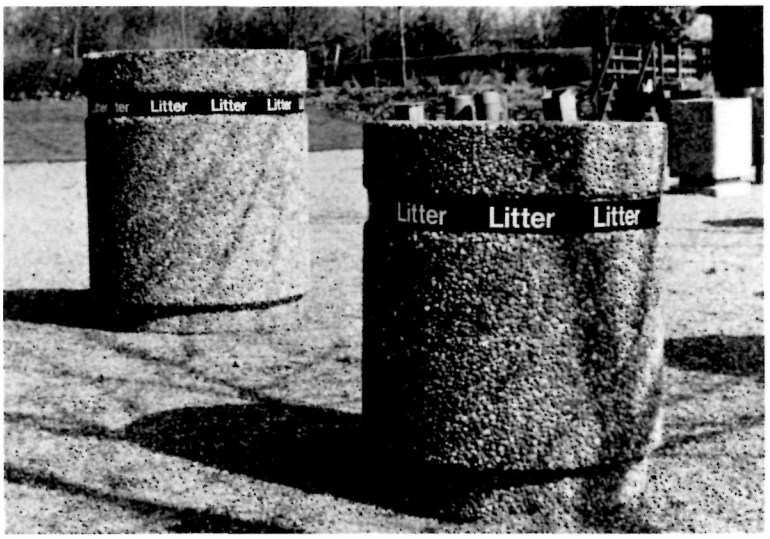


6c



6. Parking cars in the countryside can cause many problems. The Commission has experimented extensively with a variety of surface treatments. (a) The car parking area for the Conference Centre at Battleby has a number of different surfaces, some using grass and concrete so that an apparent stretch of grass is also a hard surface. As these are used regularly by visitors, they are also under constant test for durability. (b) Barriers as well as surfaces, are important and various types have been designed and tested at Battleby. (c) This is the "International Year of the Disabled" and part of the parking area at Battleby has been redesigned with surfaces suitable for the vehicles and wheelchairs used by disabled people.

7a



7b

7c

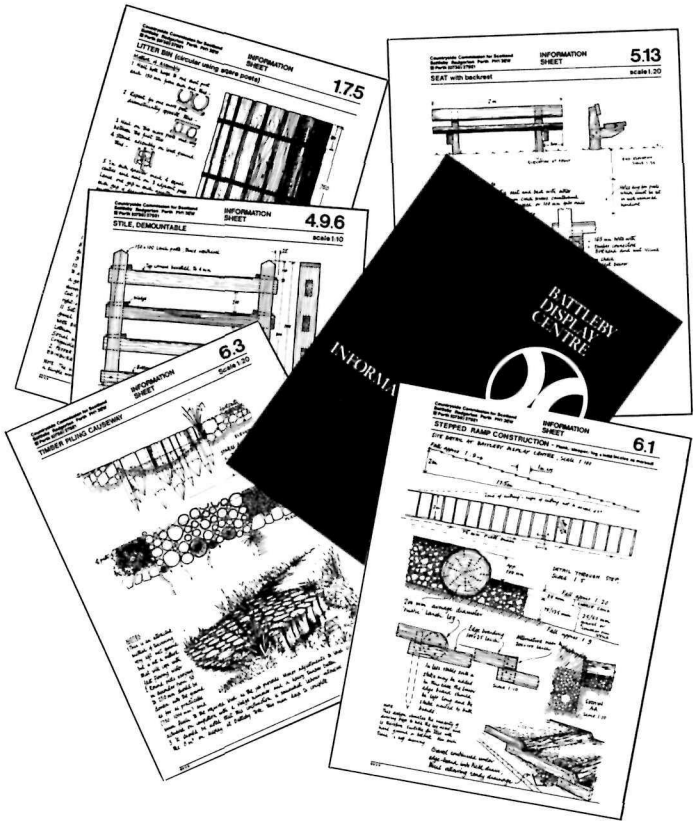
7. Litter bins on display include (a) factory made items, (b) adaptations of commercial products (design from the Peak National Park in England) and (c) designed and developed entirely on the site.

8a

8b

8c

8. In many parts of Scotland stone is still used in the countryside for construction purposes. (a) An example of a typical form of drystone walling, with a header course and projecting stones forming a stile. (b) This form of circular wall, with a narrow entrance through, provides a focal point for setting up information and interpretive material in open country and at the same time gives a modicum of shelter in high exposed locations. Beyond, is a viewpoint indicator, also built in stone. (c) The viewpoint indicator, close-up view.



9. Examples (5) of typical information sheets from the Commission's catalogue of countryside recreation equipment and construction techniques (also reproduction of cover).

10. Examples (3) of typical information sheets from the Commission's catalogue of plants and planting methods for the countryside (also reproduction of cover).

Minimum Barrier

There are displays where a physical barrier such as a rope, railing, plastic screen or wood fence seems quite out of place, and where the furnishings and artifacts displayed are not so priceless that they must be secure at any cost.

The pictured barrier, a black plastic pipe in half section, was designed for just such a situation in the Mount Washington Tavern at Fort Necessity National Battlefield, in Pennsylvania. During the ten years it was installed, interpreters felt it was a satisfactory barrier. It kept the majority of visitors on the walkway although children and non-observant adults would step over occasionally.

The black plastic pipe used was two inches in diameter — the largest diameter that would conform to the curve of the display area. A larger diameter could be used in places where the run is straight or only slightly curved.

The plastic pipe is easily sawed, fits almost any configuration, and is easily secured in place by nailing to the floor. The low cost and ease of fabrication make plastic pipe excellent for this purpose.

In 1978 the room pictured was recarpeted with a wall-to-wall reproduction, and furnished more extensively. At that time Plexiglas and wood barriers were installed in the doorways for complete protection.

Photo from *Grist,* November-December 1968.