



PARKS WATCH

FORTALECIENDO LAS AREAS PROTEGIDAS PARA CONSERVAR LA BIODIVERSIDAD

Park Profile – Venezuela Peninsula de Paria National Park



Humid forests reach the cliffs

Date of most recent on-site evaluation: March 2005

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Location: Sucre State

Year created: 1978

Area: 37.500 ha

Ecoregions: Mountane Forests of the Coastal Cordillera,
Araya and Paria Xeric Scrub

Habitats: Dry tropical forest, premontane wet forest



SUMMARY



Humid forests of the northern coast of the Paria Peninsula

The Peninsula de Paria National Park is located in the eastern end of the Coastal Cordillera, in the montane area of the Paria Peninsula. It protects a diverse set of landscapes, from coastal inlets, such as Don Pedro and Uquire, to mountain landscapes including the highest elevations in the peninsula, El Patao Hill, with 1,070 meters above sea level (masl) and El Humo Hill with 1,371 masl (MARN 1992, Fernández and Michelangeli 2003).

Biodiversity

The flora in the cloud forests of the Paria Peninsula correlates with that of the Amazon and Guyana regions in southern Venezuela and with the nearby islands of Trinidad and Tobago (Steyermark 1973, Steyermark 1974). Plant endemism levels are high, with 29 species occurring only in cloud forests, such as orchids, bromeliads and ferns (Steyermark 1979, Fernández y Michelangeli 2003). The fauna is diverse and rich in species, particularly for birds. About 27% of the bird species in Venezuela have been reported in the Park (Sharpe 1997, Lentino 1997). One of its highlights is the scissor-tailed hummingbird (*Hylonympha macrocerca*), endemic to Paria. Many mammal species are shared with the Guyana region, including the two-toed and three-toed sloth (*Choloepus didactylus* and *Bradypus tridactylus*) and the silky anteater (*Cyclopes didactylus*) (Linares 1998).

Threats

The Peninsula de Paria National Park is considered **vulnerable**. Constant monitoring is required to ensure its protection and the maintenance of biological diversity in the midterm. One of the main threats is agriculture in areas adjacent to the Park. *Conuco* (parcel of land owned by small farmers) agriculture is expanding towards the protected area, clearing montane forests in the peninsula. Other threats include illegal hunting, wood logging, and the lack of human resources and adequate management equipment for park rangers.

DESCRIPTION

Geography



Cerro Humo (Smoke Hill) is the highest in the Park

The Peninsula de Paria National Park is located in the eastern end of the Coastal Cordillera, in northeastern Venezuela, in the montane area of the Paria Peninsula. It stretches from the proximities of the Tres Puntas Cape to the Paria Headlands, including also the Patos Island and a few islets in the Boca del Dragon strait. The Serrania de Paria crosses the park east to west as a narrow mountain chain, reaching its highest elevations in El Patao Hill, with 1,070 masl and El Humo hill with 1.371 masl (Fernández and Michelangeli 2003, MARN 1992). As the rest of the Coastal Cordillera, these mountains started to rise during the Eocene, 45 million years ago. From the quaternary to the present, erosion has produced large sediment accumulations in the southern slopes of the sierra, in the area known as the fluvial-costal plain of the Paria Gulf (González de Juana et al. 1980). This is the area where most population centers in the peninsula are located, including the town of Macuro, the first mainland site visited by Cristobal Colón in the continent (MARN 1992).

The park also includes costal landscapes to the north and east of the peninsula. In the northern shoreline, facing the Caribbean Sea, highlights include the enchanting landscapes of the Mejillones, Don Pedro and Uquire Coves, and the Paria Headlands, where rain forest vegetation reaches the very edge of the cliffs (Michelangeli 2003). In the northern face, steep slopes of up to 45 degrees dominate. Water courses are short, straight and of high erosive power. In contrast, the southern side of the sierra has gentler slopes of 25-35 degrees. Rivers are longer, their courses draining into the adjacent plains and then flowing into the Paria Gulf (Gremone y Capobianco 1985, Fernández y Michelangeli 2003). There are numerous terrestrial and marine caves, of which more than 330 have been explored (FUDECI 1990).



Map of the Peninsula de Paria National Park (source: Tapiquén y col. 2004)

The climate is warm and rainy, characteristic of subhumid tropophilous forests, with average annual temperatures ranging between 59⁰ F and 79⁰ F, and annual rainfall averages between 1000 mm and 1500 mm (Gabaldón 1992, MARN 1992). The rainy season extends between May and November, with a drier period between January and April. El Humo Hill receives the highest rainfall, with up to 2000 mm per year. The entire Paria region is influenced by the northeastern trade winds and the movements of the intertropical convergence zone (Fernández and Michelangeli 2003).

Biodiversity



The cloud forests show high levels of endemism

The forests in Paria are considered relictual. The flora is related with vegetation found far south in the Amazonia and Guyana regions of Venezuela and with that of Trinidad and Tobago (Steyermark 1973, Steyermark 1974). Compared to adjacent areas, endemism levels are high (MARN 2000), with 29 endemic species exclusive to the cloud forests, including orchids, bromeliads and ferns (Steyermark 1979, Michelangeli 2003).

Evergreen wet forests occur between 400 and 800 masl, with tree species such as the guiana chesnut (*Pachira aquatica*), erizo (*Sloanea guianensis*), *Licania heteromorpha*, *Laplacea fruticosa*, laurelillo (*Aniba* sp.) and carapa (*Carapa guianensis*). Among shrubs, the most abundant include *Psycotria poeppigiana*, *Meriania longifolia*, *Mabea*

sp., *Clidemia debilis*, *Witheringia solanacea* and *Tabernaemontana undulata*. Also abundant are herbs such as *Becquerelia cymosa*, *Calathea casupito*, *Nautilocalyx* sp. and *Begonia humilis*, as well as epiphytes growing in all forest canopy strata (Fernández and Michelangeli 2003).

Cloud forests in the region are influenced by the humid winds coming from the sea, which condense forming clouds as they ascend along the mountain flanks. These forests occur at the summits of El Humo and El Patao Hills and in a small sector of La Cerbatana Hill. Because of the steep slopes, trees tend to be relatively sparse and not very tall. However, in narrow mountain valleys and next to river banks, some trees may reach heights of up to 25 m. This vegetation has high levels of species richness, harboring endemic species and plants that can only be found in the Venezuelan Amazon or in Trinidad and Tobago (Fernández and Michelangeli 2003).

The cloud forests of the Serranía de Paria start around 750 masl, at lower altitudes than in the rest of the country (Steyermark and Huber 1978). This has been explained in terms of the phenomenon known as the “Massenerhebung Effect” (Grubb 1971), which links local conditions in isolated mountain ranges with the altitudinal displacement of vegetation belts.

The most common trees and shrubs in these forests include: hayo (*Erythroxylum* sp.), *Aniba megaphylla*, *Schoenobiblos grandiflora*, *Dussia martinicensis*, *Tocota broadwayii*, *Chrysoclamys membranacea*, *Tovomita* sp. and palms such as palmillo (*Prestoea pubigera*), cubarro (*Bactris* sp.), *Geonoma* sp. and *Asplundia moritziana*. Among ferns we find *Polybotrya cervina*, *Danaea moritziana*, *Trichomanes fimbriatum*, *Asplenium serra*, *Dryopteris leprieurii* and several species of *Selaginella* and *Hymenophyllum*. Some frequent herbs and small shrubs in the understory include *Mapania pycnocephala*, *Besleria mortoniana*, licorice pepper (*Piper dilatatum*) and terrestrial orchids (Fernández and Michelangeli 2003).

Among the endemic species found are the orchids *Epidendrum dunstervilleorum* and *Lepanthes pariensis*, the palm *Aristevera ramose*, several Rubiaceae such as *Ixora agustiniana* and *Psychotria pariensis*, the Cyclantaceae *Asplundia pariensis*, the Bromeliad *Guzmania membranacea* and the tree fern *Trichipteris steyermarkii* (Steyermark 1973, Steyermark 1979). Interestingly, several species thought to be endemic of Trinidad and Tobago were later found in the park, including *Selaginella hartii*, *Anthurium aripoense*, *Tococa broadwayii*, *Cyphomandra tobagensis* and *Solanum ierense* (Steyermark 1973, Steyermark 1979).

In some cases, species from the Amazon-Guyana region are found at hill summits in the peninsula. Examples include the Melastomataceae shrub *Platycentrum clidemoides* and the orchid *Scaphyglottis grandiflora*. In other cases, Paria species belong to genera whose main distribution center is located in the Amazon-Guyana region, but which have undergone subsequent speciation in Paria. These include genera such as *Elvasia*, *Mapania*, *Mouriri*, *Quina*, *Marilla* and *Cespedezia*. Other group of species considered relictual, occurs in other countries but has not been reported in other locations outside of Paria in Venezuela. These include the fern *Dryopteris leprieurii*, the orchid *Triphora cubensis* and the bromeliad *Aechmea aripensis* (Steyermark 1973, 1974, 1979).

The park's flora includes several threatened species. In the vulnerable category we find species such as the carapa (*C. guianensis*), palmillo (*Prestoea pubigera*), macanilla (*Bactris setulosa*), palmita (*Geonoma interrupta*) and *Stephanopodium venezuelanum*, all of which can only be found in the cloud forests of the Coastal Cordillera. In the endangered category are *Selaginella hartii* and *Aechmea aripensis*, with distributions restricted to the Paria peninsula. In both cases, the expansion of the agricultural frontier constitutes the main threat for conservation (Llamoza et al. 2003).

The park's fauna is varied and species-rich, especially for birds: 359 species have been reported in the national park and its adjacent areas (Sharpe 1997). This represents 27% of the total number of bird species in the country (Lentino 1997). The geographic isolation of the Serrania de Paria from the rest of mountain areas in Venezuela turns the park into a "mainland island", favoring the development of endemism (Fernandez and Michelangeli 2003). In fact, together with the Turimiquire Massif, the Serrania de Paria is considered one of the most important areas for bird endemism in the world (BirdLife International 2003).

Among the group of species found only in Paria are the scissor-tailed hummingbird (*Hylonympha macrocerca*) and the Paria redstart (*Myioborus pariae*). There is another group of endemic species whose habitat is restricted to the Paria and Turimiquire sierras in the eastern massif and to the central section of the Coastal Cordillera. These include the white-tailed sabrewing (*Campylopterus ensipennis*), the venezuelan flower-piercer (*Diglossa venezuelensis*), the tepuy parakeet (*Nannopsittaca panychlora*), the white-throated barbtail (*Premnoplex tatei*) and *Pripeola formosa*. Three of these species are endangered: the Paria redstart, the venezuelan flower-piercer and the white-throated barbtail (Rodriguez and Rojas-Suárez 1999).

Hummingbirds are probably the most bright and colorful birds that inhabit the park. Of the 97 species reported in Venezuela, at least 33 can be found in Paria, including many endemic to Venezuela such as the green-tailed emerald (*Chlorostilbon alicia*), the copper-romped hummingbird (*Amazilia tobaci*) and the rufous-shafted woodstar (*Chaetocercus jourdani*) (MARN 1992, Sharpe 1997). Among other bird groups, the most common are the trogons and quetzals (Trogonidae), the typical antbirds (Thamnophilidae), the flycatchers (Tyrannidae), thrushes (Turdidae), warblers (Parulidae) and the tanagers (Thraupidae). In the rocky shores, pelicans (*Pelecanus occidentalis*) and the brown booby (*Sula leucogaster*) are particularly abundant (Sharpe 1997).

Regarding mammals, many different species shared with the Guyana region stand out, the Orinoco delta serving as a connecting bridge between both regions. Among these we find the two-toed and three-toed sloths (*Choloepus didactylus* and *Bradypus tridactylus*) and the silky anteater (*Cyclopes didactylus*) (Linares 1998). Other common species include the southern tamandua (*Tamandua tetradactyla*), the armadillo (*Dasybus novemcinctus*), the howler monkey (*Alouatta seniculus*), the weeper capuchin (*Cebus olivaceus*), the collared peccary (*Tayassu tajacu*), the red brocket deer (*Mazama americana*) and the white-tailed deer (*Odocoileus virginianus*).

There are numerous species with nocturnal habits such as the paca (*Agouti paca*), the brazilian agouti (*Dasyprocta leporina*), the rice rat (*Oryzomys capito*), the spear-nosed bat (*Phyllostomus hastatus*) and the sharp-nosed bat (*Rynchonycteris naso*). Among

felids we find the jaguarondi (*Herpailurus yagouaroundi*), the ocelot (*Leopardus pardalis*) and the jaguar (*Panthera onca*). Near the park's coasts, cetaceans such as the South American dolphin (*Sotalia fluviatilis*), the humpback whale (*Megaptera novaeangliae*) and the sperm whale are common (*Physeter catodon*) (Bisbal et al. 1994).

Regarding amphibians, 40 species have been reported in the park and its adjacent areas, with 10 more considered "likely to be present" (La Marca 1992, Bisbal et al. 1994). This represents 20% of the 275 species reported for Venezuela. There are three endemic species which have been found in the cloud forests of El Humo Hill: the Castroviejo crystal frog (*Cochranella castroviejoi*), the Paria crystal frog (*Cochranella vozmediano*) and a toad species (*Mannophryne riveroi*) (La Marca 1992).

About 63 species of reptiles have been found in the region, representing 20% of the Venezuelan reptiles. Of these, a gecko species (*Gonatodes ceciliae*) and a viper (*Bachia heterotopa*) have only been reported in Paria and Trinidad, while the snake *Mastigodryas amarali* is restricted to northeastern Venezuela (La Marca 1992). Beaches in the peninsula are the main nesting area in the country for five sea turtle species: the green turtle (*Chelonia midas*), the hawksbill sea turtle (*Eretmochelys imbricata*), the olive ridley (*Lepidochelys olivacea*), the loggerhead sea turtle (*Caretta caretta*) and the leatherback turtle (*Dermochelys coriacea*). They are also nesting grounds for the American crocodile (*Crocodylus acutus*) (Guada and Vernet 1989, 1991). All six species are classified as threatened (Rodríguez and Rojas-Suárez 1999). However, most of the nesting beaches in the northern coast of the peninsula are outside the national park (Guada and Vernet 1989, 1991).

The fish fauna of the Paria region is very diverse. However, the park does not include marine sectors. The geographic location of the peninsula, dividing the waters of the Caribbean Sea and the Atlantic Ocean, determines the presence of a diverse array of marine environments (Fernández and Michelangeli 2003). Two fish species found in these waters are endangered: the chameleon blenny (*Protemblemaria punctata*) and the Venezuelan grouper (*Mycteroperca cidi*) (Rodríguez and Rojas-Suárez 1999).

The following table summarizes the threatened species present in the park and their threatened status in national and international endangered species lists:

Common name	Scientific name	Venezuela threatened status	Global threatened status
Fish			
Chameleon blenny *	<i>Protemblemaria punctata</i>	Vulnerable	Vulnerable
Venezuelan grouper *	<i>Mycteroperca cidi</i>	Vulnerable	Vulnerable
Birds			
Scissor-tailed hummingbird	<i>Hylonympha macrocerca</i>	Lesser risk	Vulnerable
Venezuelan flower-piercer	<i>Diglossa venezuelensis</i>	Vulnerable	Endangered
White-throated barbtail	<i>Premnoplex tatei</i>	Vulnerable	Vulnerable
Paria redstart	<i>Myioborus pariae</i>	Vulnerable	Endangered

Reptiles			
American crocodile	<i>Crocodylus acutus</i>	Endangered	Vulnerable
Loggerhead sea turtle **	<i>Caretta caretta</i>	Endangered	Vulnerable
Green turtle **	<i>Chelonia midas</i>	Endangered	Endangered
Hawksbill sea turtle **	<i>Eretmochelys imbricate</i>	Endangered	Critically endangered
Olive ridley **	<i>Lepidochelys olivacea</i>	Endangered	Endangered
Leatherback turtle **	<i>Dermochelys coriacea</i>	Endangered	Critically endangered
Mammals			
Humpback whale *	<i>Megaptera novaeangliae</i>	Vulnerable	Vulnerable
Sperm whale *	<i>Physeter catodon</i>	Insufficiently known	Vulnerable
Greater white bat	<i>Diclidurus ingens</i>	Vulnerable	Vulnerable
Caribbean manatee *	<i>Trichechus manatus</i>	En peligro	Vulnerable

* Found in marine areas adjacent to the park

** Nesting in the park's coastal sector.

Sources: IUCN (2004), Rodríguez y Rojas-Suárez (1999)

Management



The parks Field Superintendence in Campo Claro, Irapa

The Peninsula de Paria National Park was created in December 12, 1978 (República de Venezuela 1979) with the objective of protecting the 37.500 ha of the mountainous region of the Paria peninsula located between the Boca de Cumana and the Paria Promontory. The decree stresses the importance of conserving this forest relict in the northeastern corner of Venezuela and the richness of its flora and fauna, which shares many elements with those of the Amazon jungle and the Guyana region (MARN 1992).

The National Parks Institute (Inparques), ascribed to the Ministry of the Environment and Natural Resources (MARN), is responsible for the administration and management of the protected area. There is no Management Plan and Park Use Regulation specific to this park. Consequently, management must follow the general guidelines established by the Partial Regulations of Venezuela's Land Use Law on Administration and Management of National Parks and Monuments (República de Venezuela 1989). The absence of a management plan does not invalidate the application of all regulations established by this law, which clearly specifies those human activities that are allowed, restricted or prohibited. These regulations are of mandatory observance.

There is a proposal by H. Guada (2000) for expanding the park's limits to include the nesting areas of the five species of marine turtles present on these coasts. The proposal recommends including the marine zones between Mejillones and the eastern end of La Isleta in the north, and between Punta Garcitas and Punta de Piedras in the south. In addition, it suggests incorporating marine and terrestrial areas to completely include the Cariaquito Cove within the national park. Each of these proposals is accompanied by suggestions for zoning. The proposals should be very helpful in the establishment of an official management plan.



Park Ranger Post at Las Melenas

Peninsula de Paria has three park rangers, two technicians (including the Superintendent) and a secretary. The superintendence is located in the town of Campo Claro de Irapa. Although outside of the protected area, the location is strategic, being on the main access road to the region, frequently used both by locals and visitors. The office also serves as a visitors center where information about the park and its natural resources can be obtained.

There are park ranger posts in Las Melenas, El Mango and Macuro, towns located near the park's boundaries in the west, center and eastern sections, covering as much area as possible. These posts intercommunicate through radio, also used for communicating with other organizations, such as the Civilian Rescue Guard (Protección Civil). Two 4-

wheel drive vehicles (both with mechanical problems), one motorcycle, and a boat (based in the Guiria port) are available.

The park's limits are defined cartographically. They were established in the original decree for the creation of the protected area (República de Venezuela 1979), but have not been physically demarcated. There are no signposts for trails, sites of interest or access roads.

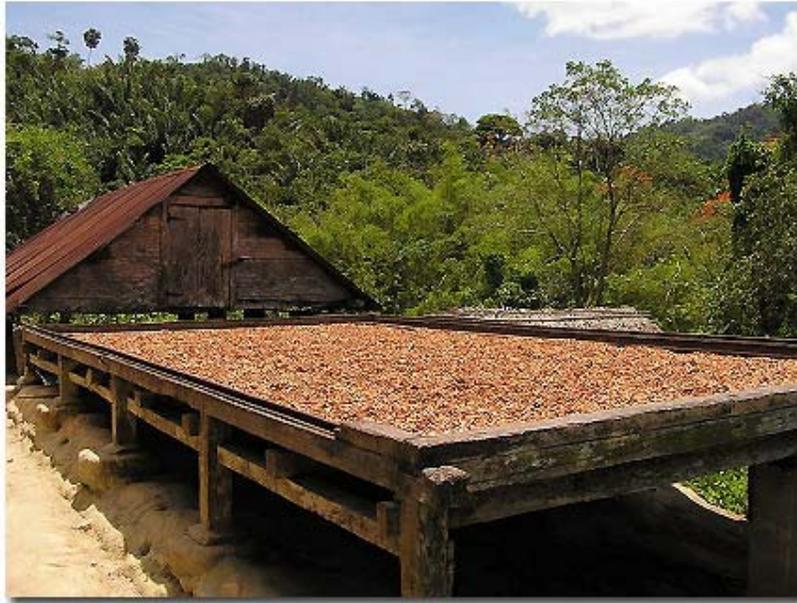
Human influence



Traditional fishing is an important economic activity in Paria

The region known as Paria, which includes both the peninsula and the gulf with the same name, was inhabited until the end of the XV century by aborigines belonging to three distinct linguistic families: Arawaco, Caribe and Warao. These were mainly hunters and fishermen. Contact with European culture first occurred in 1498, when Christopher Columbus arrived to the site later to be known as the town of Macuro. After the initial contact, other explorers such as Alonso de Ojeda, Amerigo Vespucci and Vicente Yáñez Pinzón also visited the peninsula (Perera 2003).

The first Spanish settlements founded in Paria were Río Caribe (1713) and San Juan de las Galdonas (1769). Carúpano, founded earlier (1645), was strategically placed between the Paria and Araya peninsulas. Carúpano played a mayor role in the development of this region, being one of the most dynamic commercial and production centers in Venezuela during colonial and early republican times. In fact, the town had electricity, transoceanic telegraphic cable and even a cable-car before other provincial capitals in Venezuela (Maldonado – Bourgoïn 2003).



Cocoa drying courtyard in an area adjacent to the park

The main economic activity in the region up to the 1930s was the production of cocoa and coffee in plantations. The cocoa industry became quite significant during the second half of the XIX century, when large plantations were established which exported to the Antilles (Sharpe 2001). The main shipment port was Carúpano, followed in importance by Río Caribe and Guiria (Maldonado – Bourgoin 2003).

During the Second World War, cocoa prices collapsed, which added to increased competition from other big producers such as Brazil, led to the abandonment of most plantations. Nowadays, cocoa and coffee production continues, but at a much smaller scale, and other fruits such as oranges and avocados are being commercially cultivated. From an environmental perspective, cocoa and coffee plantations under shade represent an advantage, as large forest trees are needed to maintain a continuous canopy above cultivated areas. This has contributed to the conservation of several forest species within the park and in nearby areas (Sharpe 2001).

At present, the most important population centers that exert some influence on the park are Río Caribe, Guiria, Irapa and Yaguaraparo, together with other smaller towns such as Yoco, Soro, Puerto de Hierro, Macuro, San Antonio, La Concepción y San Juan de las Galdonas. Population growth is relatively slow, below the national average rate of 2,2 % (INE 2004). Fishing is the main economic activity, using both industrial and traditional techniques. In fact, the Paria fleets are responsible for most fish landings in the country.

Traditional fishing concentrates on some seventeen species, which include: catfish, horse mackerel, king mackerel, acoupa weakfish, flying gurnard, caitipá, grouper, red snapper, king weakfish, shad, whitemouth croaker, maracaibo leatherjacket, shrimps, anchovies, sharks, and the starry butterflyfish. Industrial trolling fishing specializes on shrimps, although other species trapped in the nets are also commercialized. Commercial species include: white and brown shrimps, catfish, rays, sharks, king mackerel, whitemouth croaker, acoupa weakfish, mojarra, rough scad and moonfish (Hidromet – FLASA 1995).

Tourism



Walking trail for excursionist near Cerro Humo (photo © Rodolfo Castillo)

The main tourist attractions of the park are the large areas of relatively undisturbed forests, making it interesting both for contemplative tourism and excursions. The most popular area is the forest around the park's rangers post at Las Melenas. Numerous guided tours for school children take place each year. These include outdoor activities and talks prepared by the park rangers. Bird watching is the most common activity for foreign tourists, who are attracted by the park's diversity and abundance of endemic species. Tour operators do not offer permanent or established packages. However, some guided visit programs are organized by tourist inns in the Paria region, including those offered by the ecological farms which belong to the network known as the Paria Project.

Excursionists tend to hike across the southern part of the sierra along the south-north axis, generally finishing in the Caribbean Sea. The most common routes include: Macuro-Uquire, Mapiro-Mejillones and Las Melenas-Santa Isabel. This last route, popular among backpackers, borders El Humo hill (1371 masl), the highest point in the peninsula. Backpackers are also frequent visitors of other sites in Paria. Some rural communities such as Santa Isabel and Macuro (both outside the park), are increasingly developing their capacity to provide adequate accommodation and to offer guided tours for visitors (Sharpe 2001).

Conservation and research

The area protected by the Peninsula de Paria National Park has attracted the interest of researchers since the beginning of the XX century. However, up to 1999, only 29 scientific papers on Paria had been published (Carlsen 1999). The first botanic collections were done by W.E. Broadway between 1922 and 1923 (Gremone y Capobianco 1985). Some twenty years later, the botanist J. Beard did some studies on the cloud forests in the region (Beard 1945-6). The first botanic collections were done



Marine turtles nest in the northern coasts of the park

by W.E. Broadway between 1922 and 1923 (Gremone y Capobianco 1985). Some twenty years later, the botanist J. Beard did some studies on the cloud forests in the region (Beard 1945-6). Two minor botanic collections were also undertaken by T. Lasser in 1955 and by Aristiguieta and Agostini in 1961 (Gremone and Copobianco 1985). The botanic exploration of J. Steyermark and G. Agostini in 1962, produced the first representative plant collection, which included the description of 29 endemic species (Steyermark and Agostini 1966, Steyermark 1979). Based on this work, Steyermark repeatedly stressed the importance of protecting these forests, highlighting the species-rich flora and its interesting links with the flora of the Guyana and Amazon regions. However, our floristic knowledge of Paria is still incomplete (Fernandez and Michelangeli 2003). Fortunately, new botanic research is now under way (Meier, unpublished).

Regarding the region's fauna, the three expeditions undertaken by the Phelps' Ornithological Collection between 1947 and 1948 were a major contribution to our knowledge of Paria birds. These collections include specimens of all the reported species, including endemic bird subspecies (Phelps and Phelps 1948, Phelps and Phelps 1949). In the 1970s the Ministry of the Environment and Natural Resources (MARN) gathered the first reptile collections (Gorzula 1979). In the 1980s and 1990s, several expeditions took place. The most important was carried out by PROFAUNA (MARN), which generated the most complete fauna inventory available to this date (Bisbal et al. 1994).

An ongoing research program on marine turtles was established in the 1990s by H. Guada. These studies have produced detailed information on aspects such as habitat characteristics (Guada 1992) and the location of nesting beaches for five marine turtle species (Guada and Vernet 1989, Guada and Vernet 1991). Guada (2000) has also put forward a zoning and park enlargement proposal with the objective of protecting nesting areas for turtles. In addition, the "Conservation and Research Project for Sea Turtle Conservation" has been implemented since 1999 in the Paria region by CITMAR

(Centre for Marine Turtle Conservation and Research) and WIDECAST (Wider Caribbean Sea Turtle Conservation Network).

Regarding other conservation efforts, it is important to mention the “Project for Sustainable Development of the Orinoco Delta” implemented by Fundación Tierraviva, which produced a detailed report alerting about the many threats faced by the park (Sharpe 2001). There have also been proposals by local leaders in Guiria and members of local NGOs such as Vuelta Larga Foundation for implementing reforestation programs in the park and its nearby areas. The Thomas Merle Foundation has edited guides for ecological tourism in Paria (Manara 1996).

THREATS



Agriculture near the park boundaries in the southern slopes of the Serranía de Paria

The Peninsula de Paria National Park protects the last relatively undisturbed mountain forests in the Coastal Cordillera. The development of cocoa and coffee plantations up to the first half of the XX century contributed to the protection of these ecosystems, because of the partial conservation of the forest canopy above of the cultivated areas.

In terms park management, one of the main strengths is the service ethics and commitment to conservation shown by Inparques personnel in the region. However, there is a series of threats to the conservation of biological diversity in the midterm. The most important ones are:

- Agriculture
- Illegal hunting
- Illegal logging
- Insufficient staff and lack of management equipment

Agriculture



Ocumo (Xanthomonas sagittifolium) is the main crop in Paria

The primary economic activity for the park's inhabitants is fishing. However, this is done outside of the park limits, which does not include marine areas (the northern park boundary is defined by the coastline). The second most important economic activity is traditional agriculture in the *conucos* (parcels of land owned by small farmers), which have a substantial impact on the park's natural resource base. This kind of agriculture involves clearing and burning the vegetation before cultivation. The most important crops are taro (*Colocasia esculenta*), malanga (*Xanthosoma sagittifolium*), manioc (*Manihot esculenta*), plantain (*Musa paradisiaca*) and maize (*Zea mays*). The largest cultivated areas inside the park are near the towns of the northern coast such as Uquire, Pargo, Don Pedro and Mejillones, which were established prior to the park. *Conuco* agriculture started expanding after the collapse of the cocoa (*Theobroma cacao*) economy, during the second half of the XX century. This transformed *conuco* cultivation from a subsistence-oriented activity for the workers in these plantations into a market-oriented activity used as an income generating strategy by small farmers.

Conuco agriculture is also practiced near the park boundaries in the southern slopes of the sierra, and in some cases, inside the park. The expansion of the agricultural frontier into the park is taking place at a faster pace near towns such as Santa Isabel, Puerto La Cruz, Puerto Viejo, Las Playitas and Pica-Pica, in the southeast and Las Vegas, Naranjal and Río Arriba, towards the southwest.

The limited soil fertility of these mountain soils allows for only two consecutive crops before yields become insufficient. Then, farmers leave the plot in fallow for about five years and move to a different area (shifting cultivation). Farmers can either move to a restored fallow plot that is ready for another cultivation cycle, or clear a new patch of pristine forest. This strategy results in many disturbed plots being adjacent to each other, generating fragmentation or complete forest cover loss. This process has already destroyed significant forest areas outside of the national park. Interestingly, there are

still some cocoa (mainly in dry forest areas) and coffee (in several altitudinal belts) plantations inside the park, although their surface area is unknown.

Illegal hunting

Hunting is a very common activity inside and outside the park. It is mainly a subsistence activity, although some species are captured for commercialization as pets. The species hunted for subsistence include paca (*Agouti paca*), collared peccary (*Tayassu tajacu*), armadillo (*Dasyus novencintus*), porcupine (*Coendu prehensilis*), little tinamou (*Cryptorellus soui*), band tailed guan (*Penelope argyrotis*), rufous-vented chachalaca (*Ortalis ruficauda*), and small birds as tanagers. The most popular species among hunters is the paca (Sharpe 2001). Several Psitacid species are captured for commercialization as pets, including the orange-winged amazon (*Amazona amazonica*) and the blue-headed pionus (*Pionus menstruus*). Hunters generally use shotguns, traps, and even slingshots. Wild cats such as the jaguaronde (*Herpailurus yagouaroundi*), the ocelot (*Leopardus pardalis*) and the jaguar (*Panthera onca*) are also captured and their pelts sold (Fernández and Michlangeli 2003).

Illegal logging

Outside of the park limits there are several legal lumber operators. However, there are unidentified illegal operators who extract wood from inside and outside the park. In some cases, selective logging has taken place in the northern shores of the park, where there is no access by road, using maritime routes for timber transportation. The species more frequently logged include carapa (*Carapa guianensis*), cedars (*Cedrela* sp), laurel (*Cordia alliodora*) and tropical tabebuias (*Tabebuia* sp). The cedars, laurel and tabebuias are considered vulnerable in Venezuela because of large scale illegal exploitation (Llamozas et al. 2003).

Local inhabitants also extract timber for building houses and boats. However, this kind of small-scale activity does not constitute an important threat, as non-commercial extraction by locals tends not to concentrate in any particular area and be very sporadic. The control of logging activities is under the responsibility of the Ministry of the Environment (MARN). However, there are only two officials in the Guiria office who are responsible for the whole Paria region. Consequently, vigilance and control of timber commercialization is limited.

Insufficient staff and lack of management equipment

Inparques personnel in the region includes five officers, responsible for the management of the park's 37.500 ha (each park ranger has in average 12.500 ha to monitor). Park rangers are distributed in three posts in strategic locations to the west, center and east of the peninsula. However, vehicles are not operational for monitoring and control visits. Both 4-wheel drive vehicles and the motorcycle available are usually broken down and there is no budget for covering their maintenance and the cost of gasoline. The Inparques boat is in good shape, but there is no budget for gasoline either. The superintendence is in the town of Campo Claro de Irapa, located strategically on the main access road to the peninsula. This allows the park officers to have more frequent contact with locals and visitors. However, the building is not owned by Inparques and improvements are needed to turn it into a more effective visitor center.

A new building was built as a seat for the superintendence in El Mango. This building has all the necessary space, although it lacks furniture. However, El Mango is very remote and of difficult access, making it an inconvenient location for Inparques regional headquarters.

There are also major deficiencies in the park's tourist service infrastructure. There are no established visitor trails, kiosks, etc. The park ranger post at Las Melenas is an ideal place for establishing more adequate tourist infrastructure, making use of the open spaces available for picnics and the existing trails that lead into the cloud forests of Cerro Humo.

Future threats

Oil – gas sector development projects in adjacent areas

The state owned company, Petróleos de Venezuela S.A. (PDVSA), has among its short term plans the construction of the “Industrial Oil, Gas and Petrochemical Complex Gran Mariscal de Ayacucho” (CIGMA). In its first stage, the development will establish industrial activities associated with natural gas production in the “Mariscal Sucre” and “Deltana Platform” projects (PNUD-PDVSA 2004). The CIGMA complex will occupy an area of 6.300 ha near the town of Guiria.

The Mariscal Sucre project involves the extraction of natural gas in the marine areas located to the northeast of the national park. The transportation of gas to the CIGMA requires building a gas pipe. For the pipe's layout, three alternatives are being considered. One of them crosses the park in the north-south axis. Hence, its construction would have major impacts on the cloud forests as a result of the use of heavy machinery for road construction and the transport of building materials. The two other alternatives avoid the national park by establishing the pipe's layout inland, beyond the western limits of the protected area, or by sea beyond the eastern limits. However, these alternatives imply a longer pipe and are consequently more expensive.

The Deltana Platform project is further away from the influence zone of the national park. It will be developed in the marine waters outside of the Orinoco delta. Oil and gas transportation to the CIGMA will take place through the waters of the Gulf of Paria.

Besides their direct environmental impacts, these projects will have other kinds of indirect effects in the region. They will change the economic, demographic, and urban structure of Guiria and the Valdez Municipality as a whole (PNUD-PDVSA). Social mobility will be high as a result of the creation of new jobs. This is particularly true for non-specialized labor, as the industry will most probably bring along its own specialized work force from other regions in Venezuela and from other countries (given the participation of transnational corporations). Some estimate the arrival of some 12.000 people during the first stage of the project. These would dramatically increase the demand for public services, including water, an environmental service provided by the national park. In the case of Guiria, water is collected from the Guatapanare and Guarama rivers, which drain down from the park. However, the aqueduct has many

problems and there are plans to do extensive repairs and expand the system to be able to meet the new demands (PNUD-PDVSA 2004).

The industrial operation of the CIGMA will create large additional water demands which will probably have to be satisfied from sources outside the region or by the construction of a water desalinating plant. The increased water demand could result in positive effects on the parks management, as it could increase the interest and efforts for conserving the cloud forests in the sierra. However, land use dynamics will probably experience important changes, promoting urban growth, which will affect both natural and cultivated areas. This could in turn create new pressures for the expansion of the agricultural frontier, a phenomenon which is already taking place. On the other hand, according to estimates by local leaders, about 60% of the cattle raised on future CIGMA lands would disappear.

RECOMMENDED SOLUTIONS



INPARQUES requires assistance from others

Agriculture

Agricultural activities within park boundaries predate its creation. Current regulations allow the continuation of these activities under specific conditions. These include the use of conservationist practices for agriculture, avoiding soil erosion and the pollution of water courses with agrochemicals (República de Venezuela 1989). This necessarily implies the participation of other government institutions as the Ministry of Agriculture (MAT). MAT should provide technical assistance to farmers for the establishment of more sustainable agricultural practices.

A different strategy is required for agricultural activities in areas adjacent to the park, especially those that have expanded inside its boundaries in recent times. Because their establishment occurred after the creation of the protected area, these are in fact illegal activities which need to be controlled, either by relocating farmers or through other

strategies. The presence of agriculture near the park suggests it is necessary to establish policies specifically directed to regulate human activities in these areas. The development of effective buffer zones could be an alternative. Through the establishment of specific land use regulations, these zones could contribute to a more harmonic man-nature relation near the park. In other parts of the world, low impact activities such as shade-coffee plantations have been proposed in buffer zones, so that rural development can be made compatible with conservation objectives.

The Fundación Proyecto Paria has been promoting ideas and programs in favor of the rural population in the region. These include a capacity building program for the establishment of sustainable cocoa plantations and the promotion of ecological tourism. Their strategy is to foster sustainable rural development through the cooperation of civil society and the private sector.

Illegal hunting

Hunting could be considered part of the cultural background of farmers in some rural areas in Venezuela. It is usually perceived as an activity that combines complementing the regular diet (i.e. a subsistence activity) with recreation and adventure. However, because of its significant impact on biodiversity, it is necessary to eliminate and/or regulate this activity. Hunting is illegal within the national park. Hence, it is necessary to increase the number of park rangers to guarantee more vigilance and patrolling. Outside park boundaries there are also regulations in place regarding hunting activities, which are contained in the Wild Fauna Protection Law. Their enforcement is a responsibility of MARN. For controlling commercial fauna extraction, more cooperation with the National Guard (an integral part of the environmental monitoring system) is required. This kind of collaboration would allow detecting fauna smuggling routes and capturing those responsible for illegal trade. Moreover, the implementation of environmental education programs in schools could contribute to raise awareness among the new generations about the importance of protecting biodiversity and eradicating illegal hunting.

Illegal logging

To improve monitoring and control of illegal timber extraction it is necessary to increase the number of officials at the MARN Guiria post. This would contribute to a more rigorous enforcement of the regulations established in the Soil and Water Forest Law and the technical environmental norms for logging. These include the application of the “forest hammer” (a certificate of origin seal stamped on each log upon extraction) and the use of a guide for transportation of timber products. This would increase the control on the legal markets and allow the National Guard to detect illegal traffic and its commercialization chain.

Insufficient staff and lack of management equipment

Given that many protected areas in the country are understaffed, a national strategy is needed to tackle this critical issue. The strategy should include the improvement of the infrastructure available to park rangers and visitors (park ranger posts, visitor centers, etc). In most cases, the authorities in each protected area have a detailed diagnosis of their needs. This information could be integrated in the design of a plan for obtaining the necessary funds for the whole system.

Three new park rangers are urgently needed for the National Park, so that they can rotate with the existing personnel. In the northeastern section of the protected area more Inparques presence is needed to monitor and control the expansion of the agricultural frontier. The incorporation of new personnel will necessarily have to be complemented with the provision of new equipment and infrastructure.

The development of oil and gas extraction projects could be seen as an opportunity to gain new allies for conservation of the park as a provider of environmental services for the local population and the industry. The industry could make significant contributions for improving the management and administration of the park (e.g. through the donation of equipments and infrastructure).

Oil-and-gas sector development projects in adjacent areas

As established in the Constitution of the Bolivarian Republic of Venezuela (República Bolivariana de Venezuela 1999), development projects (such as those planned by the oil industry in the region) must undertake environmental and socio-cultural impact assessment studies. These studies allow an assessment of the different alternatives available for each project, to determine those that minimize environmental impacts, and to propose the necessary preventive, corrective, and mitigating actions. These studies should also contribute to predicting more precisely the indirect effects of the project on the park. Results must be made available through citizen participation mechanisms and public consultations. Hence, local communities should be informed about the impacts of industrial activities and their views incorporated into the decision making process.

Even though the oil industry could contribute to the development of economic alternatives in the region, it is necessary to also consider traditional economic sectors: fishing, agriculture, and cattle rising. Actions should be directed towards increasing the environmental sustainability of these productive sectors and to decrease their impacts on the national park.

The complexity of the socio-economic situation in the peninsula has led PDVSA and local community leaders to implement a series of roundtable discussions with technical assistance from the United Nations Development Program (UNDP) under the name of “Rapid Impact Project Portfolio for Sustainable Local Human Development in the Valdez Municipality of the Sucre Province”. This initiative has been implemented since 2003 and has already generated economic, environmental, land use, political-institutional, social, and gender equality proposals (PNUD-PDVSA 2004). As a result, projects have been formulated including the reforestation of the Guatapanare and El Hoyo River Watersheds, which include areas inside the national park. However, additional projects are required for addressing issues such as the pressure exerted by conuco agriculture on natural forest areas.

Regarding the construction of the gas pipe from Mariscal Sucre to the CIGMA, the alternatives that do not cross the national park should be favored. Even though these alternatives are more expensive in economic terms, they would generate less environmental costs. It is important to invest on the basis of a long-term perspective: the conservation of the forests in the Paria peninsula guarantees the maintenance of environmental services such as water provision, carbon sequestration, and biological

diversity for present and future generations. These natural resources could be the platform for the development of ecologically and economically sustainable alternatives such as ecotourism.

CONCLUSIONS



El Mango park rangers post

The Peninsula de Paria National Park protects important cloud forests of the Eastern Coastal Cordillera. These forests have a high ecological value because of their high degree of endemism and their links with the flora of distant regions in the Amazon and Guyana. The park's fauna is also very special, with numerous endemic bird species and mammals typical of the Amazon region. The presence of agricultural activities in areas adjacent to the park constitutes the main threat for the protection and conservation of biological diversity in the midterm. Additional threats include illegal hunting and logging and the lack of park personnel and appropriate equipments. The development of industrial oil and gas projects in the region is likely to have a series of indirect effects on the protected area. On the basis of the above considerations the park is considered **vulnerable**. A diverse set of actions needs to be implemented for eliminating or mitigating the impact of these threats, especially agriculture. The implementation of viable solutions will necessarily require the collaboration of many different governmental and non-governmental institutions. Making the conservation of the park a key objective for projects like those coordinated in the region by PNUD and PDVSA, is an important opportunity that should not be overlooked.

REFERENCES



Isla de Patos

Beard, J.S. 1945-46. Notas acerca de la vegetación de la Península de Paria. Boletín de la Sociedad Venezolana de Ciencias Naturales 65-66: 191-204.

BirdLife International 2003. BirdLife's online World Bird Database: the site for bird conservation. Version 2.0. Cambridge, UK: BirdLife International. Disponible en internet: <http://www.birdlife.org>

Bisbal, F.J., A.A. Ospino, P.A. Bermúdez, S. Bermúdez, R.A. Rivero y A. Ferrer. 1994. Inventario Preliminar de la Fauna Silvestre del Parque Nacional Península de Paria, Estado Sucre, Venezuela. PROF

Carlsen, M. 1999. Recopilación y Reproducción de Información Sobre las Investigaciones en el Sistema de Parques Nacionales. INPARQUES. Dirección General Sectorial de Parques Nacionales. División de Evaluación, Inventario y Monitoreo Ambiental.

Fernández, A. y F. Michelangeli. 2003. Naturaleza entre Dos Mundos. Pp. 113-142, En: Michelangeli, F. (ed). Paria, Donde Amanece Venezuela. Gerencia de Asuntos Públicos de ExxonMobil de Venezuela S.A. Caracas. 411 p.

FUDECI. 1990. Expedición al Parque Nacional Península de Paria. Memoria de la Fundación para el Desarrollo de las Ciencias Físicas, Matemáticas y Naturales. 1990: 5 pp.

Gabaldon, M. 1992. Parques Nacionales de Venezuela. Instituto Nacional de Parques y Fundación Banco Consolidado. Stephan y Thora Amend (eds.). Caracas.

González de Juana, C., J. Iturralde de Arozena y X. Picard. 1980. Geología de Venezuela y sus cuencas petrolíferas. Ediciones Fonives. Tomos I y II. Caracas.

Gremone, C. y G.A. Capobianco. 1985. Programa de Conservación del Patrimonio Natural de Venezuela. Una Primera Aproximación al Análisis Ecológico de los Centros Endémicos de El Tamá, Aroa, Borburata, Turimiquire, Paria. Tomo 2. Fundación para la Defensa de la Naturaleza (FUDENA). Caracas.

Guada, H.J. 1992. Informe de caracterización de los elementos ambientales vegetación y fauna para el análisis de impacto de una sección del extremo oriental de la Península de Paria. Universidad Simón Bolívar, Departamento de Estudios Ambientales. Caracas.
Guada, H. J. 2000. Áreas de anidación e impactos hacia las tortugas marinas en la Península de Paria y lineamientos de protección. Trabajo Especial de Grado de la Maestría en Ciencias Biológicas. Universidad Simón Bolívar. Sartenejas.

Guada, H. y P. Vernet. 1989. Informe Final del Proyecto Cipara. Fundación para la Defensa de la Naturaleza (FUDENA). Caracas. 13 p.

Guada, H. y P. Vernet. 1991. New Nesting Localities for Sea Turtles in the Sucre State, Venezuela. Marine Turtle Newsletter 53: 12-13.

Hidromet – FLASA. 1995. Caracterización del Medio Socioeconómico. Proyecto TAP Güiría – Primera Etapa (Terminal Marino – Patio de Tanques). Lagoven S.A. Vol. 1, p. 4-1 – 4-50.

INE. 2004. Censo 2001. Primeros resultados. Instituto Nacional de Estadística. Caracas. Disponible en internet: <http://www.ine.gov.ve>

IUCN 2004. 2004 IUCN Red List of Threatened Species. Disponible en internet: <http://www.redlist.org/search/search-basic.html>

La Marca, E. 1992. Catálogo taxonómico, biogeográfico y bibliográfico de las ranas de Venezuela. Universidad de Los Andes. Cuadernos Geográficos 9: 1-97.

Lentino, M 1997. Lista actualizada de aves de Venezuela. En: Vertebrados actuales y fósiles de Venezuela (E. La Marca, ed.), pp. 143-202. Museo de Ciencia y Tecnología de Mérida. Mérida.

Linares, O. 1998. Mamíferos de Venezuela. Sociedad Conservacionista Audubon de Venezuela y British Petroleum. Caracas. 691 p.

Llamoza, S., R. Duno de Stefano, W. Meier, R. Riina, F. Stauffer, G. Aymard, O. Huber y R. Ortiz. 2003. Libro rojo de la flora venezolana. PROVITA. Fundación Polar. Fundación Instituto Botánico de Venezuela Dr. Tobías Lasser. Caracas. 555 p.

Manara, B. 1996. Paria, en el tiempo y en el corazón. Guía para el turista ecológico. Fundación Thomas Merle. Carúpano, Venezuela. 132 p.

Maldonado – Bourgoïn, C. 2003. Los que Vienen en Nombre del Señor. Pp. 49-80, En: Michelangeli, F. (ed). Paria, Donde Amanece Venezuela. Gerencia de Asuntos Públicos de ExxonMobil de Venezuela S.A. Caracas. 411 p.

MARN. 2000. Primer Informe de Venezuela sobre Diversidad Biológica. Ministerio del Ambiente y de los Recursos Naturales Renovables, Oficina Nacional de Diversidad Biológica. Caracas. 227 p.

MARNR. 1992. Áreas naturales protegidas de Venezuela. Serie Aspectos Conceptuales y Metodológicos. DGPOA/ACM/01. Ministerio del Ambiente y de los Recursos Naturales Renovables. Caracas.

Meier, W. en prep. Estado actual del conocimiento florístico de los bosques montanos de la Cordillera de la Costa.

Michelangeli, A. 2003. El Ambiente y los Recursos en Paria: Riqueza para Aprovechar y Conservar. Pp. 143-159, En: Michelangeli, F. (ed). Paria, Donde Amanece Venezuela. Gerencia de Asuntos Públicos de ExxonMobil de Venezuela S.A. Caracas. 411 p.

Perera, M.A. 2003. Paria: Golfo y Mar Primigenio de Encuentros, Sueños y Luchas. Pp. 31-48, En: Michelangeli, F. (ed). Paria, Donde Amanece Venezuela. Gerencia de Asuntos Públicos de ExxonMobil de Venezuela S.A. Caracas. 411 p.

Phelps, W.H. y W.H. Phelps Jr. 1948. The discovery of the habitat of Gould's Humminbird, *Hylonympha macrocerca*. Auk 65 (1): 62-66.

Phelps, W.H. y W.H. Phelps Jr. 1949. Eight new birds from the tropical zone of the Paria Peninsula, Venezuela. Proceedings of Biological Society of Washington 62: 33-44.

PNUD-PDVSA. 2004. Agenda de Proyectos de Impacto Rápido, y de Corto y Mediano Plazo para el Municipio Valdez, Estado Sucre. Programa de las Naciones Unidas para el Desarrollo. Petróleos de Venezuela S.A. Güiría. 32 p.

República Bolivariana de Venezuela. 1999. Constitución de la República Bolivariana de Venezuela. Gaceta Oficial N° 36.860. Caracas. 30 de Diciembre.

República de Venezuela. 1979. Decreto N° 2.982 del 12 de Diciembre de 1979, por el cual se declara Parque Nacional con el nombre de "Península de Paria", la región ubicada en jurisdicción de los Distritos Arismendi, Mariño y Valdez del Estado Sucre. Gaceta Oficial N° 2.417 Extraordinario. Caracas, 7 de Marzo.

República de Venezuela. 1989. Decreto N° 276 del 7 de Junio de 1989: Reglamento Parcial de la Ley Orgánica para la Ordenación del Territorio sobre Administración y Manejo de Parques Nacionales y Monumentos Naturales. Gaceta Oficial N° 4.106. Caracas, 9 de Junio.

Rodríguez, J.P. y F. Rojas Suarez. 1999. Libro rojo de la fauna venezolana. 2° ed. PROVITA. Fundación Polar. Caracas. 472 p.

Sharpe, C. 1997. Lista de aves del Parque Nacional Paria, Estado Sucre, Venezuela. Sociedad Conservacionista Audubon de Venezuela. Caracas. 42 p.

Sharpe, S. 2001. Situación Ambiental del Parque Nacional Península de Paria. Proyecto Desarrollo Sustentable Delta del Orinoco. Fundación Tierra Viva. Caracas. 33 p.

Steyermark, J.A. 1973. Preservemos las Cumbres de la Península de Paria. Defensa de la Naturaleza 2 (6): 33-35.

Steyermark, J.A. 1974. Relación florística entre la Cordillera de la Costa y la zona de Guayana y Amazonas. Acta Botánica Venezolana 9(1-4): 245-252.

Steyermark, J.A. 1979. Plant Refuge and Dispersal Centres in Venezuela: Their Relict an Endemic Element. Pp. 185-221, In: K. Larsen & L.B. Holm-Nielsen (eds.). Tropical Botany. Academic Press, Inc. Great Britain, London. xi + 453 pp.

Steyermark, J.A. y G. Agostini. 1966. Expedición Botánica del Cerro Patao y poblaciones adyacentes a Puerto de Hierro, en la Península de Paria, estado Sucre. Acta Botánica Venezolana 1(2): 7-82.

Steyermark, J.A. y O. Huber. 1978. Flora del Ávila. Sociedad Venezolana de Ciencias Naturales. Ministerio del Ambiente y de los Recursos Naturales Renovables. Caracas. 971 p.

Tapiquén, E., M.A. Oliveira-Miranda, R. Lazo y C. Kalinhoff. 2004. Parque Nacional Península de Paria. En: Rodríguez, J. P., R. Lazo, L. A. Solórzano y F. Rojas-Suárez (eds.) Cartografía Digital Básica de las Áreas Naturales Protegidas de Venezuela: Parques Nacionales, Monumentos Naturales, Refugios de Fauna, Reservas de Fauna y Reservas de Biósfera. Versión 1.0, CD ROM y en-línea. Centro Internacional de Ecología Tropical (CIET), Instituto Venezolano de Investigaciones Científicas (IVIC), Conservación Internacional Venezuela, UNESCO y Oficina Nacional de Diversidad Biológica del Ministerio del Ambiente y de los Recursos Naturales (MARN). Caracas, Venezuela. Disponible en Internet: <http://ecosig.ivic.ve>.

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