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"SOME DATA RELATED TO COSTS AND BENEFITS OF NATIONAL  
PARKS IN LATIN AMERICA"

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## II. Introduction to Study

The basic problem of finding ways of quantifying costs and benefits of a protected area such as a national park is not new. Conservationists have always faced this problem in trying to determine the values of conservation and express these values in language meaningful to the public and higher level decision makers. While advocates of alternative programs and projects have been able to show quantifiable economic values to be derived from other land uses, it has always been difficult for the conservationist to establish monetary values for esthetics, fauna and flora conservation, culture, etc. It is commonly accepted that these values exist but there has been little success in quantifying them.

In the developing countries, the lack of recognition of these values often makes it difficult for the conservationist to gain governmental support in establishing and managing national parks and other protected areas.

It is still not generally accepted that the conservation of the natural and cultural resources and the utilization of these resources for socially beneficial purposes such as outdoor recreation merit equal treatment politically and economically with public health, education and similar accepted non-economic activities, and conservationists and environmentalists must continue to search for ways to quantify such values and present more defensible arguments in favor of environmental conservation.

This work does not pretend to establish a formula for measuring the numerous intangible values that are related to national parks.

The document will only describe various costs and benefits related to such areas and present a collection of information relevant to these costs and benefits in some parks and reserves in Latin America. The information may hopefully assist the conservationist, government officials, land managers and the public to better evaluate and make decisions concerning conservation.

It should also be noted that costs and benefits or inputs and outputs have a somewhat different use in this paper than is commonly utilized. Thus rural development, investment opportunities, employment opportunities, etc. are considered benefits or outputs, while land use conflicts, planning, lands etc. are considered inputs or costs. This will be pointed out in the various chapters.

An attempt was made to gather the data concerning benefits and costs from a statistically correct sampling of Latin American parks and reserves which could be used to document the value of setting aside protected areas. However, as described in the following chapter on data collecting, this was not successful.

With this in mind it is hoped that the information presented will serve some useful purpose in the effort to more effectively manage Latin America's cultural and natural resources.

### III. Statistical base and collection of data

The major reason for the deviation of this study from the original intentions of making it a comparative cost analysis study is the almost nonexistence of relevant statistical data in most countries of the Latin American Region.

One problem is that each country utilizes a different budgetary system and consequently similar program activities such as protection or visitor services are often placed in a broad budgetary categories such as administration or personnel, which makes it impossible to determine with accuracy how much was actually spent in any given program. For this reason it has been practically impossible to compare budgets between different countries or at times even between different parks within the same country.

Another problem is that the statistical information for several items of interest in this study do not exist in most of the countries.

Some of the data given are also based on rough estimates by government officials and may be inexact. The collection of data was therefore reduced to gathering the information that was available in each particular case.

The gathering of data had to be undertaken whenever possible and in connection with other travel purposes. The sample obtained can therefore not be considered a random sample, nor systematical, and it is obviously biased in many cases. Any stratification of the parks is not considered feasible due to the vast difference in the kinds of management, the differences in the natural, financial and human resources available as well as numerous other factors. The results and their groupings should therefore only be considered as a collection of information without statistical proof.

## A. GENERAL INTRODUCTION TO THE LATIN AMERICAN NATIONAL PARK SYSTEM

### 1. Background

Although the national parks idea was introduced to Latin America in the early nineteenth hundreds when the first conservation movement was developing and which was shortly after followed by the creation of several parks, it has not been until recent years that there has been a significant expansion of national park programmes in the region.

The rapid destruction and loss of unique features and ecosystems has prompted several parks to be established during the last decennium. As a result of the growing interest in the conservation of the continent's natural and cultural heritage, national parks or equivalent reserve projects are now included in several of the Latin American national development programmes.

### 2. Geographic distribution

The present distribution of National Parks according to the United Nations List of National Parks and equivalent reserves which is prepared by the IUCN (International Union for Conservation of Nature and Natural Resources) is shown on Map N° 1.

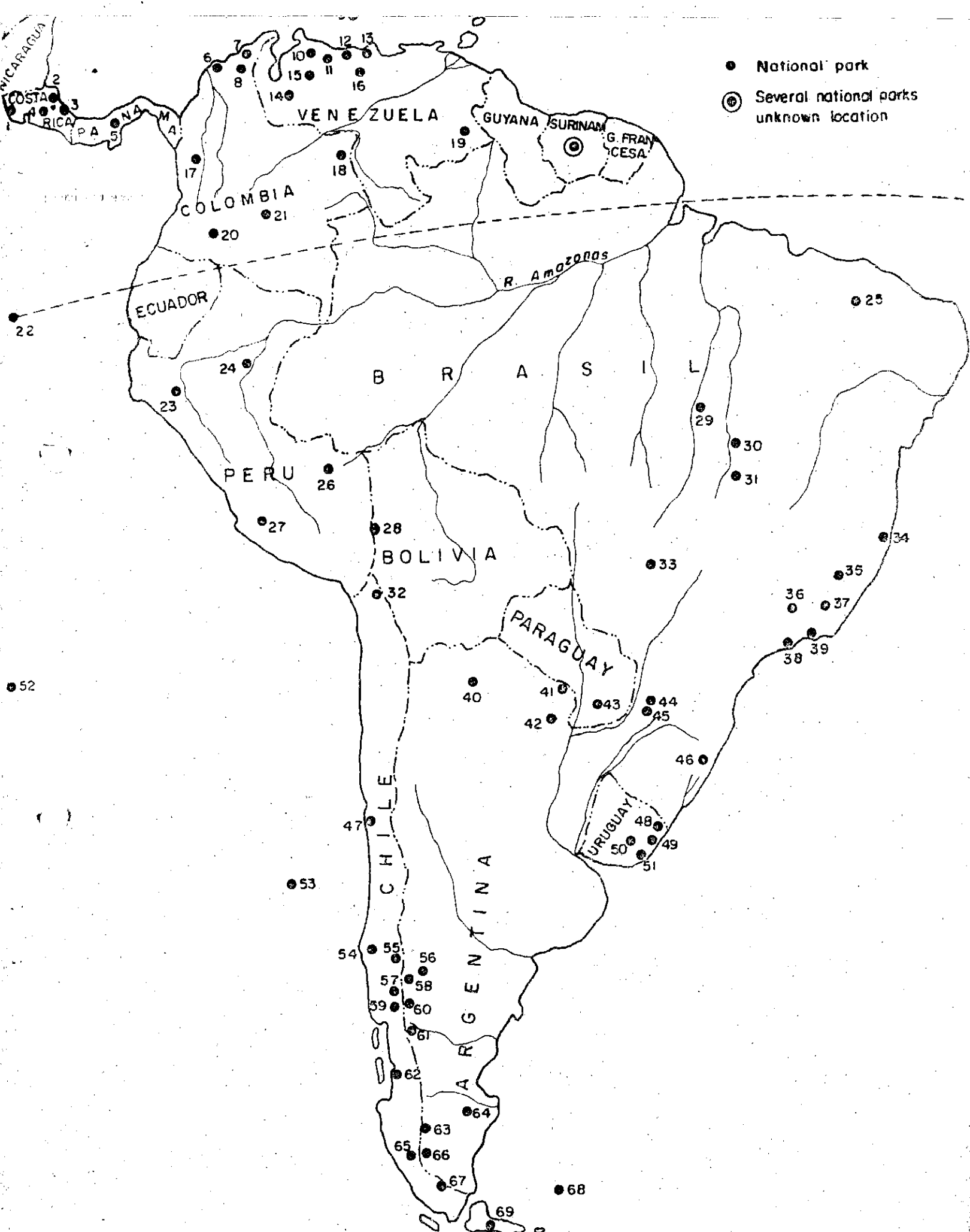
### 3. Costs and Benefits

The establishment and management of a national park obviously requires certain costs. It also produces benefits and products. Several of the benefits (and certain costs) are considered to be economically intangible; that is, they are impossible or difficult to measure. Examples of such intangible benefits are protected outstanding landscapes, protected cultural traditions or archaeological ruins.

There are many who feel that all benefits are, in the last analysis, intangible, because they eventually deal with man's satisfaction. The term "intangible", then, refers to our ability to measure the benefits.

However, the intangible benefits considered in this paper are very real and often visible through other sectors, perhaps not separate but as integral parts of other benefits. Such is the case with scenery and its relationship to tourism, genetic materials and their relationship with science, or recreation and its relationship with public health and wellbeing. Due to the difficulty of measuring these values, they are often overlooked by politicians, government leaders, as well as the general public in Latin America.

This study will attempt to point-out some of the costs and benefits of conserving certain areas as national parks or as similar management units.



● National park

⊙ Several national parks  
unknown location

Map references

1. Santa Rosa
2. Tortuguero
3. Cahuita
4. Volcan Poas
5. Altos de Campana
6. Isla Salamanca
7. Tayrona
8. Sierra Nevada
9. Archipielago "Los Roques"
10. Cueva de la Quebrada del Toro
11. Yurubi
12. Henri Pittier
13. El Avila
14. Sierra Nevada de Merida
15. Yacambu
16. Guatopo
17. Las Orquideas
18. El Tuparro
19. Canaima
20. Purace
21. Sierra de la Macarena
22. Galapagos
23. Cutervo
24. Pacaya
25. Sete Ciudades
26. Manu
27. Pampa Galeras
28. Ulla Ulla
29. Araguaia
30. Chapada dos Veadeiros
31. Brasilia
32. Lauca
33. Emas
34. Monte Pascoal
35. Caparao
36. Itatiaia
37. Serra dos Orgaos
38. Serra da Bocaina
39. Tijuca
40. El Rey
41. Rio Pilcomayo
42. Chaco
43. Ybycui
44. Iguacu
45. Iguazu
46. Aparados da Serra
47. Fray Jorge
48. San Miguel
49. Santa Teresa
50. Arequita
51. Cabo Polonio
52. Easter Island
53. Juan Fernández
54. Nahuelbuta
55. Congullio
56. Laguna Blanca
57. Lanin
58. Puyehue
59. Vicente Pérez Rosales
60. Nahuel Huapi
61. Los Alerces
62. Laguna San Rafael
63. Perito F.P. Moreno
64. Pretrified forest
65. Bernardo O'Higgins
66. Los Glaciares
67. Torres del Paine
68. Kidney Island
69. Tierra del Fuego
70. A.M. de Agostini



#### 4. National Parks and Reserves

There is a great variation in physical make up as well as in the reasons for the establishment of the national parks of the region.

The objectives of some national parks and reserves in Latin America are given in Table N° 1.

According to accepted international criteria, a national park should have an unaltered ecosystem represented together with other natural features or phenomena of high scientific or aesthetic value. It should also have a protected natural zone of at least 1000 ha. together with a sufficiently large budget, to efficiently protect the resource.

The concept of a national park is however often understood in a context different from the most commonly accepted international definition by Latin American Government leaders, legislators and the general public. Enabling legislation is also often vague as to the definition and purposes of national parks. Therefore, one may find areas which are created as national parks and comprise only a few hectares, sometimes completely man-made or altered, or that permit uses incompatible with international criteria.

In fact, few national parks in Latin America meet all international criteria particularly regarding the administrative, organizational and protective aspects.

Equivalent reserves is a term used for areas that fulfill the requirements of national parks in so far as having general protection, size in excess of a certain minimum and the protected status adequately maintained. They differ from national parks in that they are either strict nature reserves where general visitation is not permitted or are protected by other than central government authority. There are relatively few of these areas, and they often vary in management from one nation to another due to the lack of international criteria. A list of Latin American National Parks and Equivalent Reserves according to the U.N. List, and their size is given in Appendix N° 1.

Table N° 1\*

Major objectives for establishment of some  
national parks and reserves in Latin America

National Park	Objectives for establishment
Santa Rosa National Park Costa Rica	Protection of historic feature and ecozones
Volcan Poas National Park Costa Rica	Protection of geologic features and ecozone
Tayrona National Park Colombia	Protection of ecozone, scenery and archaeological features
Salamanca Nat. Park Colombia	Protection of birds and mangroves
Henri Pittier Nat. Park Venezuela	Protection of watersheds and flora and fauna
Canaima National Park Venezuela	Protection of watershed, scenery and unique features
El Avila National Park Venezuela	Protection of watershed, scenery and recreation area
Guatopo National Park Venezuela	Protection of watersheds, flora and fauna
Archipelago Los Roques N.P. Venezuela	Protection of marine and island ecosystems
Iguazu National Park Argentina	Protection of unique feature. tourism, and protection of flora and fauna
Nahuel Huapi Nat. Park Argentina	Protection of scenery and recreation/ tourism opportunities
Tikal National Park Guatemala	Protection of archaeological ruins

(continues)

\* The Table may not be complete

National Park	Objectives for establishment
Manu National Park Peru	Protection of ecozones and genetic resources
Pampa Galeras Reserve Peru	Protection of vicuña for survival of specie and utilization
Pacaya Reserve Peru	Protection of wildlife and fish production potential
Santa Teresa Nat. Park Uruguay	Protection of historic ruins, and recreation areas
Tijuca National Park Brazil	Protection of recreation areas and scenery
Las Orchideas Nat. Park Colombia	Protection of wild orchids and other flora species
Galapagos Island Nat. Park Ecuador	Protection of unique endemic flora and fauna

B. THE COMPREHENSIVE COSTS OF ESTABLISHING AND OPERATING NATIONAL PARKS AND RESERVES IN LATIN AMERICA

1. Human resources

In the context of this paper, the personnel or human resources necessary for the management and operation of national parks or reserves is considered a cost or input, different from the salary costs.

National parks have a relatively complex management structure incorporating planning, administration, visitor services and protection. If effective management is to be obtained it requires the necessary personnel input. However, because of the general lack of funds in Latin America and insufficient trained personnel, ideal requirements are seldom met. This usually has severe effects on both the protection of resources and the provision of necessary visitor services. Adequate protection programs have therefore not yet been established in even the most intensively managed parks. For example, Santa Rosa National Park in Costa Rica, considered one of the best managed in Central America has not been able to fully protect some wildlife species against poachers and El Avila National Park in Venezuela, one of the most intensively guarded parks has a constant problem with infractors.

Table Nº 2 shows the total numbers of employees, annual visitation, visitors per employee, park size in hectares and hectares per employee in a sample of Latin American national parks. There is a serie of factors which are determinants of personnel requirements. These include the park attraction, the infrastructure, human pressure and specific resource protection needs of the area.

Parks located far from urban centers usually receive fewer visitors and consequently need a lower personnel input. Only a very strong public park attraction upsets this tendency in some few national parks on the continent.

A further comparison of the figures in Table Nº 2 with visitors per employee in the U.S.A. shows that in 1971 there were 16,129 visitors per employee in the U.S. park system. This is a considerably greater number of visitors per employee than found in Latin America parks. It might be assumed that with increased development and provision of services such as in the established system of the U.S. National Parks Service, more visitation will decrease the personnel input per visitor. It could probably be said that no park in Latin America has reached full

Table Nº 2

Number of employees, annual visitation, visitors/employee,  
hectares and hectares/employee in some national parks  
in Latin America (1973)

National Park/Reserve and Country	Number of Employees	Annual Visitation	Visitors per Employee	Number of Hectares	Hectares per Employee
Santa Rosa N.P., Costa Rica	18	15,000	833	9,904	500
Volcan Poas N.P., Costa Rica	14	60,000	4,285	4,000	285
Tortuguero N.P., Costa Rica	1	-----	-----	18,000	18,000
Tayrona N.P., Colombia	31	40,000	1,290	11,600	374
Salamanca N.P., Colombia	31	15,000	483	21,000	677
Henri Pittier N.P., Venezuela	29	85,000	2,931	90,000	3,103
El Avila N.P., Venezuela	182	900,000	5,000	100,000	494
Guatopo N.P., Venezuela	25	120,000	4,800	92,640	3,705
Iguazu N.P., Argentina	49	200,000	4,020	75,820	1,547
Manuel Huapi N.P., Argentina	164	300,000	1,829	785,000	4,786
Tikal N.P., Guatemala	52	40,000	769	57,600	1,107
Ulla Ulla Reserve, Bolivia	5	50	10	200,000	40,000
Manu N.P., Peru	10	13	1	1532,806	153,280
Pampa Galeras Res., Peru	31	100	3	6,500	532
Pacaya Reserve, Peru	13	-----	-----	660,000	50,769
Iguacu N.P., Brazil	44	325,000	7,400	170,000	3,863
Santa Teresa N.P., Uruguay	85	250,000	3,000	2,700	31
San Miguel N.P., Uruguay	16	20,000	1,250	1,495	93
Cabo Polonio Res., Uruguay	12	-----	---	14,250	1,216
Average	43	124,000	2,000	203,000	15,000

development in the sense that they can receive additional visitation without jeopardizing the protection objectives.

However, the large difference in the U.S. figure as compared to Latin American figures may be due to other factors such as personnel education, social structure of the society, problems of protection often originated from insufficient knowledge of and traditional disrespect for certain laws, and pressure from subsistence agriculture and forestry practices, which are much greater in Latin America and call for a higher personnel input per hectare. There appears in addition to be an effect due to the respect and comprehension for the national parks and the value they represent among the U.S. citizens. Latin America has yet to reach this stage.

## 2. Salary costs

The human resource or personnel input also involves a direct monetary outlay for salaries. This cost is the largest of the non capital monetary costs involved in Latin American park budgets.

Table Nº 3 shows the total personnel cost figures for a sample of parks and also personnel costs as percentage of total non-capital costs or variable costs (i.e. salaries, maintenance, supplies, electricity and water, etc.)

An average of 77% of the non-capital costs goes to pay salaries with a maximum of 97% and a minimum of 50%. Particularly in Venezuelan parks almost the total budget goes to pay for the personnel.

Bearing in mind that there is an overall shortage of funds available and within that framework, the relative large percentage of budget allocation to salaries may be considered a common internal management policy partly due to the great need for job opportunities in developing countries. However, it may also reflect in part the lack of management and development plans that can guide money allocation to other sectors of park administration and development. Often the concern that exists for the protection of a country's natural resources results in the allocation of manpower to a threatened area, while a follow-up of budgetary allocations for maintenance, equipment and other operational expenses may be non-existent or difficult to obtain. This lack of operational support at times results in personnel working below their potential capacity.

When national parks or reserves have been fully established and operational, it appears that personnel cost in relation to other operating expenses goes down. For example, in parks like Nahuel Huapi and Iguazu in Argentina which have a relatively intensive development and management structure, the salary budgets accounts for only 56 and 58% of the total non-capital expenses. It appears from this that with increased visitation and development there will be a corresponding need to increase operational expenditures in relation to salary costs to enable the parks to be managed more effectively.

Theoretically, it should be possible to separate salary costs

Table N° 3

Total annual personnel costs and personnel costs as % of  
Total variable costs in some Latin American national parks  
(in US\$ - Year 1972)

National Park or Reserve	Total annual Personnel costs	Personnel costs as % of total variable costs
Santa Rosa N.P., Costa Rica	19,400	73%
Volcan Poas N.P., Costa Rica	12,900	68%
Tayrona N.P., Colombia	23,400	84%
Salamanca N.P., Colombia	52,200	95%
Henri Pittier N.P., Venezuela	66,000	97%
El Avila N.P., Venezuela	522,000	96%
Guatopo N.P., Venezuela	50,000	87%
Iguazu N.P., Argentina	78,000	56%
Nahual Huapi N.P., Argentina	200,000	58%
Tikal N.P., Guatemala	60,000	66%
Ulla Ulla Reserve, Bolivia	2,400	92%
Manu N.P., Peru	10,000	50%
Iguacu N.P., Brazil	50,000	77%

along with other relevant costs according to the various functions necessary in national park operation, such as management, administration, research, planning, protection, visitors services, etc. However, this has not been possible due to the various budgetary methods utilized, most of which are not itemized based on functions.

### 3. Technical capacity of personnel

Technical know-how and training may be considered an input or cost to the park programs, since the employee's education is utilized in the parks. It has however, not been possible to obtain monetary figures for the value of this education in Latin American national parks.

Technically trained personnel are needed to carry out a variety of essential national park management functions, including administration, planning, resource and visitor protection and maintenance. In most parks there is presently a need for additional trained personnel.

From an international sample of 20 national parks having a total of 806 full-time personnel, 136 of these employees had technician training (17%). Personnel with some university training accounts for about 5% of the total. However, there may be rather significant individual differences. The professional or technical training that personnel have received may not always be in a natural resource related field. Actually it appears that quite often park personnel are trained in quite different fields like architecture, public administration, accounting, etc. Nevertheless, the majority are trained in related fields like agriculture and forestry. There is a specially strong need for additional training opportunities for personnel in national park management.

### 4. Non-capital and capital costs

An attempt was made to separate budget items for comparison among parks. However, lack of data made this impossible apart from between salary costs, non-capital costs and capital costs. With non-capital costs are included expenditures such as salaries, consumable supplies, electricity and water, gasoline and similar annual expenses. Capital costs include costs of buildings and other constructions, infrastructure, and non-consumable supplies such as vehicles and equipment.

Table No 4 shows the total non-capital costs, total non-capital costs per hectare and total non-capital costs per visitor for some Latin American parks. Total non-capital costs indicate that salaries are included. All figures are for one year(1973).

The sample is too small to draw any firm conclusions, but there appears to be considerable difference in costs/hectare or costs/visitor expended in parks both within an individual country and among the parks in the various countries. A relatively small



Table No 4

Total non-capital costs, non-capital costs/ha.,  
non-capital costs/visitor, capital costs, capital costs/ha.,  
and capital costs/visitor in some Latin American National Parks

(Year 1973-US\$)

National Park and Reserve	Size ha	Total non-capital costs*	Non-capital costs*/ha.	Non-capital costs*/visitor	Capital costs	Capital costs/ha	Capital costs/visitor
Santa Rosa N.P., Costa Rica	9,000	26,400	2.93	1.76	82,000	9.1	5.46
Volcan Poas N.P. Costa Rica	4,000	18,800	4.70	6.31	36,000	9.0	6.60
Tayrona N.P., Colombia	11,600	27,700	2.39	0.69	220,000	9.0	5.50
Salamanca N.P., Colombia	21,000	54,800	2.61	3.65	130,000	6.2	8.66
Henri Pittier N.P., Venezuela	90,000	67,900	0.75	0.80	505,000	5.6	5.94
El Avila N.P., Venezuela	90,000	539,600	6.00	0.50	290,000	3.2	0.32
Guatopo N.P., Venezuela	92,640	57,100	0.62	0.48	36,200	0.4	0.30
Iguazu N.P., Argentina	75,800	138,000	1.82	0.69	-----	-	--
Mahuel Huapi N.P., Argentina	785,000	340,000	0.43	1.13	-----	-	--
Tikal N.P., Guatemala	57,600	90,000	1.56	2.25	-----	-	--
Ulla Ulla Reserve, Bolivia	200,000	2,600	0.01	52.00	8,500	0.04	170.00
Manu N.P., Perú	1,532,806	20,000	0.01	1,538.00	40,000	0.02	3,077.00
Pampa Galeras Reserve, Perú	6,500	29,800	4.58	298.00	162,800	25.04	1,628.00
Iguacu N.P., Brazil	170,000	65,000	0.38	0.20	-----	---	----

\* Non-capital costs include salaries.

Table No 5

Development over a 3 year period of non-capital and capital costs  
per visitor in some Latin American national parks  
(non-capital costs includes salary costs)

National Park and country	Non-capital costs per visitor US\$		Capital costs per visitor US\$	
	1971	1972	1971	1972
Tayrona N.P., Colombia	3.74	0.84	44.00	9.00
Salamanca Island N.P., Colombia	5.00	4.40	13.00	10.80
Sta. Rosa N.P. Costa Rica	1.40	1.70	8.20	8.20
Volcan Poas N.P., Costa Rica	0.13	0.30	0.28	0.41
El Avila N.P., Venezuela	0.88	0.63	0.40	0.35
Guatopo N.P., Venezuela	0.56	0.47	0.30	0.28
Henri Pittier N.P., Venezuela	0.83	0.78	6.27	5.92
Iguazú M.P., Argentina	0.92	0.77	--	--
Tikal N.P., Guatemala	4.73	3.75	--	--

park will generally have a higher cost per hectare than a larger park. This obviously implies that there are generally certain structures or supplies common to a park that is relatively independent of the size of the park. Costs per visitor seem to be more independent. Extreme results have been obtained for Ulla Ulla Reserve in Bolivia, Parana Galeras Reserve and Manu National Park in Peru. Both Ulla Ulla and Parana Galeras are reserves with very specific objectives, which do not include the attraction for large numbers of visitors. Manu is a new park set aside for genetic preservation and very difficult to reach for visitors. Thus the high costs per visitor in these parks.

It should be noted that none of the parks in table NO 5 can be considered as having terminated the investments desired according to the administration's intentions, nor have any of the parks reached their full visitor carrying capacity perhaps with the exception of certain zones in Iguazu National Park. As visitation increases there is of course a decrease in cost per visitor until full capacity is reached and further investments are needed.

#### 5. The land area input

Since national parks and reserves are characterized by relatively extensive areas of land, real estate acquisition is normally the largest capital cost input. Most Latin American countries are experiencing an increasing demographic pressure on the land and its value is therefore rapidly increasing.

Table NO 6 presents the total land area of countries with legally established national parks, the land area of the national parks and the per cent of the countries' total land area occupied by national parks.

In Latin America nearly 1% of the land area is presently under National Park status. There are however large differences between countries. Chile for example has decreed vast areas in the south and along the Andes chain as national parks and has presently 8% of the land in National Park status, while countries like Bolivia, Paraguay and Panama have around 0.01% of their land area set aside as national parks.

The percentages of the land area presently in national parks compares to the USA with 1.34% and to USSR with 6.34%. These countries however, in addition have other land classification systems that provide protection similar to that of a national park but utilizing other terminology and administrated by other governmental entities such as state parks or wilderness areas in National Forests. The commercial value of the land areas within existing parks in Latin America has not been possible to estimate with any margin of security. However, most of these lands have a very low economic value since the majority of the parks are located in remote areas and in mountainous or difficult terrain without agricultural value. Certain exceptions do occur. El Avila N.P. near

Table Nº 6

Total land areas by countries, land area occupied by national parks and national parks in % of total land area in Latin America

	km <sup>2</sup> Total land area	km <sup>2</sup> Land area. occupied by N.P.	N.P. in % of total land area
Argentina	2,776,656	26,707	0.96
Brazil	8,511,965	15,919	0.19
Bolivia	1,098,580	2,000	0.18
Chile	756,950	68,149	8.00
Colombia	1,138,000	11,731	1.03
Costa Rica	50,700	336	0.66
Ecuador (Galapagos N.P.)	283,560	6,910	2.44
Guatemala	108,889	672	0.62
Panama	75,650	26	0.03
Paraguay	406,750	550	0.01
Peru	1,280,219	20,690	1.62
Surinam	163,270	4,852	3.00
Uruguay	177,510	194	0.11
Venezuela	912,050	17,193	1.88
Total (km <sup>2</sup> )	17,740,749	175,429	0.99 (average)

Caracas, Venezuela, has several areas that could or would be used as residential areas, with a rather high commercial value of the lots if this use were allowed. If one wishes to have some indication of the commercial value for the land presently in national parks in Latin America, rough estimates indicate from US\$ 50 to 250 per hectare on an average. That should indicate that it would be advantageous to protect or set aside areas for national parks while the land is still available and the cost is low. Land in national park status tends to rise in commercial value. This is usually also true for adjacent lands.

Not all the areas presently designated as national parks in Latin America are government owned lands. Private owners are still present in most parks. The acquisition of this terrain is usually a slow process, depending upon each nation's legislation. The normal procedure is acquisition of land through purchasing. However, in certain areas it is necessary to acquire the land through expropriation, which is normally an even slower process. Cases exist for example in Uruguay (Cabo Polonio) where the expropriation process had not been completed thirty years after its initiation. In certain instances, such as in the Pampa Galeras Vicuña Reserve in Peru and the Ajusco National Park in Mexico, the areas have been protected through a legal agreement with a community of owners. In Ajusco National Park the owners maintain the right to income derived from tourism and recreation in the area. Acting as a cooperative they have constructed restaurants, motels, camping places, etc. under the supervision of the park authorities and with economic assistance from the government. In Pampa Galeras the agreement is that the authorities shall administer the reserve which belongs to the community but for this right the government will build certain public facilities for the community owners such as a medical dispensary, schools and reforestation of degraded areas. This may be a feasible solution in more areas, but should only be used where the highest competent authorities of the country can guarantee the perpetual protection of the area.

## 6. Land use conflicts

Among the costs of park management are land use conflicts. When a park or reserve is to be established it should be demonstrated that for the specific area being considered, a park is the optimum land use, or that there are alternative lands capable of providing the benefits produced by the conflicting activity, and no acceptable alternative for reaching the objectives of the national parks. This decision should be arrived at in view of long range national needs or objectives of the country. This often presents, however, a confrontation with short term private or even official economic considerations, thus creating a conflict of interests.

In the weak economies of several countries of Latin America this can be a serious obstacle to park establishment. Whenever possible, the long range national benefits must be demonstrated.

against the short term economic benefit to permit a maximum of objectivity when considering alternative land uses.

Consideration must also of course be given to the social aspects involved, both with regard to problems arising from the change in ownership status or uses as well as to the long range public benefits.

Land use conflicts originating from park or reserve establishment in Latin America are fairly common. An example is Guatopo National Park in Venezuela where around 5000 families were removed from the area and resettled. In this case national needs and objectives were very clear because of a direct relationship between the park and the potable water supply for Caracas.

On the other hand is the newly created Manu National Park in Peru. In spite of the large size (" 1,500,000 ha) the park establishment caused little friction with other interests because of its remote location. (Later oil prospecting in the park began, but this problem seems to have been solved through a compromise).

The factor of land use conflicts following human settlement emphasizes the wisdom of early establishment of national parks and reserve in areas not yet settled in Latin America.

In some cases governments have settlement programmes which have located people on lands suitable for national parks, but where the soils is of very poor agricultural quality. This has doomed the settlers to poverty, and if the area later is to be included in the park system, it implies an additional very high cost of resettlement. This problems is particularly common in tropical rain forest areas where the natural vegetation usually gives a false impression of fertility.

C. THE COMPREHENSIVE BENEFITS OF NATIONAL PARKS AND RESERVES IN LATIN AMERICA

This section considers the various benefits derived from national parks or equivalent reserves in Latin America. The term "benefit" includes both those that can easily be identified in monetary or other quantifiable terms such as tourism derived income and water production, as well as less quantifiable benefits such as protected scenery and genetic resources.

Only by considering both tangible and intangible values is it possible to approach a comparison of national parks with other management systems in a relatively complete and objective evaluation.

1. Ecosystem Protection

By definition, one of the primary objectives of national parks is to protect samples of natural ecosystems, ecological diversity and genetic resources in a natural evolutionary state. This is essential if opportunities are to be retained for biological, agricultural and medicinal research and for environmental monitoring. The effective protection of an ecosystem is therefore considered one of the major benefits or outputs of a national park, although this benefit is difficult to express in economic terms.

In order to evaluate how national parks in Latin America presently provide this protective function the continent has been divided into major ecological zones. Although there are various types of classifications that can be utilized to demonstrate these ecological zones, in this study a system of biotic provinces has been employed, using a classification presently being elaborated by the International Union for the Conservation of Nature and Natural Resources (IUCN).

A biotic province is distinguished by its vegetation, flora and fauna. The physiognomy of the prevailing climatic climax vegetation is the first basis for recognition of a biotic province. (Dasmann, 1973).

According to Dasmann's system\* there are 28 biotic provinces in the Neotropical Region of South America. Panama is considered a separate biotic province. In addition the Middle American Sub-Region has 6 biotic provinces (see appendix II). Latin America has 4 biotic provinces that belong to the Nearctic Region. Dasmann's system is a very broad and general system, and other more detailed classifications are necessary for specific country studies. The data available indicates that of the 39 biotic provinces in Latin America, the following 6: 1. Colombian coast, 2. Ecuadorian dry forest, 3. Brazilian Araucarian forest, 4. Argentinian thorn scrub, 5. Peruvian desert and 6. Atacama, do not have any sufficiently protected areas.

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\* Dasmann builds his system on various other studies.

In the Middle American Sub-Region and in the Nearctic Region, information is insufficient but at least 5; 1. Campeche, 2. Caribe-Pacific, 3. Central Cordillera, 4. Guerreran and 5. Sierra Madre, have one or more protected areas.

Care should however be taken when conclusions are drawn from this. Although it seems as if the Latin American national parks and equivalent reserves system sufficiently cover a major number of Latin America's biotic provinces, there are at least three points to bear in mind:

1. National parks tend to be selected for other purposes than preserving a representative sample of a biotic province. Therefore a national park or reserve, although geographically located within the biotic province may not be representative.
2. Taking the immense size of some of the biotic provinces, there undoubtedly has to be great local variations in the ecosystem. The risk of not covering a good sample of a large biotic province with only one or two national parks is rather significant.
3. The size of a protected sample of an ecosystem is seldom if ever large enough to protect the ecosystem if the adjacent land is altered.

Table N°7 shows the number of Latin American national parks divided into size classes. The table shows that there is a concentration of parks in the lower size classes. 65% of the parks have a size between 1,000 and 50,000 ha. and 35% are below 10,000 ha. It may be worth mentioning that in several cases in Latin America, two or more parks are bordering on each other, and in this way actually functions as a larger protected area than the impression each singularly gives. Such is the case with Los Glaciares N.P. in Argentina and Torres del Paine N.P. in Chile, and with Lanin N.P. and Nahuel Huapi N.P. in Argentina and Puyehue N.P. in Chile among others.

In spite of the fact that there are still several important ecological zones in Latin America without sufficient protection and that several protected areas are rather small, there still appears to have been a considerable advance in this conservation effort in the last few years. Some of the components integrated in ecosystem protection will be further discussed in the following chapters.

## 2. Fauna

In addition to discussing some specific Latin American data on the topic this chapter will also discuss wildlife more generally.

Among the common objectives for the establishment and management of most national parks is the protection of wild animal species, and specially those in danger of extermination. This results from the basic belief that the preservation of wildlife species provides certain benefits to the society.

Although national parks may not be expected to maintain any large wildlife population for cropping, hunting or similar uses



they can serve the important role of preserving species from extinction, species that may prove economically, medicinally or scientifically valuable in the future. Such species may then be produced for utilization in game reserves, game ranches, etc. An example is Venezuela where initiatives already have been made for the establishment of farms for crocodiles (Caiman schlerops) and capybara (Hydrochoeri hydrochaeri), and Peru where the wildlife reserve at Pampa Galeras already has shown very promising results both for the preservation and utilization of the vicuña (Vicugna vicugna).

It is a well known fact that the disappearance of animal species is still occurring, with the consequent irreversible genetic losses. According to IUCN, 112 mammal species have become extinct since the year 1600, plus 5 species for which there is some doubt whether they are extinct or not. How many species are presently endangered by extinction is unknown but a rough estimate is 500 mammal species endangered out of about 3500 mammal species presently existing. The facts determining whether or not a specie is close to its extinction threshold are not well known for most species.

National parks or reserves give ample possibilities for studies into the behaviour patterns of species, which is sometimes essential to know if species are to survive. Examples of such knowledge are the relationship between territoriality and fertility for vicuña (Vicugna vicugna) and the homing to natal beaches by the Atlantic Green Turtle (Chelonia mydas).  
(Bachmura Frank J.)\*

The question of whether the preservation of all species always is desirable should be considered. This may be a question of economic calculations. However, to make such calculation complete, one needs to consider all possible future benefits from the particular specie as well as costs. This of course is impossible and consequently any extermination of a specie today may be a serious loss to mankind of tomorrow.

\* Several sections and examples in this chapter are influenced by or taken from Bachmura's article.

Table N° 7

Latin American national parks and reserves stratified on size classes

Number of national parks and reserves	Total protected area in Hectares					
	<1000	100-9999	10000-49999	50000-199999	200000-499999	500000- >1000000
Total 122	3	43	37	20	9	6

The demand function for wildlife preservation is often difficult to establish, and an underestimation of the consumers' demand for species survival is common since this demand seldom is expressed in a clear and concerted way. The demand, however, is clearly visible in the purchasing of animal products in Latin America, but this incorporates the problem that since the wildlife species usually belongs to the state or nobody, a person selling animal products may only want to maximize his personal benefit and consequently exterminate the species. However, the public or welfare benefits derived from species survival are often large and continuous. In some cases this benefit can be increased with a relatively modest effort. The vicuña population in Pampa Galeras increased from 500 to 10,000 in 8 years after it was protected. The exploitation of its wool, now considered the world's finest has started on an experimental basis. See Flow Chart N<sup>o</sup> A. (Peru, Bolivia, Argentina and Chile have signed a convention prohibiting the commercialization of vicuña products until 1978).

The cost of maintaining a species in natural state is normally small and in national parks it is an integral benefit. However, even high costs of maintaining a species are usually justified considering the long-term benefits possible to derive from a species.

In this work concerning Latin America, it may not be appropriate to use statistics from other countries, but in order to put the value of fauna protection in national parks into perspective for Latin American decision makers, it may be worthwhile to summarize some results from the United States, considering the lack of similar Latin American data. Today more than 200 million visitors enter the US national parks annually. Although these visitors often have other interests than direct wildlife observation, nature walks, bird watching and wildlife photography attract a significant portion of the total number. According to Bachmura, the 1965 Outdoor Recreation Survey estimated that yearly 19.8 million visitors participated in nature walks, 7.1 million visitors watched birds and 2.8 million photographed wildlife with a total of 147 million days devoted to such activities. (Today's figures are much higher). This, at least in part, reflects species preservation demand.

Considering other forms of wildlife demand in the United States, 28.7 million fishing permits and 20.8 million hunting licenses were issued in 1968. This went up 88% and 65% respectively in 17 years.

Investigation show that demands for recreation associated with wildlife increases with rising incomes and higher education levels. These trends are very important for Latin America, which could now take the necessary measures to satisfy these very likely future demands.

Data concerning the economically productive aspect of wildlife outside national parks in Latin America are insufficient. However, certain indicative studies have been made. Particularly interesting are some figures from Peru, which with care probably can be extrapolated to other countries like Bolivia, Ecuador, Colombia, Vene-

zuela, and Brazil. The data indicate that 5,278,000 kgs of wildlife meat with a value of 3,976,000 US\$ was produced from four species of wild animals (Hydrochoerus hydrochaeris, Tayassu pecari, Tayassu tajacu, Mazama americana) alone in Peru in 1970 (official statistics). In Venezuela permission was given officially to hunt 40,000 Capybaras in 1972. With an average meat weight of 25 kg, this species alone accounted for 1,000,000 kg of meat.

A study by Dourojeanni in 1972 in the Department of Loreto found that wildlife protein made up for 20% of the local people's diet. It is not clear how many people were included in the sample.

About 20 species are being utilized for fur and hides in Peru. During the period 1966-1972 a total of 1,820,800 fur units were officially exported from Peru to a value of 4,248,300 US\$ (55% alligators, 23% from peccari, 10% from deer). In the period 1966-1972 Peru also exported officially 384,459 live animals to a value of 1,530,980 US\$.

These figures indicate one approximation of the value of wildlife from the Amazonian region of Peru derived from official export statistics. It is also necessary to mention that these official estimates are probably not showing the total value of exports of wildlife products from the region. Dourojeanni (1972) estimated that the true value of the fauna products mentioned from tropical Peru reaches twice the official estimates.

In Uruguay the well managed and state controlled exploitation of Sea Lions (Otaria byronia and Arctocephalus australis) has a sustained yield of 15,000 harvested animals annually, with a fur value of US\$ 560,000 plus fat and meat (1972).

So far reference has only been given to the value of wildlife meat, furs, hides and live animals in a sample. Other wildlife products may also conceive a high market value like wool, trophies fishing, birds or insects. Presently the sale of butterflies in Brazil is estimated as generating several million dollars worth of direct non-taxed personal income. If this harvesting of wildlife products were just taking off the annual production, it would not create problems. There are however, strong indications that the capital stock is being depleted. It should be mentioned however, that some of the figures or prices used in these calculations may be inflated due to the species reaching extinction threshold or being scarce. If a threatened species is being protected and managed and thereafter "mass produced" market prices and the "value" of each animal may go down, although not the total value of the species population. The Vicuña may be an example of this situation although this has yet to be shown.

### 3. Flora.

Flora has much in common with fauna when considering the value of protecting species and the loss of benefits that result

from their extermination. National parks play an important role in a nation's attempt to preserve plant species in danger of extinction.

For this reason the protection of plant species is considered a direct output or benefit of national parks and reserves. Plant species can have a very direct economic value through timber, medicinal plants, edible plants or plant products and other derivatives. However, since parks are not directly related to these industries, existing Latin American statistics available on these products are not considered relevant to this paper. Since the different ecosystems and plant communities have been discussed in a special chapter, this chapter will only underline the importance of preserving large samples of forests with special reference to the tropical rainforest, if species richness is to be retained.

Central and South America have had large tracts of tropical rainforest extending back in time perhaps more than 60 million years. During this time span, the rainforests evolved to what it is today; a complex, specie-interdependent ecosystem highly adapted to the generally nutrient-poor tropical soils. Recent satellite photographs show that the Latin American rainforests are rapidly being reduced in size, and calculations indicate that there may only be a few remains left in 30 to 40 years time. The tropical Latin American rainforests are characterized by a high number of species but each with few individuals per area unit. Rainforests on other continents do have the same characteristics but a totally different range of species. The ecological characteristics of these forest types implies that if the forest cover is extensively cleared and for a relatively long time, it may never return to the site even if the area is left to natural regeneration. The artificial reforestation of many species from this forest type appears to be difficult or impossible to do due to interlinks and interdependences amongst the species. This underlines the importance of keeping relatively large tracts of rainforest protected. Leaving small patches of rainforests does not maintain specie richness and diversity due to the characteristics of this ecosystem.

Very little research has been done on specially tropical rainforest plant species, and if relatively extense areas are not protected soon this conglomerate of species will be extinct before man has even begun to explore it.

The recently created Manu National Park in Peru with more than 1.500,000 ha. of virgin forests, and Canaima National Park in Venezuela with 1.600,000 ha. presently, with a proposal to be extended to 3.000,000 ha. as well as other large national parks created by other Latin American countries are proof of the growing concern among the nations in this respect.

It should be noted that although the tropical rainforest may be the most complex ecosystem with the greatest number of species, other systems may have even more highly adapted and unique species.

Table N° 8

Some endangered flora and fauna species  
in a sample of Latin American national parks

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National Parks	Some special resource examples related to rare species and genetics
Iguazu N.P., Argentina	Jaguar ( <u>Felis onca</u> ),
Nahuel Huapi N.P., Argentina	Huemul ( <u>Hippocamelus bisulcus</u> )
Ulla Ulla Reserve, Bolivia	Vicuña ( <u>Vicugna vicugna</u> )
Salamanca Isl. N.P., Colombia	Several rare bird species
Tayrona N.P., Colombia	Green turtles, 50 coral species.
Santa Rosa N.P., Costa Rica	Tapir ( <u>Tapirus bairdii</u> ), Turtles ( <u>Lepidochelys olivacea</u> ), Endemic flora species.
Tortuguero N.P., Costa Rica	Jaguar ( <u>Felis onca</u> ), Anteater ( <u>Myrmecophaga tridactyle</u> ), Manatee ( <u>Trichechus manatus</u> ), Tapir ( <u>Tapirus bairdii</u> ), Turtles ( <u>Chelonia mydas</u> , <u>Eretmochelys imbricata</u> ).
Volcan Poas N.P., Costa Rica	Quetzal ( <u>Pharomachus mocinno</u> ), Clark's screech owl ( <u>Otus clarkii</u> ), Poas Mountain Squirrel ( <u>Syntheosciurus poensis</u> ).
Tikal N.P., Guatemala	Deer ( <u>Mazama sarterii</u> ).
Manu N.P., Peru	Several Amazonian species.
Pacaya S., Peru	Caimans, felinos
Pampa, Galeras S., Peru	Vicuña ( <u>Vicugna vicugna</u> ), Unique plant species ( <u>Buddleia</u> sp., <u>Porylepis tola</u> ).
Canaima N.P., Venezuela	Several endemic orchid species.
Guatopo N.P., Venezuela	Endemic orchid species, Jaguar
Henri Pittier N.P., Venezuela	More than 530 bird species recorded.

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Only by protecting representative samples of all plant communities can it be expected to avoid irreversible species losses with unknown economic consequences for the future.

Table N<sup>o</sup> 8 shows a sample of national parks and some species of flora or fauna in immediate danger of extinction.

#### 4. Ecological monitoring.

There is a rapid reduction in naturally undisturbed areas in Latin America. Forests are logged and cleared and agricultural developments move steadily towards the remotest corners of the continent.

There are still, however, areas that have received very little disturbance. Areas where the air is unaffected by pollution, where water has only natural contamination and where flora and fauna species interact undisturbed. Scientists today are eager to protect some of these few remaining areas for biological monitoring and several scientific organizations are involved in the work of establishing a world wide series of such reserves. UNESCO's Man and the Biosphere Programme has one such project.

In many cases the already existing national parks in Latin America serve this function. In fact, as Table 9 shows several parks already register important data that serve for monitoring purposes. Latin American governments are increasingly taking ecological, climatological, hydrological and other types of monitoring results into consideration when planning land uses or developments and national parks play an important role in furnishing such data both for national as well as international use.

#### 5. Research and Training

Among the benefits of national parks and reserves, are their capacity to function as outdoor laboratories that offer excellent opportunities for training and research in relatively undisturbed natural environments.

Many of the Latin American parks are used irregularly or regularly by groups of students from universities and schools. Students studying natural and cultural resources often write their thesis on phenomena they observe in parks and individual scientists as well as scientific groups are using parks to a significant extent. Some of the Latin American parks contain natural features of world wide scientific importance as, for example, the Galapagos Islands National Park in Ecuador and Pampa Galeras National Vicuña Reserve in Peru, and receive attention from scientists from many countries. The Galapagos Islands National Park has received almost 100 scientific expeditions in the last ten years. Due to this scientific interest several national parks have constructed special scientific facilities. A list of some of these parks and their facilities are shown in Table N<sup>o</sup> 10.

Table No 9

Meteorological and/or Environmental  
monitoring equipment in some Latin American  
National Parks

	Pluvio meter	Baro-- meter	Evapor ation	Soil Temp	Tempe rature	Wind	Hygro meter	Solar radiat	Seismo graph	River Measur Stream Turb. Bacter.	Meteorolo gical station u known measur.
Guatopo N.P.	4		2		2		2	2		2	
Tayrona N.P.	1										
El Avila N.P.	1	1	1		1		1	1			
Henri Pittier N.P.											1
Ulla Ulla											
Santa Rosa	1		1	1	1	1	1	1			
Volcan Poas	1		1		1	1	1		1		
Isla Salamanca	1										Under constr.
Tikal	1										
Pampa Galeras	1		1		1	1	1				ifw under constr.
Pacaya	1				1		1				

(N.B. The Table may not be complete)

Table N° 10  
Scientific facilities  
in some Latin American national parks

Park and Country	Facilities
Nahuel Huapi, Argentina	Museum with laboratories
Iguazu, Argentina	Museum, Lodging
Iguacu, Brazil	Museum and laboratories
Serra dos Orgaos, Brazil	Laboratories and lodging
Tijuca, Brazil	Museum and laboratories
Itatiaia, Brazil	Laboratory
Tayrona, Colombia	Biological Station (Marine)
Tortuguero, Costa Rica	Private Biological Station
Santa Rosa, Costa Rica	Laboratory and Lodging
Galapagos Islands, Ecuador	Complete Biological Research Station
Tikal, Guatemala	Small Laboratory and Museum
Manu, Peru	Small Biological Station, Lodging
Pacaya, Peru	Small Laboratory (Plans)
Pampa Galeras, Peru	Small Laboratory
Cutervo, Peru	Small Investigation Center
Archipelago "Los Roques", Venezuela	Biological Station
Henri Pittier, Venezuela	Biological Station
Sierra Nevada de Merida, Venezuela	Forest and Fish Culture Experimental Station
Yacambu, Venezuela	Housing and auditoriums



Table N° 11

Some research studies done  
in some Latin American national parks

National Park or Reserve	Subject matter of studies
Santa Rosa N.P., Costa Rica	Sea turtles, monkeys, birds, Effects of burning on vegetation
Volcan Poas N.P., Costa Rica	Ecology, biology of fresh water lagunes, fauna and flora.
Cahuita N.P., Costa Rica	Marine ecosystem. Flora of Cahuita, Coral reefs. Terrestrial biology.
Tortuguero N.P., Costa Rica	Green Sea Turtles. The ecology of lizards on a tropical beach. Ecology of a tropical estuary.
Pampa Galeras Reserve, Perú	Population dynamics of vicuña. Pasture capacity and production. Nutrients in grass species consumed by vicuñas Parasites on vicuña.
Manu N.P., Perú	Alligators, birds, and anthropology,
Cutervo N.P., Perú	Flora and fauna of the area.
Pacaya Reserve, Perú	Fish resources.
Canaima N.P., Venezuela	Orchids, ferns and trees.
El Avila N.P., Venezuela	Rodents, vegetation, birds.
Guatopo N.P., Venezuela	Rodents, Leishmania americana, Onconercosis, flevatomus.
Henri Pittier N.P., Venezuela	Birds
Tayrona N.P., Colombia	Archaeology, palm nutrition, corals, flora, fauna.
Isla de Salamanca N.P., Colombia	Birds of the island, molluscs flora fauna, entomology.
Ulla Ulla N.P., Bolivia	Vicuña (started)
Tikal N.P., Guatemala	Archaeology
Galapagos Islands N.P., Ecuador	Ecology, evolution, flora and fauna. Marine life.

These 19 parks containing facilities were taken from a sample of 58 parks. The rest either did not have facilities or the information was insufficient to determine if facilities existed.

Table NO 11 shows examples of the kind of studies or research work that has been carried out in a sample of parks and reserves.

#### 6. Public education through natural phenomena interpretation.

Another output of national parks are the excellent opportunities which the parks offer to teach the public the importance and value of conservation. Presently, this aspect receives considerable attention in a large number of the Latin American parks. Interpretation of natural phenomena or environmental education took place in 90% of the national parks included in a sample of 20, although the sample may have been biased. These activities vary in methodology and sophistication. Interpretive nature trails are most common as is some type of visitor center varying in size from an information kiosk to a large museum. Pamphlets, outdoor amphitheatres, restored historical buildings, guides giving talks and roadside exhibits are other means used in the dissemination of knowledge to the public. These initiatives usually prove to be effective and create considerable interest amongst visitors.

Table 12 indicates some of the educational facilities available in a number of national parks.

#### 7. Tourism and Recreation

Tourism and recreation are often important catalysts in the establishment of national parks in Latin America.

Tourism related to parks may create significant economic benefits, although these benefits are not always accrued in the park itself, but in a larger area or region surrounding the park.

The economic benefit of tourism depends to a large degree on the local or national society's ability to produce products and services needed by the tourists. The economic impact may in many cases be insignificant to the local economy of rural areas close to parks in Latin America, while there may be a considerable positive impact of tourism related to national parks on the national economy. Among the reasons for this are that due to lack of facilities and services in the area of the park, visitors and tourism agencies tend to operate out of larger urban centers where such facilities exist. In certain cases like that of island parks, the visits of, for instance, foreign cruise ships which are essentially self sufficient units may even have a negative economic impact for the country. In such cases a possible discriminate entrance fee may be a solution.

Many commodities utilized by visitors are normally imported from other regions and therefore the local multiplier effect may be very low, even if saving rates by local businesses serving the park are low.

Table N° 12

Some public education facilities in some  
Latin American national parks

National Park or Reserve	Facilities
Santa Rosa N.P., Costa Rica	1 Reconstructed historic hacienda with exhibitions. Books and pamphlets for sale.
Volcan Poas N.P., Costa Rica	1 Visitor Center with interpretative exhibits. Guide service, Pamphlets. Pre-recorded tape guiding.
Tayrona N.P., Colombia	Information kiosk, one nature trail guide service.
Salamanca N.P., Colombia	One visitor center/museum with auditoriums and exhibits. One cineroom. Two small zoo. Nature trails. Guides.
Canaima N.P., Venezuela	Private hotel arranges tours with guides of the area.
El Avila N.P., Venezuela	One visitor center. One restored coffee hacienda.
Guatopo N.P., Venezuela	One visitor information center. One restored sugarcane mill museum. One restored coffee mill museum. Guide, pamphlets.
Iguazu N.P., Argentina	Extensive network of nature viewing trails. One museum in Puerto Iguazu. Guides.
Nahuel Huapi N.P., Argentina	One visitor center with exhibits. One museum. Pamphlets. Guides. Trails.
Tikal N.P., Guatemala	One small museum, pamphlets and books. Guides. Trails.
Iguazu N.P., Brazil	Extensive network of nature trails. One museum. Pamphlets.
Puyehue N.P., Chile	One visitor center with exhibits and auditorium, Interpretative trails.
Conguillio N.P., Chile	Nature trails.

However, tourism as related to national parks may provide a substantial contribution to the national economies as demonstrated in the United States where it has been calculated that tourism to the national park system contributes 45 times its own budget to the nation's economy.

The utilization of Latin American national parks in integrated tourism programs is generally not well developed. National parks are only now being recognized as important tourist attractions by the countries of the region and have therefore not yet been given significant recognition by tourism organizations. A tourist visiting Latin America seems therefore to search more for the specific unique or scenic area, and not necessarily for the "national parks". In the United States a visitor generally understands the significance of a national park and therefore, will often visit any national park within the area he is travelling.

Another factor impeding tourism may be the lack of cooperation between the officials responsible for tourism and those responsible for national parks administration. Such lack of cooperation or conflicts is most commonly based on a mutual misunderstanding of the objectives and responsibilities of each sector. A common example is that tourism agencies want to exploit the economic tourism potential to a maximum without regard to conservation needs, while the park administration often regards tourism as a threat to park protection and conservation. Certainly, in some parks mass tourism may not be desirable due to the fragility of the resources or capacity of the present developments to support more use.

There is of course a direct relationship between the number of visitors to a national park and the infrastructure and access, which partly counts for the great variation in visitation to national parks in Latin America. This diversity is demonstrated by for example, Tijuca National Park located in the middle of Rio de Janeiro and Manu in Peru which can only be reached by expeditions. It is evident then that if national parks or recreation areas were located near urban centers or within easy access, they would give a greater economic benefit as well as other values to the society. However, many of the primary objectives of national parks would be impossible to achieve if the area were heavily used, for example, conservation of ecosystems, protection of flora and fauna and environmental monitoring, and national parks must be located where the resource justifies their establishment.

Although many national parks in Latin America do not have statistics regarding the number of visitors to the area, it has been possible to obtain data from the following national parks for the year 1973: Table N° 13.

There are 110 national parks listed by IUCN for Latin America. Assuming that the 18 that are listed in Table 13 are representative insofar as visitation, the total number of visitors to national parks in Latin America would be around 21 millions. Compared to the United States of America this is about 10%. (U.S. parks receive around 200 million a year).

Table N° 13

Annual visitation to some  
Latin American national parks

National Park	Country	1973 Visitors / year
1. Iguazu N.P.	Argentina	200,000
2. Nahuel Huapi N.P.	Argentina	300,000
3. Iguacu N.P.	Brazil	325,000
4. Bra ília N.P.	Brazil	200,000
5. Itatiaia N.P.	Brazil	80,000
6. Serra dos Orgaos N.P.	Brazil	750,000
7. Tayrona N.P.	Colombia	40,000
8. Salamanca Island N. .	Colombia	15,000
9. Galapagos N.P.	Ecuador	6,000
10. Tikal N.P.	Guatemala	24,000
11. San Miguel N.P.	Uruguay	20,000
12. Santa Teresa N.P.	Uruguay	250,000
13. Guatopo N.F.	Venezuela	120,000
14. Canaima N.P.	Venezuela	8,000
15. El Avila N.P.	Venezuela	900,000
16. Henri Pittier N.P.	Venezuela	85,000
17. Volcan Poas N.P.	Costa Rica	60,000
18. Santa Rosa N.P.	Costa Rica	15,000
	Sum	3,423,000

In most of these areas the number of visitors is increasing at a rapid rate. Table 14.

E.W. Swanson in his economic study titled "Travel and the National Parks" (1969) estimates that the average daily expenditures for a visitor to the US parks system runs above US\$ 15.00 per person per day. This figure is of course not directly applicable to Latin American parks, but lacking other data, it could be of some interest to use this figure. This figure would be low for present day calculations in the U.S. In Latin America, the expenditure is probably much higher for the foreign tourists, while probably lower for the local or national tourist. However, using 15 US\$ as an average expenditure per visitor considering each person stays only one day as average the amount of money directly accrued to national parks activities in Latin America amounts to US\$ 315,000,000 per year. Swanson then estimates that 70% of this income actually goes to pay purchases from outside the region or for imports, and uses a multiplier effect of 2.5 for the nation to estimate the total net national benefit. As an exercise this gives a net benefit to Latin America of 236,000,000 US\$ annually.

Any more realistic economic impact of tourism to Latin American national parks is difficult to calculate with the data available to the author.

Looking upon the direct local impact in a survey of Uruguayan national parks, several of which have a high "day use" visitation and camping activity, no significant economic activity in the immediate regions of the parks was noted, although direct fees only in Santa Teresa National Park amounted to 75,000 US\$ annually (1972). In comparison, Nahuel Huapi National Park in Argentina is no doubt the main attraction for most of the visitors to San Carlos de Bariloche. This has become a major touristic center for the Central Southern Argentina with several tourist hotels of various classes, pensions and lodges. The town is rapidly expanding and various kinds of services are offered. However, lack of statistics by the author makes it impossible to estimate the economic impact of tourism with any measure of accuracy.

An indication, however, is given in the Chubut province of Argentina, where 7 million US\$ were generated from tourism in 1972 according to the Province's economic estimates. The province's main attraction is the wildlife reserve of Peninsula de Valdés, offering close up view of sea lions and penguins.

In an economic evaluation of tourism related to national parks one should be aware that tourism generally requires infrastructure of high quality as well as high quality and high investments in hotels, transport facilities, food and services, etc. An isolated national park that has no "free" facilities or infrastructure may find costs of connecting the park to highway systems, electricity, telephone, air services, etc. prohibitive. There may also be social costs involved. Tourism may cause tension and conflicts in relation with local people.

Table N° 14

Increase in visitation to some  
Latin American national parks between 1971 and 1973

National Park - Country	Year		
	1971	1972	1973
Iguazu N.P., Argentina	150,000	180,000	200,000
Iguacu N.P., Brazil	300,000	310,000	325,000
Tayrona N.P., Colombia	5,000	25,000	40,000
Salamanca Island N.P., Colombia	10,000	12,000	15,000
Santa Rosa N.P., Costa Rica	10,000	10,000	15,000
Volcan Poas N.P., Costa Rica	45,000	55,000	60,000
Tikal N.P., Guatemala	15,000	19,000	24,000
El Avila N.P., Venezuela	600,000	750,000	900,000
Guatopo N.P., Venezuela	100,000	120,000	120,000
Henri Pittier N.P., Venezuela	80,000	85,000	85,000
San Miguel N.P., Uruguay	10,000	15,000	20,000

The provision of outdoor recreation opportunities is considered as an important reason for the establishment and management of many Latin American national parks. The interest shown by the countries in providing certain recreational facilities is demonstrated in Table N° 15. Picnicking and camping are the activities most commonly provided for in the parks. Most recreation activities require special physical facilities and practically all national parks in Latin America offer facilities for camping and picnicking. A sample is given in Table N° 15.

#### 7a. Investment opportunities

Opportunities for investments occur frequently both within national parks and in the immediate area outside the parks. Parks often have a zone where constructing restaurants, hotels, motels, etc. is permitted. Present planning philosophy however considers it advantageous if hotels and similar large developments can be kept outside the boundaries of smaller parks. Experience has shown that large scale touristic developments within park boundaries can cause considerable disturbance to park values. Apart from investment opportunities in hotels and restaurants, equipment for rental to facilitate participation in boating, diving, skiing, mountaineering, and fishing are other examples of business opportunities related to national parks. Since park objectives always include the conservation of the existing attractions of the area it implies that investors in facilities utilizing these attractions are guaranteed against the destruction of the same attractions for which the investments were established.

An Argentinian example will be used to demonstrate an investment opportunity (see flow chart N° D). A recent study done in Iguazú National Park discusses the feasibility of investments and their immediate economic impact. Based on the present trend in visitation an estimate for the period 1972-1976 suggests 1,500,000 visitors to the park during the five years.

The planned investment include:

	Costs in US\$
Improved trails	158,000
Cafeteria, restaurant	50,000
Sanitary units	12,000
Parking lots	115,000
International foot bridge	50,000
Interpretive trail	40,000
Complementary work, Hotel Cataratas	42,000
Sound and light show	33,000
To the Protection sector	60,000
To the Service sector	40,000
Total	<u>600,000</u>



Table N° 15

Visitor use facilities in  
some Latin American national parks

National park	Picnic facilities	Camping facilities	Other visitor accomodation facilities
Tayrona N.P. Colombia	10 units	40 units	Cafeteria (under construction)
Salamanca Island N.P. Colombia	20 units	none	Cafeteria
Volcan Poas N.P. Costa Rica	3 sites 30 units	1 site	Shelters
Santa Rosa N.P. Costa Rica	Various sites	1 site	Guest House (restricted use)
Henri Pittier N.P. Venezuela	8 units w/roof 4 units stand.	10 sites	Guest House (restricted use)
El Avila N.P. Venezuela	20 sites 31 units	13 sites	Guest House (restricted use) Restaurant-Bar
Canaima N.P. Venezuela	—	Free camping	Hotels, Restaurants
Guatopo N.P. Venezuela	29 units separate	4 sites	2 Playgrounds. Guest House (restricted use)
Tikal N.P. Guatemala	2 sites	1 site	Refugio, Restaurant Hotels
Nahuel Huapi N.P. Argentina	Various	Various	Hotels, Restaurants
Iguazu N.P. Argentina	Various	2 large sites Various small sites 1 group site	Hotels, Restaurants
Puyehue N.P. Chile	2 mayor sites	1 major site	Restaurants, Cabins for rent
Conguillo N.P. Chile	Various	1 major site	Cabins for rent
Santa Teresa N.P. Uruguay	Various	Several sites	Restaurants

Calculated benefits (all net) for the 5-year period:

	Costs in US\$
1. Entrance fees	300,000
2. Circuit fee, Garganta del Diablo, foot, boat, bus; 60% of visitors	135,000
Interpretive trail, foot, boat, bus; 30% of visitors	45,000
Sound and light show; 30% of visitors	90,000
International foot bridge fees; 50% of visitors	<u>112,500</u>
Total	682,500

Payback time is about 5-6 years depending on the rate of interest. The budgeted investments and revenues give a high rentability to the project and are also flexible since even if all the investments are not carried out, the rentability is high. Only by charging entrance fees for existing facilities it can be calculated that 300,000 US\$ in revenue for the five-year period will be incurred. These figures refer to the park itself. The benefits to the municipality and to Argentina is considerably greater. These additional benefits do not only enter through a multiplier effect but also through additional spending on taxes, employment, transport, accommodations, etc. although imports have to be subtracted. It should also be kept in mind that the greatest benefit is the conservation of the natural resources in the area. In this specific case tourism can be said to have reinforced conservation by demonstrating an economic benefit to the country as a result of the efforts to conserve the resources.

### 8. Rural Development

Rural development is generally considered as a benefit of national parks. However, the establishment of national parks or reserves does not necessarily imply that rural development will take place near the park. The ability of the surrounding area to absorb or utilize the beneficial opportunities provided by the development of the park or reserve depends on the capacity of the local inhabitants to invest in developments, to fill positions available in the park organization or to make products saleable to the visitors.

Much can be done to increase the local economic benefit or multiplier effect through skillful management. For example, care can be taken to assure that local expertise and suppliers are used, and that orders are spread out to as many suppliers as possible.

Only in Argentina (Nahuel Huapi, Iguazú, and Lanín National Parks), was it found that national parks had a significant direct beneficial impact on the local rural communities. Where the protected area is a significant and popular attraction, considerable

infrastructure and development may be justified which in turn normally has a strong impact upon rural development, although at times this is only temporary due to the very temporary nature of such projects as road building, communication networks, etc.

#### 9. Employment at different educational levels

Several of the items described under inputs, also carry an integrated output. Factors such as education and labour are inputs necessary for the efficient functioning of a national park or reserve. At the same time it can be considered that the national park offers an opportunity for work at various educational levels, thus giving an output. Some quantification of this benefit is given in the chapters B.1 Human Resources and B.3 Technical capacity of personnel. The number of employees in a sample of national parks in Latin America is given in Table N<sup>o</sup> 2.

#### 10. Water production

To conserve and maintain even water flows can be of high direct economic importance for both present and future downstream uses of water. Several rivers originating on national parks on the continent are already being used for hydroelectric power production, irrigation, navigation, and recreation and more have been allocated to such future uses.

The conservation of the water supply is seldom the main objective of establishing national parks and should in reality never be the main objective. However, this is a very real and important function of several Latin American national parks, and it has often served as the factor catalyzing establishment efforts. For example, Venezuelan national parks were in several cases established in order to protect important watersheds. Guatopo National Park is essential for the water supply to Caracas (See Flow Chart N<sup>o</sup> C) and Canaima National Park protects the industrially important watershed of the Caroni river. In these cases the water supply would have been detrimentally affected if action had not been taken to protect the areas. In other instances disturbances were already taking place to an extent that required application of conservation measures. For example the establishment of the Guatopo National Park in Venezuela necessitated the removal of 5000 families, an action which indicates the importance of the water conservation. There are of course other management systems that can provide the same services to the water production as national parks. (Water production may be defined as securing a regulated flow of clean water over time, without erosion or sedimentation or flood dangers). Properly managed, water production may be maintained and at the same time the area can provide for timber production, hunting, recreation, etc. The fact that national parks have been established for such areas in Latin America either indicates that there are other values in the area that warrant protection or that the management techniques of other management systems legally available are not known or developed to an extent that they guarantee the protection of the water resource.

Table N° 16

Watersheds in a sample of some  
Latin American national parks

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National Park and Country	Watersheds protected by the park
Volcan Poas N.P., Costa Rica	22
Santa Rosa N.P., Costa Rica	None
Tortuguero N.P., Costa Rica	1
Tayrona N.P., Colombia	Several intermittent rivers
Salamanca Island N.P., Colombia	None
El Avila N.P., Venezuela	39 + several intermitent (most of them used for drinking water)
Henri Pittier N.P., Venezuela	Various, used for drinking water
Guatopo N.P., Venezuela	18 (important for drinking water)
Canaima N.P., Venezuela	Various. Part of a large industrial river.
Ulla Ulla R., Bolivia	1 significant
Manu N.P., Peru	Several smaller, part of one large Amazonian watershed.
Pampa Galeras R., Peru	1
Tikal N.P., Guatemala	0

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Table No 16 shows a sample of national parks and watersheds. "Watersheds" is here applied in an ample sense to include rivers of a significant size and importance and these originating within the park boundaries.

#### 11. Health

The urbanizing trend in Latin America has aggravated the social problems in most metropolitan cities and brought grave consequences for the public mental and physical health. A rising wave of crime, frustration and isolation from nature has been documented. The lack of adequately planned urban areas for recreation which to some extent, can reduce tensions, is serious and the results are visible in overcrowded small city parks, zoos, gardens, etc. Seldom is this demand given sufficient attention and it is often considered a low priority public service. As a result it is common to find groups of people recreating on every green piece of land in the cities, and along highways and rivers during week ends and holidays.

National parks, especially those close to urban centers, offer an opportunity for people to recreate and improve both their mental as well as their physical health. The economic value of this is difficult to estimate, although the social value is easy to understand. Usually a network of trails is open to visitors in national parks, where they can walk and view undisturbed natural scenery and enjoy fresh air and quietness. Cross country walking is also normally encouraged in most national parks. Other physical activities are also usually permitted. These activities all assist in maintaining health.

The aspect of maintaining the mental health may be more important than the maintenance of the physical health in this context. National parks offer unique opportunities for urban people under stress to relax and recreate in esthetically pleasing natural surroundings.

#### 12. Cultural and Historic Features protection

National parks often protect some cultural or historic heritage of the country for present and future enjoyment. In several cases in Latin America, national parks have served to protect such remains as well as their surrounding natural environment. There is an increasing awareness that not only does the specific historic feature deserve protection, but also its natural settings. In other parts of the world such areas have sometimes been modified to show what the area was like in a specific period of time related to the history or the cultural features protected. This is not yet practiced very often in Latin America although interest has been increasing in setting aside special zones to accomplish this objective. At times a particularly important cultural landscape merits protection even though it does not contain any single outstanding feature. Such cultural landscapes normally need continuous manipulation and management to inhibit normal vegetational successions. Historic

Table N° 17

Historic/Archaeological features in  
some Latin American national parks

<u>National Park and Country</u>	<u>Historic Features</u>
Santa Rosa N.P. Costa Rica	Reconstructed hacienda from the battle period between Costa Rica and Nicaragua. Sites of 3 battles. Indian culture remains.
Cahuita N.P. Costa Rica	Some historic remains from the 17th century (cannons, etc.)
Tayrona N.P. Colombia	An area with archaeological remains from the Tayrona indian culture. (Precolombian). More than 450 years since last occupied.
Salamanca Island N.P. Colombia	Some few remains of an indian culture
El Avila N.P. Venezuela	A 17th Century stone road from Guaira to Caracas. Ruins of a house that was used by Humbolt. Reconstructed haciendas.
Guatopo N.P. Venezuela	Restored coffee hacienda (100 years). (El Elvira), restored sugarcane mill as museum. Ruins of an old Spanish pueblo (San Antonio)
Henri Pittier N.P. Venezuela	A colonial pueblo near the coast
Tikal N.P. Guatemala	The famous imperial and ceremonial center of the Maya indian culture. Numerous ruins of world significance.
Pampa Galeras R. Peru	Ruins from the Inca indian culture. Especially constructions related to their trapping of vicuña.
Santa Teresa N.P. Uruguay	Historic fortress. Period of the Spanish-Portuguese war.
San Miguel N.P. Uruguay	Historic fortress. Period of the Spanish-Portuguese war.

(continues)

Manu N.P. Peru	Unknown but possible Inca ruins. Rich indian living cultures.
Canaima N.P. Venezuela	Rich indian living culture.
Juan Fernandez Island N.P., Chile	Rich history of pirates and deporta- tions.
Easter Island N.P. Chile	Rich archaeological history. Stone- head. Stone carvings.

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features or cultural landscapes will normally be included in specific zones in Latin American national parks. Table NO 17 gives a sample of historic features in some Latin American national parks.

### 13. Special scenic and geologic features protection

Superlative scenery is one factor that in general characterizes national parks on the continent. This uniqueness or superiority of the landscape usually include some geologic formation of the area. Mountains, volcanoes, waterfalls, caves, canyons, lakes and islands very often constitute the most significant features of interest.

The protection of these scenic features for the continuous enjoyment of all people constitutes a significant benefit to humanity and should be considered an output of national parks, since the management provides protection from activities that could otherwise destroy these natural assets. Although it is almost impossible to put a monetary value on scenery, it is a well known fact that superb scenery may represent tourism revenues, recreation and may generate significant pride for the natural heritage of a nation.

Table NO 18 gives a sample of unique or superlative scenery in some Latin American national parks.



Table N° 18

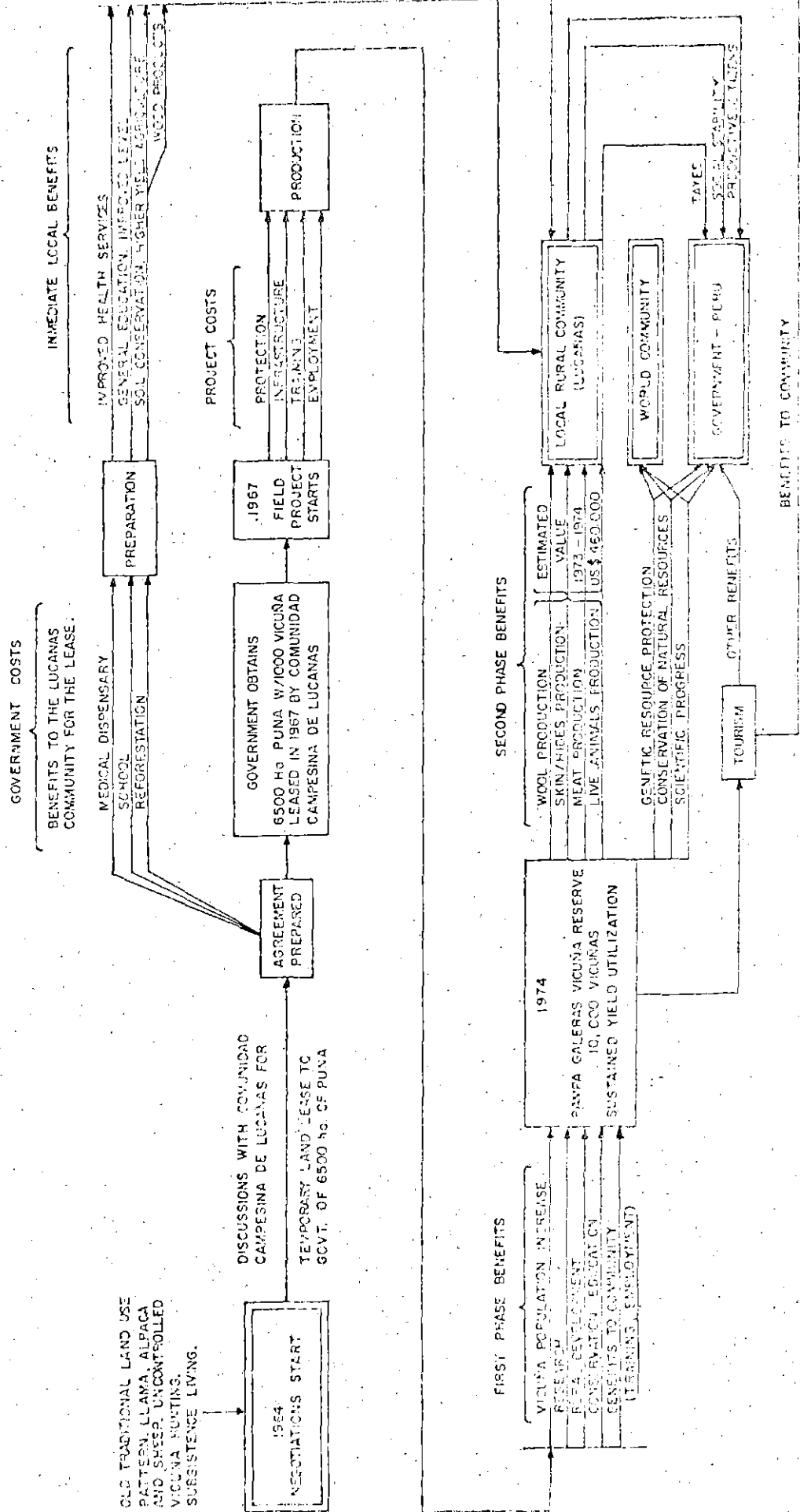
Unique scenery in some  
Latin American national parks

<u>National Park and Country</u>	<u>Unique natural feature</u>
Canaima N.P., Venezuela	World's highest waterfall (Angels Fall, 973 m). Unique geologic formations (Roraima formations)
Iguazu N.P., Argentina and Iguacu N.P., Brazil	One of the world's largest waterfalls (2,700 m waterfalls horizontally measured and with a height of about 70 m).
Volcan Poas N.P., Costa Rica	One of the world's largest true craters (Approx. 1,5 km in diameter)
Vicent Perez Rosales N.P. Chile	One of the most spectacular classical snowcaped strato volcanoes on the continent.
Torres del Paine N.P. Chile	Unique mountain and glacier scenery.
Archipelago Los Roques N.P., Venezuela	One of the extremely few coral atolls of the Atlantic
Cueva de la Quebrada del Toro N.P. Venezuela	Superlative cave formations
Salamanca Island N.P., Colombia	Superlative mangrove and sandbar formations
Galapagos Islands N.P., Ecuador	Unique islands and nature features (flora, fauna).

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FLOW CHARTS

PANPA GALERAS NATIONAL VICUÑA RESERVE, PERU  
SIMPLIFIED SCHEMATIC MODEL OR FLOW CHART A



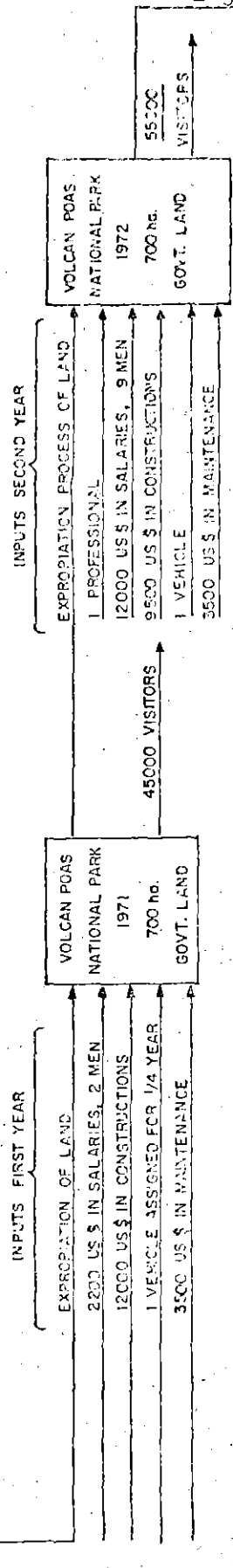
VOLCAN POAS NATIONAL PARK  
COSTA RICA

INPUT - OUTPUT FLOW CHART

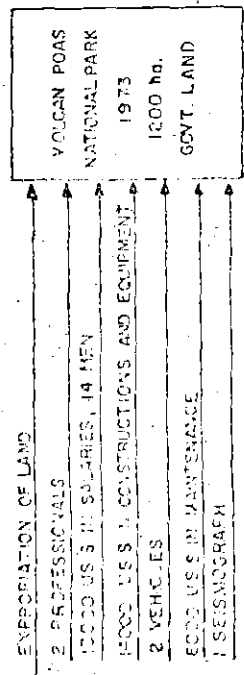
B

VOLCAN POAS COSTA RICA BEFORE 1970  
PARTLY DEGRADED, UNCONTROLLED LAND  
USE AND EXPLOITATION

NATIONAL PARK ESTABLISHED  
4,000 ha.  
23 DECEMBER 1970  
LEY DE LA REPUBLICA  
Nº 4716



INPUTS THIRD YEAR



CUMULATIVE PRODUCTION OF THIRD YEAR

- 160,000 VISITORS / TOURISTS
- 5000 US\$ IN ENTRY FEES (USERS FEES BEING STARTED THIRD YEAR)
- PUBLIC EDUCATION THROUGH CONSTRUCTED VISITOR CENTER, 2 NATURE TRAILS, GUIDES, BOOKLETS, ETC.
- RECREATION THROUGH THE USE OF CONSTRUCTED 3 PICNIC AREAS, 1 CAMPING SITE, VIEW POINTS WITH FACILITIES
- VIGILANCE AND ADMINISTRATION FACILITATED THROUGH CONSTRUCTION OF 3 GUARD HOUSES, OFFICE, WORKSHOP, ETC.
- PROTECTED LOWER MONTANE AND MONTANE CLOUD FOREST
- SECURED ECOLOGICAL DIVERSITY
- PROTECTED GENETIC RESOURCES LIKE THE QUETZAL AND VARIOUS ENDEMIC FLORA AND FAUNA SPECIES
- PROTECTED 22 UPPER STREAM WATERSHEDS
- PROTECTED UNIQUE GEOLOGIC FEATURES, THE POAS VOLCANO CRATER
- METEOROLOGICAL STATION INSTALLED, MEASURING TEMPERATURE, EVAPORATION, PRECIPITATION, WIND, HUMIDITY
- SEISMOGRAPH INSTALLED TO MONITOR MONITORING PURPOSES
- RESEARCH ON LIMNOLOGY, BIOLOGY, ECOLOGY AND VOLCANISM

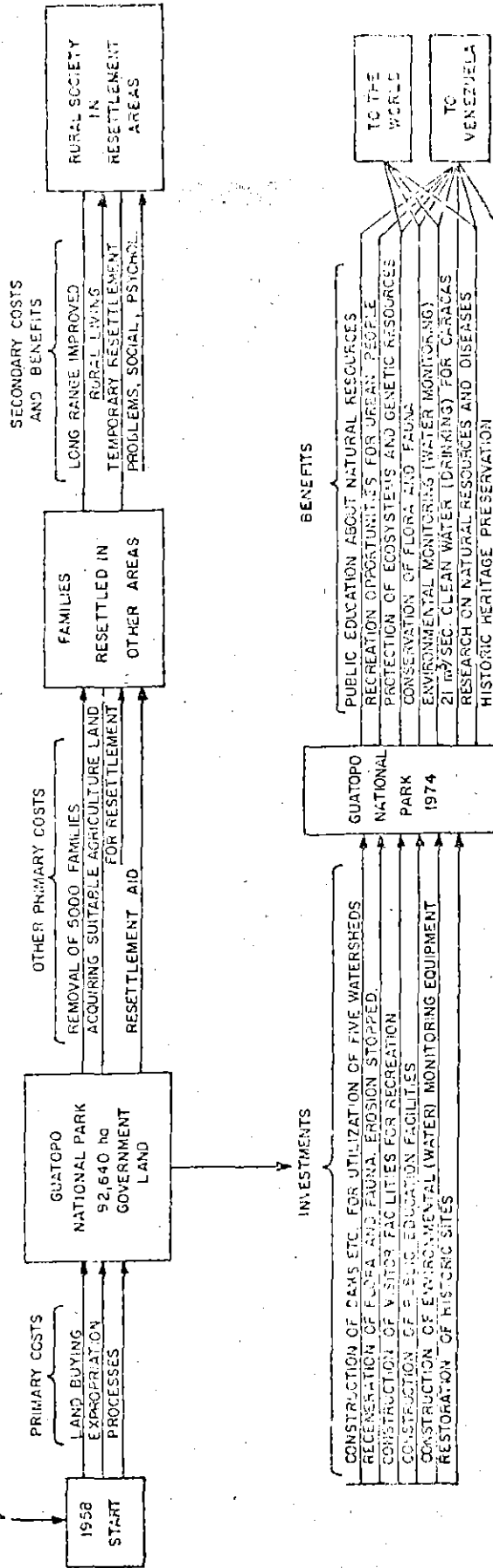
GUATOPO NATIONAL PARK - VENEZUELA

SIMPLIFIED SCHEMATIC MODEL, FLOW CHART C

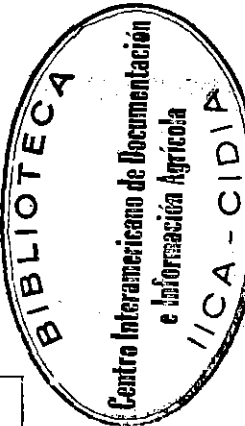
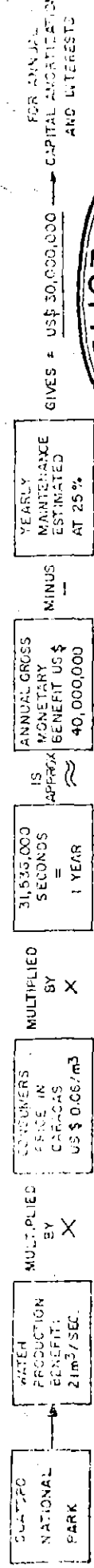
TOTAL MONETARY COSTS US \$ 222,000,000 (1958-1973)

CONDITIONS PRIOR TO START OF NATIONAL PARK

LARGE PARTS OF WATERSHEDS ARE INHABITED AREAS HAD BEEN CLEARED FOR SUBSISTENCE AGRICULTURE AND ENJOYED WATER SHORTAGES FOR CARACAS



IF THE BENEFIT OF SECURED WATERPRODUCTION WAS TO COVER THE TOTAL ECONOMIC INVESTMENT:



IGUAZU NATIONAL PARK  
ARGENTINA

INVESTMENT FLOW CHART D  
(INTEREST NOT INCLUDED IN CHART  
DUE TO TWO-WAY FUNCTION)

5-YEAR PERIOD

ENTRANCE FEES	US \$ 300,000
TOLL TRAILS	35,000
FEES INTERPRET. TRAIL	45,000
LIGHT AND SOUND SHOW FEES	90,000
INTERHAC. BRIDGE FEES	112,500
GOVT. BUDGET ALLOC. (15 YEARS)	1,000,000
	<u>1,682,500</u>
PARK OPERATION COSTS	- 690,000
BENEFITS	992,500

REVENUE TO PARK

AFTER 5 YEARS  
INCOME  
INCREASES  
WITH  
VISITORS NUMBER

5-YEAR PERIOD

1,500,000 VISITORS x 2 DAYS =	
3,000,000 VISITOR/DAYS x 15 US\$	= US\$ 45,000,000
MINUS 5-YEAR GOVT. BUDGET	1,000,000
MINUS LOST ALTERNATIVE LAND USE (SUBST. AGRIC.)	5,400,000
MINUS INVESTMENTS	600,000
BENEFITS	US \$ 39,000,000
(partly due to invest.)	

REVENUE TO REGION  
AND NATION

AFTER 5 YEARS  
INCREASED  
BENEFITS

CONTINUOUS

UNIQUE OCCASION PROTECTION (ONE OF  
WORLD'S LARGEST WATERFALL)  
ECOLOGICAL ZONE PROTECTION  
GENETIC RESOURCES PROTECTION  
PARTLY REVERSED PROTECTION  
WILDLIFE PROTECTION  
RECREATION

BENEFIT TO NATION  
AND WORLD

VISITATION

CONSERVATIVE ESTIMATE:  
1,500,000 VISITORS  
OVER A 5-YEAR PERIOD  
1975 - 1980

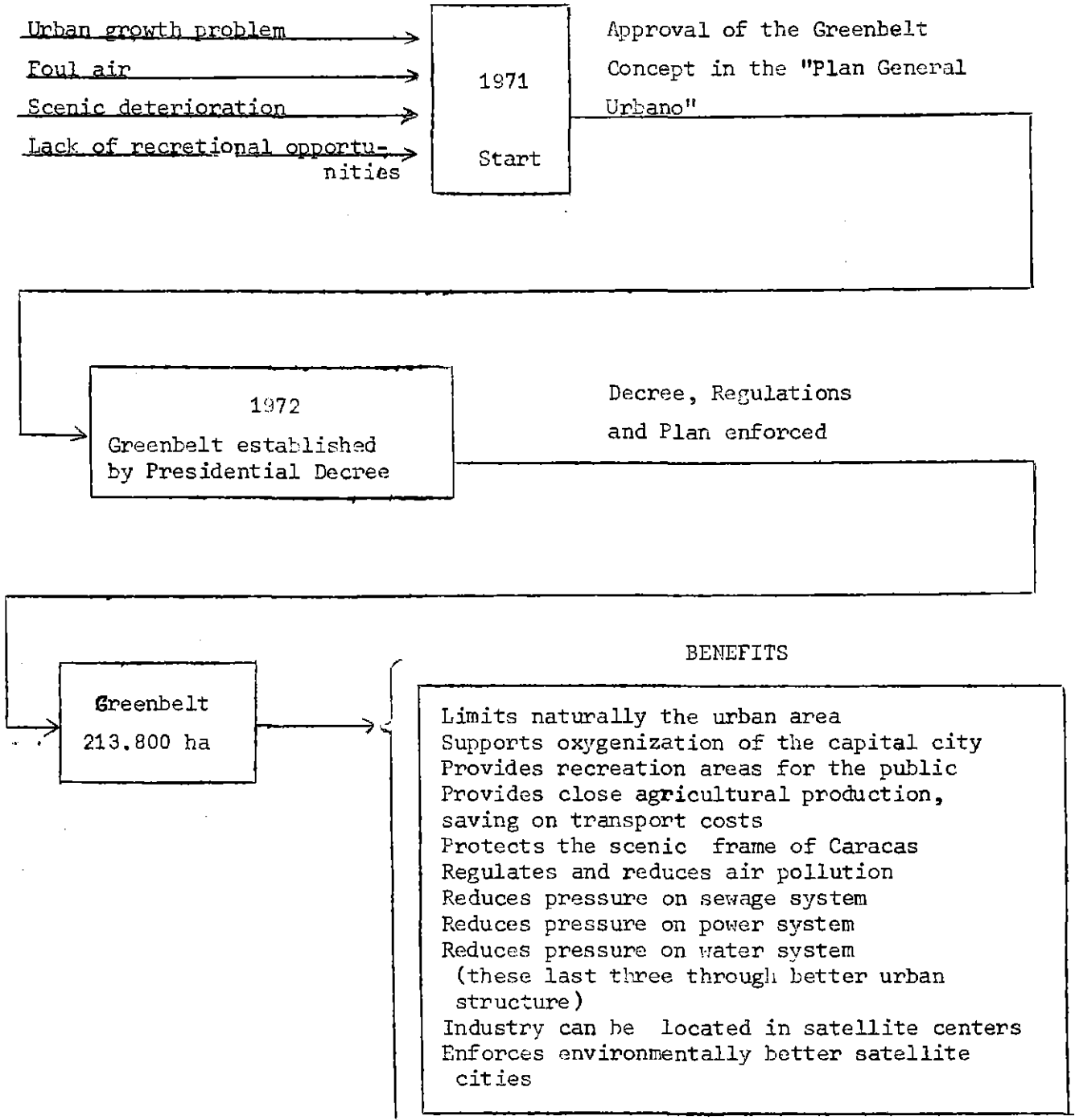
1974 - 1975  
NEW INVESTMENTS IN  
ESTABLISHED AND FUNCTIONING  
NATIONAL PARK

	US \$
IMPROVED FOOT TRAILS	158,000
CAFETERIA	50,000
SANITARY UNITS / BAR	12,000
PARKING LOTS	115,000
INTERPR. FOOTBRIDGE	50,000
INTERPRETIVE TRAIL	40,000
IMPROV. EXIST. HOTEL	42,000
LIGHT AND SOUND SHOW	33,000
VIGILANCE SECT., MISC.	60,000
SERVICE COCT., MISC.	10,000
	<u>600,000</u>

PARK AREA	APPROX. COMMERCIAL LAND VALUE/Ha.	TOTAL COMMERCIAL VALUE OF PARK
75,920 ha	210 US\$	20,000,000 US\$

THE GREENBELT AROUND CARACAS VENEZUELA

Simplified Schematic Model



SANTA TERESA NATIONAL PARK

URUGUAY

INPUT - OUTPUT FLOW CHART

F

INPUTS

2,700 ha of coastal land

5 Administrators and Managers +  
80 military workers

Construction costs (no figures)  
administration center, sanitary  
units, camping sites, etc.

Planting costs (The area was pre-  
viously treeless, with moving  
sand dunes).

SANTA TERESA  
National Park  
and  
Recreation Area  
Established in  
1927  
Uruguay

OUTPUTS

Protected historic fortress

Protected Atlantic sand beaches and littoral  
zone

Sand dune stabilization

Protected good Nutria and bird habitat

Improved public health through recreation

Concession Fees (kiosks) - (no figures)

200,000 camping days annually: about  
US\$75,000 in fees

Public recreation (day use), sports fishing,  
swimming, nature walks, etc.

Operation of educational farm, incomes from  
farm products.

Public education in history and nature.



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APPENDIX I

Size of national parks and reserves  
in Latin America in Hectares

<u>National Parks</u>	<u>Hectares</u>
Argentina	
Nahuel Huapi	785,000
Los Glaciares	600,000
Lanin	395,000
Río Pilcomayo	285,000
Los Alerces	263,000
Perito Francisco P. Moreno	115,000
Iguazu	75,820
Tierra del Fuego	63,000
El Rey	44,162
Chaco	15,000
Laguna Blanca	11,250
Petrified Forest	10,000
Palmar de Colon	8,500
Bolivia	
Ulla Ulla	200,000
Brazil	
Tocantins	625,000
Araguaia	460,000
Iguacu	170,000
Serra da Bocaina	134,000
Emas	100,000
Brasilia	28,000
Monte Pascoal	22,500
Itatiaia	11,943
Aparados da Serra	10,500
Caparao	10,435
Serra dos Orgaos	10,000
Sete Cidades	6,221
Tijuca	3,300
Chile	
Bernardo O'Higgins	1,761,000
Laguna San Rafael	1,350,123
Alberto M. de Agostini	800,000
Hernando de Magallanes	800,000
Lauca	400,000
Villarica	167,000
Vicente Perez Rosales	135,175
Puyehue	117,000
Cape Horn	63,093
Conguillio	40,000

(continues)

<u>National Parks</u>	<u>Hectares</u>
Chile (cont.)	
El Guayaneco	30,498
Bahia Erasmo	28,320
Torres del Paine	24,530
Juan Fernández	18,300
Los Paraguas	18,000
Laguna del Loja	11,600
Isla Guamblin	10,625
Fray Jorge	9,960
Monte Balmaceda	7,900
Nahuelbuta	5,415
Isla de Pascua	4,589
Huerguehue	3,900
Tolhuaca	3,500
Paliatike	3,000
Los Alerzales	1,230
Los Pingüinos (island)	97
Laguna de los Cisnes (Island)	25
Colombia	
Sierra de la Macarena	600,000
El Tuparro	380,000
Puracé	80,000
Sierra Nevada	50,000
Las Orquideas	30,566
Isla de Salamanca	21,000
Tayrona	11,600
Costa Rica	
Tortuguero	18,000
Santa Rosa	9,904
Poas Volcano	4,000
Cahuita	1,700
Dominican Republic	
Haina-Duey	5,030
Ecuador	
Galapagos islands	691,200
Guatemala	
Tikal	57,600
Mexico	
La Malinche	41,711
Iztaccihuatl-Popocateptl	25,679
Zoquiapan	20,454
Pico de Orizaba	19,750
Bosencheve	15,000
Cofre de Perote	11,700
Lagunas de Chacahua	10,000

(cont.)

<u>National Parks</u>	<u>Hectares</u>
Mexico (cont.)	
Lagunas de Montebello	6,022
Constitución de 1857	5,009
Lagunas de Zempoala	4,669
Desierto de los Leones	1,900
Insurgente Jose M. Morelos y Pavón	1,813
Insurgente Miguel Hidalgo y Costilla	1,836
El Chico	1,835
Grutas de Cacahuamilpa	1,600
Surinam	
Eilerts de Haan Gebergte	220,000
Tafelberg	140,000
Voltzberg Raleighvallen	56,000
Wia-Wia	36,000
Coppename River Mouth	12,000
Brownberg	11,200
Brinckheuvel	6,000
Galibi	4,000
Panama	
Altos de Campana	2,600
Paraguay	
Ybykuí	5,000
Peru	
Manu	1,532,806
Huascarán	85,000
Cutervo	2,500
Uruguay	
Santa Teresa	2,700
San Miguel	1,495
Arequita	1,000
Venezuela	
Canaima	1,000,000
Archipelago Los Roques	225,153
Sierra Nevada de Merida	190,000
El Avila	100,000
Guatopo	92,640
Henri Pittier	90,000
Yacambu	9,000
Cueva de la Quebrada del Toro	8,500
Yurubi	4,000

(cont.)

<u>Reserves</u>	<u>Hectares</u>
Brazil	
Caracara	70,000
Sooretama	24,000
Nova Lombardia	4,350
Corrego de Veado	2,400
Serra Negra	1,100
Poco das Antas	3,000

Costa Rica	
Cabo Blanco	1,172

Cuba	
Cupeyal	10,260
El Cabo	7,535
Jaguani	4,932
Cabo Corrientes	1,578

Peru	
Pacaya	660,000
Pampa Galeras	6,500

Uruguay	
Cabo Polonio	14,250

<u>Provincial Parks (not included in other tables)</u>	<u>Hectares</u>
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Brazil	
<u>Sao Paulo</u>	
Morro do Diabo	37,157
Itatins	12,058
Campos do Jordao	8,132
Serra da Cantareira	4,500

APPENDIX N° II

Biotic provinces and national parks  
in Latin America

<u>Neotropical Region Biotic Province</u>	<u>Established National Parks or Equivalent Reserves</u>
1. Amazonian	a. Manu (Peru) b. Pacaya (Reserve, Peru) c. Sierra de la Macarena (isolated mountain range, Colombia)
2. Colombian Coast	None
3. Bahian coast	a. Serra da Bocaina (Brazil) b. Monte Pascoal (Brazil) c. Serra dos Orgaos (Brazil) d. Tijuca (Brazil)
4. Venezuelan deciduos forest	a. Yacambu (Venezuela)* b. Sierra Nevada de Mérida (Mountain, Venezuela)
5. Brazilian deciduos forest	a. Itatiaia (Brazil) b. Caparao (Brazil) c. Aparados da Serra (Brazil) d. Iguacu (Brazil) e. Iguazu (Argentina)
6. Caatinga	a. Sete Cidades (Brazil)
7. Gran Chaco	a. Rio Pilcomayo (Argentina) b. El Rey (Argentina) c. Chaco (Argentina)
8. Venezuelan dry forest	a. El Avila (Venezuela)** b. Guatopo (Venezuela)**

\*Mostly cloud forest

\*\*Mostly humid tropical forest

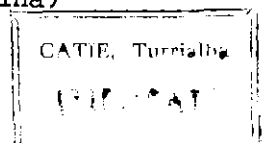


- c. Henri Pittier (Venezuela)\*\*
  - d. Yurubí (Venezuela)\*\*
  - e. Cueva de la Quebrada del Toro  
(Cave, Venezuela)\*\*
  - f. Archipiélago "Los Roques"  
(Atoll, Venezuela)
  - g. Salamanca Island  
(Mangrove, Colombia)
  - h. Tayrona (Colombia)
  - i. Sierra Nevada  
(High mountain, Colombia)
9. Ecuadorian dry forest                      None
10. Brazilian Araucarian forest              None
11. Chilean Araucarian forest
- a. Los Paraguas (Chile)
  - b. Conguillio (Chile)
  - c. Nahulbuta (Chile)
  - d. Villarica (Chile)
  - e. Los Alerzales (Chile)
12. Chilean temperate rainforest
- a. Puyehue (Chile)
  - b. Vicente Pérez Rosales (Chile)
  - c. Laguna San Rafael (Chile)
  - d. Alberto M. de Agostini (Chile)
  - e. Cabo de Hornos (Chile)
13. Chilean sclerophyll
- a. Fray Jorge (Chile)
  - b. La Campana (Chile)
14. Llanos
- a. El Tuparro (Fauna Reserve, Colombia)
15. Campos
- a. Araguaia (Brazil)
  - b. Emas (Brazil)
  - c. Brasilia (Brazil)

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<sup>2636</sup> Mostly humid tropical forest

- d. Chapado dos Veadeiros (Brazil)
- e. Ybycuí (Paraguay)
  
- 16. Pampas
  - a. Cabo Polonio (Uruguay)
  - b. Arequita (Uruguay)
  - c. Santa Teresa (Uruguay)
  - d. San Miguel (Uruguay)
  - e. El Palmar (Argentina)
  
- 17. Argentinian thorn scrub
  - None
  
- 18. Patagonia
  - a. Petrified Forest  
(Monument, Argentina)
  - b. Tierra del Fuego (Argentina)
  
- 19. Peruvian desert
  - None (One proposed)
  
- 20. Atacama
  - None (One proposed)
  
- 21. Guyana highlands
  - a. Canaima (Venezuela)
  
- 22. Northern Andes
  - a. Puracé (Colombia)
  - b. Las Orquídeas (Colombia)
  
- 23. Southern Andes
  - a. Cutervo (Perú)
  - b. Pampa Galeras (Fauna Reserve, Perú)
  - c. Lauca (Chile)
  - d. Bernardo O'Higgins (Chile)
  - e. Nahuel Huapi (Argentina)
  - f. Los Glaciares (Argentina)
  - g. Lanin (Argentina)
  - h. Los Alerces (Argentina)
  - i. Perito Francisco P. Moreno  
(Argentina)
  - j. Laguna Blanca (Argentina)



- 24. Puna
  - a. Ulla Ulla (Bolivia)
- 25. Andean cloud forest
  - a. Manu (One part, Peru)
- 26. Juan Fernández
  - a. Juan Fernández (The whole Archipelago is a National Park, although heavily disturbed, Chile)
- 27. Falkland Islands
  - a. Kidney Island (Nature Reserve, Falkland Islands)
- 28. Galapagos
  - a. Galapagos Islands (80% is National park, Ecuador)
- 34. Panama
  - a. Altos de Campana (Panama)

Nearctic Region  
Biotic Province

- 14. Sierra Madre
  - a. Bosencheve (Mexico)
  - b. Insurgente J.M. Morelos y Pavon (México)
  - c. El Chico (Mexico)
  - d. Grutas de Cacahuamilpa (Mexico)
  - e. Iztaccihuatl-Popocateptl (Mexico)
- 17. Sonoran
  - Insufficient information
- 18. Chihuahan
  - Insufficient information
- 19. Tamaulipan
  - Insufficient information

NEOTROPICAL REGION

Middle American Sub-Region  
Biotic Province

- 20. Campeche
  - a. Tikal (Guatemala)
  - b. Cofre de Perote (Mexico)
  - c. Pico de Orizaba (Mexico)

- 21. Carib-Pacific
  - a. Santa Rosa (Costa Rica)
  
- 22. Sinaloan
  - Insufficient information
  
- 23. Guerreran
  - a. Lagunas de Chacahua (Mexico)
  
- 24. Yucatan
  - Insufficient information
  
- 25. Central Cordilleran
  - a. Volcan Poas (Costa Rica)
  - b. Lagunas de Montebello (Mexico)