Status of Venezuela's Biological Diversity: An Overview

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STATUS OF VENEZUELA'S BIOLOGICAL DIVERSITY: AN OVERVIEW

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by

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1. INTRODUCTION

The aim of this document is to make a synthesis on the current information of Venezuela's biological diversity in order to recommend which areas/species of the country are of immediate concern for protection.

As implied by its name, this overview will not get into recommendations for specific localities, nor will it suggest specific measures to be taken on a species-to-species basis.

Once these recommendations are coupled with the results of the institutional overview (Romero in litt.), more detailed procedures for conservation in Venezuela will be outlined.

2. METHODS

The information presented in this overview has three sources: 1) bibliographical, 2) personal communications, and 3) in-house research.

All information obtained from published materials has been cited throughout the text and listed in the literature cited section. All published data found during the bibliographical research which appeared little reliable due to inconsistencies, obscure methodology, and/or because being outdated, was not taken into consideration.

Direct contact with researchers was made in order to obtain unpublished information and/or opinions on existing data. The list of those contacted is in the acknowledgements section.

In-house research consisted mostly of overlapping of maps, matrix of data, and statistics.

The list of selected taxa was chosen on the basis of reliable information demonstrating the need for some protection action for each of them. Thus, this list should not be considered an exhaustive but rather a focused one.

The section of recommendations was elaborated on the basis of both published information and personal communication with researchers that have field experience in Venezuela. I understand that each researcher listed and/or ranked his/her recommendations on the basis of knowledge of the area and

personal stand toward their primordial field of research. The rank of the list I present here is eclectic and based, as much as possible, on objective data concerning diversity, endemism, protected areas, and human population pressures. Its final form is my responsibility.

3. SUMMARY OF BIOLOGICAL DIVERSITY

3.1 Geographic Diversity

Venezuela is located between 1° and 12° of latitude N. It has a total surface of 912,050 Km^2 and 2,816 Km of coastline.

Eisenberg and Redford (1979) divided Venezuela into seven biogeographic regions whose physical and geological characteristics can be summarized as follows:

a) The Maracaibo Lake Basin, which is a deep gulf surrounded by lowlands. Mostly late Eocene.

b) The Andean Highlands and adjacent hill country in the northwest with altitudes that range between 500 and 5,000 m. Mostly Mesozoic and Paleozoic.

c) The Falcón Arid Zone. Eocene, Pre-oligocene, Oligocene, Miocene and Pre-pleistocene.

d) The North Coast Ranges and Valleys and adjacent coastlines with altitudes that range between 0 and 3,000 m. Cretaceous and Eocene.

e) Los Llanos (including the Orinoco Delta), which extend from the north and northwest mountains south and east to the Orinoco River and southward into Colombia. It is a 200,000 Km^2 area (nearly 25% of the country) with elevations ranging from 0 to 150 m. Mostly Cenozoic.

f) The Amazon Lowlands, between the Orinoco and the Guayana Highlands. Pre-Cretaceous, Pre-Cenozoic.

g) The Guayana Highlands, a vast area of high plateus and rolling plains south and east of the Orinoco, with an altitude up to 3,500 m, and made of Precambric rocks.

Additionally, there is a series of Venezuelan caribbean islands most of them parallel to the coastline. Eocene Cenozoic and and Menozoic (Schubert and Moticska 1983).

Faunal and floristic characterization of each one of these regions can be found in Eisenberg and Redford (1979), Ewell et al. (1976), Huber (1984), Mago (1970), Monasterio (1980), Salgado-Labouriau (1979), Steyermark (1977) Vuilleumier (1979), and Vuilleumier and Ewert (1978). Additional geological characterizations can be found in Bucher (1952).

3.1.2. Climate

Temperatures depend upon altitude and time of the day. Annual average for Los Llanos = 29°C, and for the high Andes (4,600 m) = 0°C.

There are two distinct rainfall seasons whose duration and intensity largely depend upon the region. In the Llanos, for example, there is a marked dry

season that occurs from November/December to April/May. In the North Coastal Range there is precipitation even during the dry season, so the separation between both seasons is not as sharp.

As it will be seen later, these extreme variations in altitude, geographic zones, geological history, temperatures, and rainfalls provide a country the size of Texas and Oklahoma combined, with a rich variety of habitats.

3.1.3. Human Geography

Population estimates for 1985 indicate that Venezuela has about 17,510,000 habitants, with a 3.0% of annual increase, a doubling population period of 23 years, and its population for the year 2,000 will be 28,146,000 (Comisión 1970, Gale 1981.)

With 19.20 habitants/Km^2, Venezuela has a rather average population density (PD) for the area. Costa Rica, for example, has three times Venezuela's PD, and Brazil about the same.

Eighty-two percent of Venezuela's population live in urban areas mostly along the central mountains, the Andes, and the northern end of the Maracaibo Lake. In consequence, although most of the country's PD is very low, there can be presumed strong population pressures along the areas mentioned above (Comisión 1970, Gale 1981, James 1969).

3.2 Ecological Diversity

3.2.1. Life Zones

There are 22 life zones in Venezuela according to Holdridge's classification (Ewel et al. 1976). Table I presents the total areas and percentage of the country that each life zone occupies. From this Table, it can be concluded that most of the country (78.54%) is either tropical dry forest, tropical wet forest or premountain very wet forest. This roughly corresponds to most of Los Llanos and the Guayana Highlands areas which are, in turn, the lowest populated areas.

3.2.2. Vegetation

Huber's (1982) vegetation map lists 151 vegetation units (13 of which are altered ones by human intervention). When overlapped, a great deal of vegetation units can be found for a single life zone. For example, bosque seco tropical (mostly llanos), contains 60 different types of vegetation units; on the other hand, the same vegetation unit can be found in two or more life zones (e.g., vegetation type number 127, which corresponds to bosque pluvial sempiverde montano bajo, can be found in the following life zones of the Bolívar state: bp-P, bmh-T, bmh-P, and bh-T).

Other sources offer different systems of classification of vegetation as well as statistical analysis of them (National Research Council 1982, Hamilton 1976, Myers 1980, Office of Technology Assessment 1984, Organización de las Naciones Unidas para la Agricultura y la Alimentación 1981).

Table II summarizes vegetation types, total areas, and the percentage of each one represented in Venezuela according to the FAO classification. It shows that 63.01% of the country is either evergreen grassland forest or tropical ombrophilous forest. Again these formations correspond to the less populated areas of Venezuela (Llanos and Guayana).

Table III summarizes two classifications of forests in Venezuela. Again the largest numbers (closed forest and primary rainforest, respectively) correspond to the lowest populated areas.

3.3. Taxa

Data on species diversity, including emdemic taxa, comparative figures with other faunas, and rare, threatened, endangered and/or vulnerable species are summarized in Table IV.

For a country that includes less than 0.000002% of the earth's surface and which has yet to be throughly explored, the percentages shown in Table IV are impressive. Furthermore, for one of its National Parks (Henri Pittier) which covers 1,078 Km^2, there are 520 species of birds which represents nearly 5.7% of all the species of birds of the world. Also, 48.18% of the Venezuelan species of amphibians are endemic.

It is widely believed that once long term suverys of most of the remote areas of the Guayana Highlands (Bolívar state and T.F. Amazonas) are carried out, a large number of new species, particularly endemic ones, will be described (Huber and Wurdack 1984, Steyermark 1977).

An analysis of the threatened, endangered, rare and/or vulnerable species will be presented in section 4.1.3

4. STATUS AND LOCATION OF EXISTING PROTECTED AREAS

Venezuela has a rather large number of "protected areas" (known in Venezuela as "áreas bajo regimen especial") which include national parks, national monuments, forest reserves, wildlife refuges, wildlife reserves, forest areas for permanent production, buffer zones, and hydraulic reserves. A list of the first fire type of these areas is given in Appendix 1 (including date of establishment, location area, and disturbances reported). Locations are illustrated in Figure 1. Appendix 1 also contains a list of proposed protected areas. From now on, I will call "protected areas" only to national parks, natural monuments, and wildlife refuges.

When the surface area of national parks, national monuments, and wildlife refuges are added up, the total is 76,924.31 Km^2, which represents 8.43% of the country. This puts Venezuela among the countries of Latin America with one of the largest proportions of protected surface areas after Costa Rica (12.5%), Bahamas (8.6%), and Panama (8.6%) (Toledo 1985). However, a closer look of Appendix 1 shows a disproportion in both distribution and disturbance reports across the country. For example, five of 26 national parks are located south and/or east of the Orinoco, the less known and populated region of Venezuela; these parks account for 70.66% of the whole National Park System area (and 5.72% of the nation). Except for one (Canaima), no disturbances have been reported for those five parks, while all the others located north of the Orinoco are much more smaller and with disturbances reported.

The current status of the forest reserves is unknown due, mainly, to the lack of recent official figures.

Finally, there is a large number of proposed areas that if approved, would significantly increase the total surface of preserved areas for Venezuela. Lack of current information about the kinds of habitats they would include does not allow to predict their impact on the protection of Venezuela's biological diversity. However, among the proposed areas are most of the Venezuelan islands (La Tortuga, Las Aves, Los Testigos, Los Frailes, La Blaquilla y Los Hermanos), a significant part of the Orinoco Delta, part of the southwest Llanos (Sinaruco-Caparaparo), and a big lake which is under heavy ecological pressures due to industrial pollution and changes in its hydric balance (Valencia).

4.1. Matrix Summarizing

4.1.1 Protected and Unprotected Life Zones

Table I brings the list of life zones reported for Venezuela, with the percentage of the protected areas (national parks, national monuments, and faunal refuges) where they are represented. Appendix 1 shows the percentage of the number of protected areas they include. From the life zones viewpoint bh-P, bs-T, bmh-P, bh-T, and bmh-MB are represented more times (>20%), while me-P, bs-MB, bmh-M, p-SA, pp-SA, tp-A, and N are represented only in one protected area. bh-M (located in the Andes) is not represented in any protected area.

From the protected areas viewpoint, it is remarkable that in a single national park (Sierra Nevada) 50% of the life zones of Venezuela are represented. It is followed by El Avila (31.82% of the life zones), and Macarao, Terepaima, Henri Pittier, and El Tamá (with 22.73% each one). In fifteen of the protected areas only one life zone is represented.

Again an unbalance across the country is self-evident, since all the life zones under least or non-protection as well as the protected areas with a higher life zone diversity are north of the Orinoco.

4.1.2. Protected and Unprotected Vegetation Units

As a result of matrixing protected areas and vegetation units, it was found that of the 138 vegetation units reported for Venezuela, according the Huber's (1984) classification (after subtracting man-altered areas), only 76 are protected, plus undefined types under the A_1 subregion which, for statistical purposes, is counted as an additional vegetation unit.

The vegetation units more frequently found among protected areas are 5 and 6 (17.95% and 15.38% respectively), while sixty of them (77.92%) are represented only once.

The protected area containing the highest diversity of vegetation units was Canaima (15.58% of them), followed by la Sierra de Perijá and Duida-Marahuaca (9.09%). On the other hand, in 25.64% of the protected areas, only one vegetation unit is represented.

4.1.3. Selected Taxa

A list of threatened (in the broad sense) species matched with protected areas where they can be found is misleading for purposes of establishing the level of protection of each one of them, since such list does not take into consideration the general distribution, population levels, and behavioral ecology of such species. A more realistic view is obtained by analyzing the problem on a taxon-by-taxon basis.

Unless otherwise indicated, all the species listed below are protected by law (Fuller and Swift 1984).

4.1.3.1. Mammals

Cacajao melanocephalus (black-headed ukari; mono chucuto)

Cited for the southwestern area of Territorio Federal Amazonas, but its exact distribution within the country is unkown. It might be endangered because: 1) it is a high-canopy dweller of primary forests along bodies of water (the first altered habitats when a region is colonized by humans); 2) is hunted for food (Lancini, personal communication), and 3) its current population status is unkown. It has never been reported for a protected area, but its presence in the Yapacana National Park is possible (Handley 1976, Hernández-Camacho and Cooper 1976, Thornback and Jenkins 1982).

Ateles belzebuth (long-haired spider monkey; marimonda)

It is still uncertain whether this species is actually a subspecies of A. paniscus (Hernández-Camacho and Cooper 1976, but see Mondolfi and Eisenberg 1979). In any case, this monkey has a discontinuous distribution throughout both sides of the Andean premontane, Maracaibo Lake Basin, Sierra de Perijá, North Coastal range, western Llanos (for the supposedly A. b. hybridus), and the eastern lowlands of the T.F. Amazonas (for A. b. belzebuth) (Mondolfi and Eisenberg 1979; Thornback and Jenkins 1982). No population figures are available. Hunting and habitat destruction are the major threats for its survival. Its presence for a protected area has been confirmed only for the Guatopo National Park. If protected, it might show a high recovery potential (Robinson and Ramírez 1982).

Myrmecophaga tridactyla (giant anteater; oso hormiguero)

Found in most of the western, central, and southern areas of Venezuela. Population estimates are only for few areas (Eisenberg et al. 1979). It is under pressure by habitat loss and hunting (Thornback and Jenkins 1982). Confirmed reports for the following protected area: Canaima, Aguaro-Guariquito, and Guatopo, but it might well be present in others (Eisenberg et al. 1979, IUCN 1982). If conservation measures are not taken, its range will become highly discontinuous, which posses a serious threat for a species of low population density.

Priodontes maximus (=giganteus) (giant armadillo; cuspón)

In the central and western lowlands, and T.F. Amazonas (Eisenberg et al. 1979, Handley 1976). Wherever it is found seems to be very scarced

(Eisenberg 1980, Meritt 1973, Thornback and Jenkins 1982). It is under hunting and habitant destruction threats. There are confirmed reports of this species for Canaima, Mochima, and Guatopo (Eisenberg 1979, IUCN 1982). Given its low population levels, it is probably one of the top endangered species for Venezuela.

Speothos venaticus (bush dog; bufeo)

In the North Coastal range, Bolivar state, and T.F. Amazonas where is rare and threatend by habitat loss and killed when ecountered (Thornback and Jenkins 1982). It has been reported for Canaima (IUCN 1982).

Tremarctos ornatus (spectacled bear; oso frontino)

In the Andes and Sierra de Perijá. By 1981, there was estimated that only 100 individuals were left for Venezuela (Thornback and Jenkins 1982). Hunting, habitat loss, and lack of effective conservation practices have been the major threats for the species. It has been reported for the following protected area: Sierra de Prijá, Sierra Nevada, Terepaima, and El Tamá (IUCN 1982). It represents one of the most endangered species of the Venezuelan fauna.

Pteronura brasiliensis (giant otter; perro de agua)

It has a discontinuous distribution along the rivers of the Venezuela lowlands, but little is known of both distribution and population status. Given the high price of the skin, it is heavily hunted. It has been reported for Canaima (IUCN 1982, Thornback and Jenkins 1982). All information points out to the scarcity and vulnerability of this species.

Felis pardalis (ocelot; cunaguaro, triguillo)

Scattered localities in central and western Venezuela (Handley 1976). There is not really a reliable study on its population status across Venezuela. It has been cited for 19 protected areas (IUCN 1982). It is being threatened by hunting and habitat loss.

Felis trigrina (little spotted cat; gato atigrado, cunaguaro)

Andean, Central Coastal range, and Bolivar state (Handley 1976, Thornback and Jenkins 1982). There is little knowledge of its population status. Has not been officially reported for any protected area. Principal threats are uncontrolled hunting and habitat destruction.

Felis yagouaroundi (jaguarunda; onza, gato cervantes)

Scattered lowlands locations thorughout Venezuela (Handley 1976). Little is known about its population status, and has been officially reported for Guatopo and Henri Pittier (Eisenberg et al. 1975, Thornback and Jenkins 1982). It faces the same problems that the other big cats for the region.

Felis wiedii (margay; gato pintado)

Scattered lowlands localities in northern and southern Venezuela (Handley 1976). Little information on its population status. Found in Guatopo. Listed in vulnerable condition (Thornback and Jenkins 1980).

Panthera (=Felis) onca (jaguar; yaguar, tigre)

Reported for 12 protected areas (IUCN 1982). Same problems as for the other cats.

Trichechus manatus (caribbean manatee; manatí, vaca)

Scattered through the Orinoco and Maracaibo Basins where they are very scarce (Thornback and Jenkins 1982). Heavily hunted. Not officially reported for any protected area.

Tapirus pinchaque (mountain tapir; danta de paramo, tapir andino)

In the Andes where habitat loss represents a major problem. Not officially reported for any protected area.

4.1.3.2. Birds

There is little agreement on which of the Venezuelan bird species are under some risk of being exterminated. The following list is a composite of those for which there is solid evidence of being threatened.

Tinamus tao (gray tinamou; gallina azul)

In humid areas in rain and cloud forests of the Maracaibo Lake Basin, Andes, and Central Coast Mountain range it is very difficult to observe (Meyer and Phelps 1978), but it is frequently hunted. Found in Guatopo, the Tinamidae has been reported as a family of unusual resistance or susceptibility to extinction (Terburgh and Winter 1980).

Phoenicopterus ruber (greater flamingo; flamenco)

In the Falcón coastline, Laguna de Tacarigua (Miranda), and several of the nearby Caribbean islands. The largest population is in Falcón (Meyer and Phelps 1978) where one of its major feeding sites is being disturbed by the army tests of surface-to-surface rockets. Seen in the Laguna de Tacarigua and Morrocoy National Parks.

Netta (=Aythya) erythrophthalma (southern pochard; pato negro)

In the Maracaibo Lake Basin and Aragua state (Meyer and Phelps 1978). The largest population seems to be at the southern end of the Maracaibo lake (King 1981). Protected by law as Aythya erythrophthalma. Not officially reported for any protected area but its presence in Juan Manuel Aguas Blancas y Aguas Negras is possible.

Cairina moschata (myscory duck; pato real)

In the Orinoco Basin (including the Delta). No statistical accounts on population status, but is hunted despite legal protection (King 1981). Not officially mentioned for any protected area, but should be at the Aguaro-Guariquito.

Morphnus guianensis (harpy eagle; águila morena)

In the Maracaibo basin and Aragua state (Meyer and Phelps 1978). It is very rare. Hunted. Not officially reported for any protected area.

Harpia harpyia (harpy eagle; águila harpía)

Central Coastal range and Guayana areas (Meyer and Phelps 1978). No population data, but it is rare. Threatened by habitat distruction and hunting. Not officially reported for any protected area but probably in Canaima.

Falco peregrinus (peregrine falcon; halcón peregrino)

A migratory bird seen in several of the Venezuelan caribbean islands and central coast areas. There is not precise population information.

Reported for Las Tetas de Maria Guevara and Los Roques (IUCN 1982, Meyer and Phelps 1978). Gene banks of this species are available (Conway 1980) and reintroduction is possible (Campbell 1970).

Crax daubentoni (yellow-knobbed curassaw; paují de copete)

Throughout all Venezuela, except for the Guayana Highlands. Population studies are scarce (Thomas 1979). Reported for El Guacharo National Park.

Rupicola rupicola (Guiana cock-of-the-rock: gallo de las rocas)

In the Guayana Highlands and Amazonas Lowlands. Rare and sought after as an ornamental bird. Not officially reported for any protected area but possibly at Camaima.

Carduelis (=Spinus) cucullatus (red siskin; cardenalito)

Locally present in some areas difficult to reach in the Central Mountain range (Meyer and Phelps 1978). Without a question the most endangered bird specie of Venezuela, persecuted by bird catchers because of its popularity as a cage bird. Not officially reported for any protected area.

4.1.3.3. Reptiles

Pseudemys (=Chrysemys) scripta callirostris

Restricted to few locations in the northwest of the Maracaibo Lake Basin. Heavily hunted and the eggs are greatly collected, particularly during the Holy Week. Another subspecies (P.s. chichirivichi) is endemic to Venezuela (Pritchard and Trebbau 1984). This species is neither protected by law nor reported in any protected area.

Geochelone carbonaria (red-foot turtoize; morrocoy sabanero)

For most of Venezuela, except for the Andes and T.F. Amazonas. Hunted for food. Six hundred (600) individuals were confiscated at one place and time in Venezuela (Groombridge 1982). Not officially mentioned for any protected area.

Chelonia mydas (green sea turtle; tortuga verde)

Nesting sites in Margarita, La Tortuga, Los Roques, and in Cumaná as well as in Isla de Aves. Foraging areas in the Golfo Paria; feeding areas in the Guajira and Paraguana Peninsulas. Between 600 and 2,000 green turtles nest annually at the Isla de Aves. Hurricane David removed most of the sand from the Islands in 1979, but it has now mostly been restored by wind and wave action (Groombridge 1982). The current situation is improving (Gomez Carredano 1980). Found in Los Roques and Isla de Aves as protected areas.

Eretmochelys imbricata (hawksbill sea turtle; tortuga carey)

In Los Roques, Margarita, and Tortuga Island. In 1979, a total of 57 nests were recorded in the 28 Km of Los Roques. Commercial fishing is a major problem for the hawksbill. Found in the same protected areas mentioned above.

Podocnemis erythrocephala (South American river turtle; tortuga)

In the Orinoco Basin. It is a food source. Not offically reported for any protected area.

Podocnemis expansa (arrau; tortuga arrau)

In the Orinoco Basin. The population decline has been dramatic; from 330,000 in 1799, to less than 5,000 in 1981 (Groombridge 1982). Seriously affected by a number of motorized cargo-boats which disturb the nesting beaches during the breeding season. Reported for the Aguaro - Guariquito National Park.

Podocnemis unifilis (yellow spotted sideneck turtle; teracay)

In Los Llanos and southwest Amazonian lowlands (Pritchard and Trebbau 1984). The most heavily exploited turtle as food source in Venezuela (Groombridge 1982). Not protected for most, if not at all, of its range.

Caiman crocodilus crocodilus (spectacled caimán; baba)

In the Orinoco Basin. Still healthy populations, but is easily hunted, which makes it a vulnerable species (Staton and Dixon 1977). Not reported for protected areas.

Caiman crocodilus fuscus (brown caimán; babilla)

Most of central and southern Venezuela (Brazaitis 1973). Has always been rare, but does not appear to be subject of intensive hunting pressures (Groombridge 1982). Found in Aguaro - Guariquito.

Crocodylus acutus (American crocodile; caimán de la costa)

Formally found throughout the Venezuelan Coast; today it is restricted to the Morrocoy National Park and the Gulf of Cuare. Also found in the Laguna de Tacarigua and Laguna de las Marites. It has been over exploited.

Crocodylus intermedius (Orinoco crocodile; caiman del Orinoco)

Orinoco Basin (Brazaitis 1973). It is a very rare species and has been heavily depleted. There may be 1,000 individuals left. In the 30's one could buy up to 4,000 skins in a single transaction. Found in Aguaro - Guariquito. There are some breeding efforts in the Camatagua Reservoir.

4.1.3.4. Amphibians

No amphibian is currently listed as endangered for Venezuela. However, since 43.18% of the Venezuelan amphibians are endemic, these animals should be watched closely. No amphibian species is listed as legally protected.

4.1.3.5. Fishes

Again there is a high level of endemism (12.97%) for Venezuelan fishes (Mago 1970). Many of these species are from basins heavily affected by pollution (pesticides) and changes in the hydrological balance (dams). The most threatened basins are: Rio Tuy - Guárico River, Valencia Lake, Mazanares - Guarapiche, and Pao - Yaracuy - Tocuyo - Aroa. The four species of the Valencia Lake are endangered, particularly Moenkhausia pittieri. Some local populations require close monitoring (Romero 1985a,b). Introduction of exotic species also poses ecological problems (Mago 1978). Only one species of fish (Arapaima gigas or piranuco) is protected by law (Fuller and Swift 1984). Still many fish species have yet to be discovered and their ecology remains fully understood (Roberts 1973).

4.1.3.6. Invertebrates

The butterfly tribe Pronophilini of the family Satyridae has a high level of endemism (33%) for the Venezuelan Andes and the Sierra de Perija. Each species is restricted by altitude and most of them live around 2,500 meters (Adams and Bernard 1979, 1981). Wells et al. (1983) consider these butterflies very rare. There are no population studies, but their habitat is so restricted that many of them might become easily extinct by habitat distruction of the areas in which they are under heavy population pressure. They are not protected by law.

Recently, a group of marine gastropods was found in the Golfo Triste (northeastern Venezuela). This group is a relictual one whose closest relatives have been traced to the Miocene (Penchoszadeh 1982) since these and other species of mollusks are of commercial value in that area (which is not protected by law), they are potentially vulnerable.

4.1.3.7. Plants

Although there is still much to discover regarding the Venezuelan flora (Toledo 1985), current information reveals high diversity and high levels of endemism for areas such as the Guayana Highlands and the cloud forests of the Andes, the Perija mountains, and the Central Coast Range (Steyermark 1977, 1979). The knowledge of the status of threatened and endangered species is also incomplete, but current information suggest serious problems for the near future.

Lucas and Synge (1978) cite two bromiliads (Aechmea dichlamydea and Glomeropitcairnia erectiflora) as vulnerable. A. dichlamydea var. pariaensis is found only in the Paria Peninsula (Smith 1971) most of it being a national park). B. erectiflora is found in both Paria Peninsula and Margarita Island in the Cerro de Copey (Smith 1971) (also a national park). Their status is a product of their rarity in general and fragility in Trinidad than to anything else.

Steyermark (1977) mentioned about 40 species of plants belonging to diverse upper taxa which he considers either threatened or endangered. He listed as forces of distruction of the flora factors such as habitat destruction, over collecting by amateurs (particularly orchids - a narrative of overcollecting can be found in MacDonald 1939), and logging. Although no plant species has yet been exterminated, there is little question that there should be much concern for those of limited range and/or under human population/agricultural pressure such as the Andes, the Central Coastal range, and the Maracaibo Lake Basin.

5. SUMMARY OF DEFORESTATION/LAND CONVERSION: RATES AND PATTERNS

Although there are not too many precise and up-to-date figures on the rate of deforestation in Venezuela, certain statistics are enlighting.

Toledo (1985), for example, calculated that there was 45% of remaining natural vegetation in Venezuela, and that for the period 1981-1985 the rhythm of deforestation would be of 1,250 Km^2/year, i.e., 0.4% of the remaining natural

vegetations. When this rate is compared with the one of other countries of tropical America, it is below the average (Office of Technology Assessment 1984). This same source characterizes the condition of the closed forest for Venezuela as follows: undisturbed = 24%; logged = 36%; managed = no data; physically unproductive = 26%; protected = 14%.

However, the trend mentioned above is not evenly distributed across the country. While 89% of the tropical moist forest is located south of the Orinoco River, 33% of this type of forest disappeared between 1951 and 1975 from the other half of the country (Myers 1980). This author suggested that "if present exploitation trends persist (and they are likely to accelerate), within another two decades, this northern forest area could be reduced to only 14,000 Km^2 or less. Other exploitation and human development will continue to alter drastically this area (National Academy of Sciences 1980)".

In consequence, it is clear that although deforestation rate is not as high as it is in many countries, Venezuela's deforestation problem is located in the northern belt making the problem locally dramatic.

6. RECOMMENDATIONS FOR AREAS OF MOST IMMEDIATE CONCERN FOR PROTECTION

From the information presented above, it is clear that the general areas of most immediate concern for protection in Venezuela are the Andes, the Central Coastal Range, and the Maracaibo Lake Basin. This recommendation is supported by the fact that these areas are characterized by:

a) The high level of biotic (life zones, vegetation types, taxa) diversity.

b) The high number of little or not protected life zones and vegetation types.

c) The small overall surface protected when compared with the total surface area protected south of the Orinoco River.

d) The presence of a large number of endangered species in critical situation (spider monkeys, bushdogs, spectacled bear, big cats, mountain tapir, gray tinamo, southern pochard, crested eagle, harpy eagle, peregrine falcon, yellow-knobbed curassow, red siskin, brown caiman, American crocodile, several species of endemic ammphibian, fishes, and invertebrates, and orchids).

e) Their high deforestation rate.

f) They contain the largest concentration of human population.

Other areas in which more specific problems are found are the following:

a) The Llanos: Although it has a low human population density, only one big protected area (Aguaro - Guariquito) is found there, and some consider that it does not represent the entire Llanos's ecosystem (E. Medina, personal communication). The Llanos also represent a problem regarding many species found there that are in some level of danger, such as primates, giant anteater, giant armadillo, giant otter, big cats, manatee, muscorry duck, tortoises, turtles, caiman, crocodile, some endemic fishes, and many vegetation units.

b) The Orinoco Delta: A little known but unique ecosystem with only a forest reserve covering part of it.

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APPENDIX 1

Established and Protected Areas of Venezuela

Based on Hamilton 1976, Witterberg et al. 1985; and Ministerio del Ambiente y de los Recursos Naturales Renovables Map of "Ubicación de las áreas bajo régimen especial".

A1.1.: National Parks (Management category, IUCN = II)

No.	Name	Year established	State location	Area Km^2	Disturbances	% of Life Zones They Include
1	Canaima	1962	Bolívar	30,000	Mine exploration, fire, logging, farming, hunting	18.19
2	La Neblina	1978	T.F. Amazonas	13,600	-	18.19
3	Aguaro-Guariquito	1974	Guárico	5,690	Farming, oil-dwelling	4.55
4	Jáva-Sari-sari-ñama	1978	Bolívar	3,300	-	9.09
5	Yapacana	1978	T.F. Amazonas	3,200	-	4.55
6	Sierra de Perijá	1978	Zulia	2,952.88	Farming	18.19
7	Sierra Nevada	1952	Mérida and Barinas	2,672	Farming	50.00
8	Archipiélago Los Roques	1972	Caribbean is. Federal Depcy.	2,251.53	Occupation by native fishermen	4.55
9	Duida-Marahuaca	1978	T.F. Amazonas	2,100	-	13.64
10	El Tamá	1978	Táchira and Apure	1,390	Coffee plantations	22.73

A1.1 National Parks (Management category, IUCN II) - Continued

11	Henri Pittier	1937	Aragua and Carabobo	1,078	Farming, fire, logging, hunting	22.73
12	Mochima	1973	Sucre and Anzoátegui	949.35	Farming, fire, fishermen activities, littering	18.19
13	Guatopo	1958	Miranda and Guárico	926.4	Farming, fire, hunting	9.09
14	Médamos de Coro	1974	Falcón	912.8	Farming, fishing, littering	4.55
15	El Avila	1958	D.F. and Miranda	851.92	Farming, fire, littering	31.82
16	Península de Paria	1978	Sucre	375	Farming	9.09
17	Morrocoy	1974	Falcón	320.9	Marine pollution, fire	4.55
18	Yurubí	1960	Yaracuy	236.7	Farming	13.64
19	Laguna de Tacarigua	1974	Miranda	184	Man-Hidrological disturbances, farming, logging, hunting	4.55
20	Terepaima	1976	Lara and Portuguesa	169.71	Farming, logging, fire	22.73
21	El Guácharo	1975	Monogas and Sucre	155	Farming	13.64
22	Macarao	1973	D.F. and Miranda	* 150	Damp	22.73
23	Yacambú	1962	Trujillo	145.8	Farming, damping,	9.09
24	Laguna de la Restinga	1974	Nueva Esparta	107	Small boat trafic, electric lines, hunting, logging, microbial pollution of the water.	4.55
25	Cueva de la Quebrada del Toro	1969	Falcón	85	Farming	4.55
26	Cerro El Copey	1974	Nueva Esparta	71.3	Mining, farming, hunting, air pollution, by fire or litter, plant collection	9.09

A.1.2.: National Monuments (IUCN Category = III)

1	Maria Lionza	1960	Yaracuy	96.90	Witchcraft activities, farming	9.09
2	Laguna de las Marites	1974	Nueva Esparta	36.74	Hunting of caimans and rabbits	4.55
3	Cerro Santa Ana	1972	Falcón	19	Farming, logging	4.55
4	Cerros Matasiete y Guayamuri	1974	Nueva Esparta	16.72	-	4.55
5	Las Tetas de Maria Guevara	1974	Nueva Esparta	16.70	Water pollution, littering, hunting	4.55
6	Aristídas Rojas	1949	Guarico	16.3	Fire, hunting, farming	9.09
7	Alejandro de Humboldt	1949	Monagas	1.81	-	(cave)
8	Chorrera de Las Gonzaley	1980	Merida	1.26	-	?
9	Morros de Macaira	1978	Guárico	0.99	-	4.55
10	Cueva Alfredo Jahn	1978	Miranda	0.58	-	(cave)
11	Cerro Autana	1978	T.F.Amazonas	0.3	-	4.55
12	Laguna de Urao	1979		0.29	?	?
13	Piedra de Cocuy	1978	T.F.Amazonas	0.15	-	4.55

A.1.3. Faunal Refuges (IUCN category = IV)

1	Juan Manuel de Aguas Blancas y Aguas Negras	1975	Zulia	2,277.95	Hunting and fishing (IUCN = VIII)	9.09
2	Chiriguare	1974	Portuguesa Barinas	445	Fishing and hunting	4.55
3	Cuare	1972	Falcón	118.25	Tourism, hunting	4.55
4	Isla de Aves	1972	Caribbean Island Fed. Dependency	0.04	Tourism, army activities	4.55

A.1.4. Forest Reserves (IUCN category = VIII)

No.	Name	Year Established	Location	Area when created (km^2)	Estimated Area(1975) (km^2)
1	El Caura	1968	Bolivar	51,340	=
2	Imataca	1961	Bolivar, T.F. Delta Amacuro	32,032.5	
3	Sipapo	1963	T.F.Amazonas	12,155	=
4	La Paragua	1968	Sucre, T.F. Delta Amacuro	7,820	?
5	San Camilo	1961	Apure	4,500	2,800
6	Guarapiche	1963	Sucre, T.F. Delta Amacuro	3,700	=
7	Ticoporo	1955	Barinas	18,647	1,560
8	Caparo	1961	Barinas	1,743.7	1,690
9	Turen	1950	Cojedes, Portuguesa	1,164	220
10	Río Tocuyo	1968	Falcón, Yaracuy	466	?

A.1.5. Proposed National Parks

1. Orinoquía (T.F. Amazonas)
2. Páramo La Cimarroera (Tachira)
3. Cerron - Empalado (Lara)
4. Sinaruco - Caparaparo (Apure)
5. Guariquen
6. Delta del Orinoco (T.F. Delta Amacuro)
7. Isla Tortuga (Caribbean Islands, Federal Dependency)
8. Archipilago Las Aves (Caribbean Islands, Federal Dependency)
9. Los Testigos - Los Frailes (Caribbean Islands, Federal Dependency)
10. La Blanquilla - Los Hermanos (Caribbean Islands, Federal Dependency)
11. Macarrao
12. Lago de Valencia (Carabobo and Aragua)
13. San Esteban (Carabobo)

A.1.6. Other Proposed Protected Areas

A.1.6.1. National Monuments/National Landmark (IUCN category III)

1. Galeras de Guaruman Natural Monument
2. Palmar del Estero de Camaguán

A.1.6.2. Biosphere Reserve (IUCN category IV)

1. Páramo El Aguila
2. Serranía La Neblina National Park (T.F. Amazonas)
3. Canaima National Park (Bolivar)

A.1.6.3. World Heritage Site

1. Angel Falls and Auyan-Tepuy (Bolívar)
2. Cueva del Guácharo National Park (Monagas)
3. Java-sari-sari-nama National Park
4. Henri Pittier National Park

TABLE I

Life Zones, Total Areas, Percentage of the country they occupy and Percentage of the protected areas in which they are represented (From Ewel et al. 1976)

		Area		
	Life Zone	Km^2	% Country	% of the protected areas in which they are represented
md-T	Maleza desértica tropical	270	0.30	4.65
me-T	Monte espinoso tropical	9,333	1.02	11.63
bms-T	Bosque muy seco tropical	26,630	2.91	11.62
bs-T	Bosque seco tropical	342,660	37.60	27.91
bh-T	Bosque húmedo tropical	250,580	27.50	20.93
bmh-T	Bosque muy húmedo tropical	20,810	2.18	6.98
me-P	Monte espinoso premontano	4,790	0.52	2.33
bs-P	Bosque seco premontano	12,020	1.40	13.95
bh-P	Bosque húmedo premontano	50,210	5.52	32.56
bmh-P	Bosque muy húmedo premontano	122,620	13.44	25.58
bp-P	Bosque pluvial premontano	38,300	4.19	6.98
bs-MB	Bosque seco montano bajo	800	0.08	2.33
bh-MB	Bosque húmedo montano bajo	3,690	0.44	6.98
bmh-MB	Bosque muy húmedo montano bajo	11,370	1.24	20.93
bp-MB	Bosque pluvial montano bajo	12,127	1.32	9.30
bh-M	Bosque húmedo montano	180	0.01	0.00
bmh-M	Bosque muy húmedo montano	2,210	0.24	2.33
bp-M	Bosque pluvial montano	2,180	0.23	9.30
p-SA, pp-SA, tp-A and N	Páramo y Páramo pluvial subalpino Tundra pluvial alpino, Nival	1,270	0.13	2.33
	TOTAL	912,050	100	

TABLE II

Vegetation Types, Their Total Areas and Percentages They Occupy In Venezuela (Based on Organización de las Naciones Unidas para la Agricultura y la Alimentación 1981).

Type and Code	Total Area Km^2	% of the Country
Tropical ombrophilous lowland forest (IA 1a)	201,500	22.09
Tropical evergreen seasonal lowland forest (IA 2a)	41,100	4.50
Tropical ombrophilous submontane forest (IA 1b)	96,100	10.54
Tropical evergreen seasonal submontane forest (IA 2b)	9,700	1.06
Tropical ombrophilous cloud forest (IA 1e)	1,400	0.15
Tropical evergreen seasonal montane forest (IA 2c)	10,600	1.16
Tropical ombrophilous submontane forest (IA 1b)	7,900	0.87
Tropical ombrophilous swamp forest (IA 1g)	46,400	5.09
Mangrove forest (IA 5)	2,600	0.29
Purely deciduous thorn forest (IC 2b)	20,500	2.25
Drought-deciduos broad-leaved lowland and submontane woodland (II B1a)	6,700	0.73
Purely deciduous thorn woodland (II C2b)	5,900	0.65
Thorn-woodland (II C2)	4,700	0.52
Tall grassland with a tree synusia broad-leaved evergreen (VA 2a)	277,100	30.38
Drought-deciduous scrub w/o evergreen woody plants admixed (III B2)	2,700	0.30
Deciduous subdesert shrubland with succulents (III C2b)	600	0.07
Tropical alpine open to closed bunch grass communities with woody synusia of tuft plants (VC 5a)	4,000	0.44
Areas w/o woody plants	56,850	6.23
Man-altered formations	96,800	10.6
Unaccounted for	18,900	2.07
TOTAL	912,050	100

TABLE III

Types of forests in Venezuela

A) Classification by the Office of Technology Assessment (1984)

Type	Area (Km^2)	% of the Country
Closed forest	318,700	34.94
Open forest	33,000	3.62
Shrubland	21,200	2.32
Forest follow	106,500	11.68
Forest plantations	1,245	0.14
	480,645	52.70

B) Classification by Myers (1980, p. 149 - 150) (rain forests only)

Type	Area (Km^2)	% of the Country
Primary rainforest	353,310	38.63
Evergreen rainforest	167,000	18.31
Deciduous rainforest	94,000	10.31
Montane rainforest	20,000	2.19
	633,310	69.44

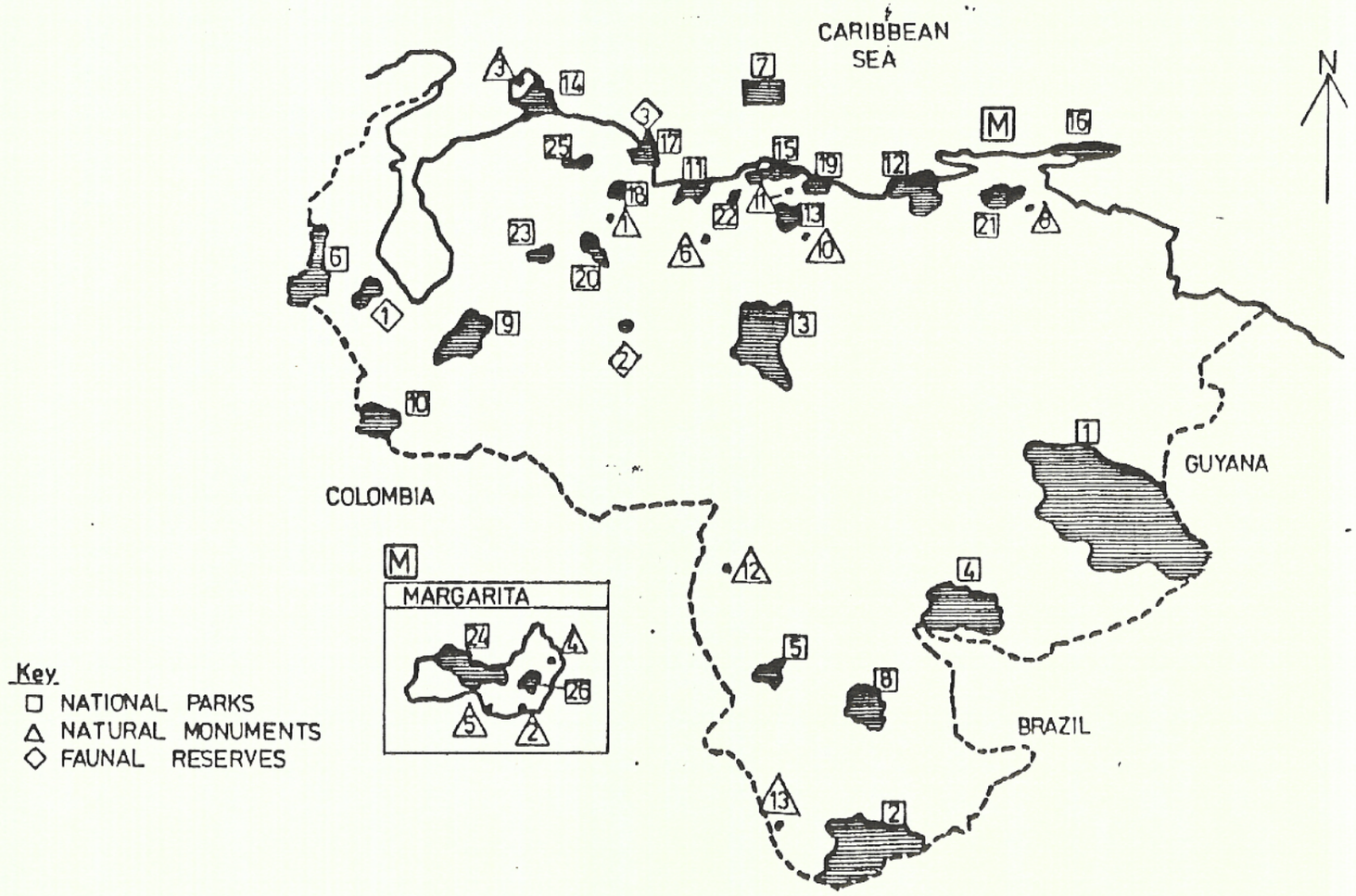
TABLE IV

Diversity of Taxa

Taxon	a spp. in the world	b spp. in Venezuela	c % Venezuelan spp./world	d Venezuelan endemic	e Endangered rare, etc.	f Overlap of d and e
Mammals	4,170 (1)	305 (2)	7.31	7 (2)	15 (2)	0
Birds	9,198 (3)	1,294 (4)	14.07	36 (4)	6-13 (4,5)	0-2
- Reptiles (6)						
- Turtles	230 (7)	23 (7)	10.00	1 (7,8)	7 (9)	0
- Crocodiles	21 (10)	5 (10)	24.00	0	3 (9)	0
- Snakes	2,700 (11)	149 (12)	5.52	26	?	-
Amphibians	3,373 (13)	176 (14)	5.22	76 (14)	?	-
Fishes	21,595 (15)	1,195 (16)	5.53	155 (16)	4 (19)	4
Plants	400,000 (17)	25,000 (18)	6.00	33 (19)	? (20)	-

(1) After Honecki et al. (1982)
(2) The Nature Conservancy Latin America Biogeography Project reference 85-34
(3) After Clements (1981)
(4) The Nature Conservancy Latin America Biogeography Project reference 85-36
(5) After King (1981)
(6) There is no up-to-date and reliable data for the reptiles as a whole
(7) After Pritchard and Trebbau (1984)
(8) Phryonops (Batrachemys) zuliae in the Maracaibo Basin. Also, Pritchard and Trebbau (1984) mention an endemic subspecies Pseudemys scripta chichiriviche
(9) After Groombridge (1982)
(10) After Brazaitis (1973)
(11) Goin and Goin (1971)
(12) After Lancini (1979)
(13) U.S. Fish and Wildlife Service (1978)
(14) The Nature Conservancy Latin America Biogeography Project reference 85-28
(15) After Cohen (1970)
(16) After Mago (1970)
(17) L.D. Gómez, personal communication
(18) Toledo (1985)
(19) After Mago (1978)
(20) Unspecified but might be large

Map of location of protected areas (sensu this document, p.8) Venezuela (from IUCN Directory of neotropical protcted areas 1982)



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