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The Palmeras: A Natural Reserve, Cubarral, Colombia

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The Palmeras Natural Reserve (PNR) is located in the Municipality of Cubarral, Department of Meta, Colombia. It has 250 hectares (618 acres) of primary and secondary forests. Its elevations range between 5413 and 6233 feet above sea level, with temperatures ranging from 53 to 74 °F, rainfall above 4000 mm per year and average relative humidity of 90%. This ecosystem, within the humid premontane forest, is characterized as a transition zone between the regions of Orinoquia, Amazonia and the Andes, a habitat with high biological diversity. The Las Palmeras Reserve has been an important research center for biodiversity, as demonstrated in the findings of birds, mammals, and plant species. The dominant plant species include the Choapo palm (*Dictyocaryum lamarckianum*), and the most abundant is Colorao (*Croizatia brevipetiolata*). Other important plant species include Half cumin (*Licaria canella*), Matapalo (*Clusia hachensis*), Palomo (*Alchornea glandulosa*), Chuguaca (*Hieronyma oblonga*), Manzano (*Billia rosea*), Laurel (*Aniba robusta*), Quino (*Lademberg ia oblongifolia*), Drago (*Croton smithianus*), and Palma macana (*Wettinia fascicularis*).

Colombia is recognized as the richest country in terms of palm diversity in the Americas, and the third richest in the world with 212 species spread over 44 genera. The Cubarral municipality is in the foothills area and is undergoing continuous development, as it is one of the most economically productive areas in the region. This causes strong pressure on the territory and changes in the structure of the forest by anthropic intervention, even in the high elevation areas, where some species are threatened with extinction. Logging is frequently driven by local people's need for income and the local economies' need for wood. Logging causes significant impacts to forest ecosystems and local communities, biodiversity loss, habitat loss of fauna and flora, erosion, sedimentation of water resources, ecosystem fragmentation, and changes in land use.

The Palmeras Natural Reserve (PNR) was established as a conservation and rehabilitation center of biodiversity. The PNR is a valuable resource available for national and international researchers. This paper includes a list of the most valuable plant species in the reserve and highlights some of the reserve's outgoing projects.

Location. The PNR is in the Municipality of Cubarral Department of Meta (E623500;N422886) and has an area of 250 ha (635 acres). The reserve is located 160 km (99 miles) from Bogota, 70 km (43 miles) from Villavicencio and 12.5 km (7.8 miles) from the urban area of Cubarral. Accessing the reserve is an adventure; once in Cubarral it can be reached by road, then by hiking along the mountain or by mule.

Climatic conditions. The reserve is located at elevations between 5413 and 6233 ft above sea level, with temperatures ranging from 53 to 74 °F. The precipitation average is 4000 mm per year, with a relative humidity of 94%, corresponding to the very humid premontane forest life zone.

Habitat and the forest. The PNR has primary and intervened forest. The intervened forest had been the object of selective exploitation on valuable timber species, and these species have been in the process of natural restoration for over 10 years. The primary forest is located at the top of the property. Among the most representative tree species are the Choapo palm (*Dictyocaryum lamarckianum*), Colorao (*Croizatia brevipetiolata*), Medio cumin (*Licaria canella*), Matapalo (*Clusia haughtii*), Palomo (*Alchornea glandulosa*), Chuguaca (*Hyeronima oblonga*), Manzano (*Billia rosea*), Laurel (*Aniba robusta*), Quino (*Lademberg ia macrophylla*), Drago (*Croton smithianus*), Comino Real (*Aniba perutilis*), and Macana palm (*Wettinia fascicularis*) (Carvajal, 2020).

Research conducted in the past decade in the PNR identified forest species directly associated with the survival of birds. One of the most important is the Choapo palm (*Dictyocaryum lamarckianum*) (Fig.1) that is important to a conservation project of the endangered yellow-eared parrot (*Ognorhynchus icterotis*) in Colombia (Fig. 2). The Choapo palm is vital to the existence of the yellow-eared parrot and this bird depends on it for reproduction, food, and shelter (Murcia et al., 2019).

Management Development

The different land uses, land management practices, and population pressures have resulted in the destruction of most of the primary forest. The main cause of deforestation is the illegal use of timber, and livestock in hillside areas that causes problems of erosion, sedimentation, and mass removal. The following actions have been conducted:

Preliminary research. The PNR was officially established in 2010. Since then, research partnerships have been formed with CORMACARENA, University Distrital Francisco Jose

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Fig. 1. Panoramic view of the forest showing the Choapo palm (*Dictyocaryum lamarckianum*).

Fig. 2. Yellow-eared parrots (*Ognorhynchus icterotis*) nesting in a Choapo palm.

de Caldas, the Cañon del Guatiquia Foundation, group ecology Cabildo Verde de Cubarral and other ecological groups. Efforts have been made targeting an inventory of the species found and evaluation of the existing forest.

More than 200 plant species have been identified including palms, orchids, trees, and shrubs; some of which some are listed as endemic to the region and to Colombia, some of which are endangered. The inventory includes complete photographic material for species identification, plus botanical and taxonomic descriptions. The authors are working on getting funding for publication (Carvajal, 2020).

Some of the palm species have potential uses for economic development of the region. Three species of palms are used by the Iriarteeae indigenous people for the manufacture of crafts for local and international commerce (Paz López, 2019).

Monitoring the dynamic of the forest. A study has been conducted since 2009 to evaluate the dynamics of the forest at the PNR, including its floristic composition and biomass. A permanent 1-ha plot was used to measure the number of individuals, number of species, families, and dominant species with interesting results: number of plants = 607; number of species = 41; number of families = 21; dominant species = *Croizatia brepetiolata* (AB: 24.6 m^2); and carbon storage = 91.69 t/ha.

Conservation of the Choapo palm (*Dictyocaryum lamarckianum*). A study is taking place to evaluate the population dynamic of the Choapo palm on a permanent plot of one hectare in the reserve, in which measures are taken annually (seedlings, juveniles, and mature plants). More than 8500 individuals/ha have been found at the PNR. This palm produces up to three clusters measured, two m. in height (2000–2500 fruits each). In this 1-ha plot the study has found 6891 seedlings, 640 juvenile plants and 48 mature plants (Alvares and Cárdenas, 2017; Carvajal, et al., 2015; Pedroza Padilla, 2016 ;and Torrejano Munevar, et al., 2018).

New plantings of Choapo palm (*Dictyocaryum lamarckianum*). The PNR has repopulated with new plantings of the Choapo palm since 2016. The reforestation involved the local community and over 2500 palms have been established.

Conservation of Yellow-eared parrot (*Ognorhynchus icterotis*). Two-hundred-seventy-six species of resident and migratory birds have been recorded at the reserve, including *Ognorhynchus icterotis, Aegolius harrisi, Catharus dryas, Falco deiroleucus, Grallaria hypoleuca, Machaeropterus regulus, Malacoptila fulvogularis, Piranga olivacea, Piranga rubra, Setophaga ruticilla, Tangara parzudakii, Thlypopsis ornata, Vireo flavoviridis, Wilsonia canadensis, Catharus minimus, Dendroica fusca, Dendroica striata, Dendroica cerulea, Catharus ustulatus, Seiurus noveboracensis, Contopus virens, Pheucticus ludovicianus*, and *Elanoides forticatus*, among others (Ruiz, 2017; Carvajal et al., 2012; Murcia et al., 2011 and Murcia et al., 2019).

The yellow-eared parrot has been designated as an endangered species in Ecuador and Colombia. This bird has been associated with the Choapo palm, and other studies relate the survival of the yellow-eared parrot with the wax palm (*Ceroxylon quindiuense*). This discovery is unique and shows the bird has been able to adapt to other ecosystems. The bird moves in the area approximately 500 ha, (60 and 80 individuals). Due to the small number of natural nests, artificial nests have been established to help ensure conservation of the parrot population. Establishing nests for the parrots will minimize the pressure on the forest. Artificial wooden nests have been placed in the Choapo palms up to 25 m high to facilitate the acceptability of precious parrots. Trained personnel were required for the installation. The project effectiveness was successful with 100% of bird colonizing the nests (Ruiz, 2017).

More research needs to be done to understand population density, eating habits, species propagation, reproductive habits, inter-specific relationships and local migrations. More artificial nests also need to be placed to help the yellow-eared parrot. Funding is required to continue with the project.

Education efforts. The PNR has been hosting students from local schools and universities. One of the recent popular educational events has been the Parrot Festival. The festival takes place in Cubarral where students from the community participate in a parade proclaiming the importance of the endangered habitat in the area. Educational presentations include talks about the yellow-eared parrot and its needs for survival.

Conclusions and Future Tasks

The PNR is an important resource to help preserve over 200 species of palms, orchids, trees, and shrubs—of which some are listed as endemic to the region and the country or are endangered.

Future projects will include the protection of the natural resources that are present in the reserve with focus on most sensitive plant and animal species, including:

1. Habitat area—Land on which the primary objective will be to protect natural resources essential to the continued existence of native plants and resident and migratory wildlife.
2. Management area/ trail corridor—Lands which includes ecological trails, including developed hiking trails that run through the forest with educational interpretation.
3. Improve facilities—Establishment of a classroom and dormitory housing to support researchers and possible ecotourism. Active management of land in these areas would be required to facilitate activities while protecting valuable natural resources.
4. Outreach—Outreach is required to increase public interest and participation. Efforts have been made to involve the local schools and should be continued and extended to all members in the community.
5. Non-consumptive and ecotourism operations—PNR is a place with high potential for ecotourism, a place to conserve native fauna.
6. Interest group studies—Invite specific partners to contribute with the project.
7. External funding—Funding is crucial to keep developing the project. This support includes national and international organizations and individuals that agree with the goals of the PNR.
8. Establishment of a nursery to produce plant material for ecological restauration porposes in the PNR.
9. Recruitment of a ranger for the care, maintenance and protection of the PNR.

Literature Cited

Álvarez Cortés, D.J. and J.F. Cárdenas Torres. 2017. Evaluación del crecimiento de palma choapo [*Dictyocaryum lamarckianum* (Mart.) H. Wendl.] en bosque muy húmedo premontano del municipio de Cubarral, Meta, Colombia. Tesis de grado. Ingeniería Forestal. Universidad Distrital Francisco José de Caldas. Facultad de Medio Ambiente y Recursos Naturales.

Carvajal Rojas, L. 2020. Flora de Orinoquia—Piedemonte Llanero, Reserva Natural Las Palmeras, Cubarral, Meta, Colombia. Universidad Distrital Francisco José de Caldas. Bogotá, D.C. En edición.

Carvajal Rojas, L., W. Ariza Cortes and A. Rodríguez Bolaños. 2015. Flora de los bosques de las cuencas de los ríos Planas y Tillavá, Puerto Gaitán, Meta, Colombia. Universidad Distrital, CORMACARENA.

Carvajal Rojas, L. and M. Murcia Nova. 2012. El loro orejiamarillo del piedemonte llanero. Cubarral, Meta. Universidad Distrital Francisco José de Caldas, Cormacarena, Ecopetrol.

Murcia Nova, M. 2019. Estructura poblacional y producción de frutos de la palma (*Dictyocaryum lamarckianum*) recurso clave de la dieta del loro orejiamarillo *Ognorhynchus icterotis*. Reserva Natural Las Palmeras, Cubarral, Meta, Colombia. Tesis de grado. Maestría en Manejo, Uso y Conservación del Bosque. Universidad Distrital Francisco José de Caldas. Facultad de Medio Ambiente y Recursos Naturales.

Murcia Nova, M. and L. Carvajal Rojas. 2011.Aves del piedemonte llanero Cubarral, Meta. CORMACARENA, Universidad Distrital Francisco José de Caldas. Bogotá. Colombia

Murcia, M., D. Beltrán and L. Carvajal. 2009. Un nuevo registro del Loro Orejiamarillo, *Ognorhynchus Icterotis*: Psittacidae en la Cordillera Oriental Colombiana. Ornitología Colombiana, 8:94–99.

Paz López, C. 2019. Potencial artesanal de las semillas de tres especies de palma la tribu Iriarteeae (Arecaceae) en la Reserva Natural Las Palmeras, Cubarral, Meta, Colombia. Tesis de grado. Ingeniería Forestal. Universidad Distrital Francisco José de Caldas. Facultad de Medio Ambiente y Recursos Naturales.

Torrejano Munevar, A. and C. Hormizda Fonseca. 2019. Estructura, composición florística y cuantificación de biomasa aérea de una parcela permanente en el piedemonte llanero. Reserva Natural las Palmeras, Cubarral, Meta, Colombia. Tesis de grado. Ingeniería Forestal. Universidad Distrital Francisco José de Caldas. Facultad de Medio Ambiente y Recursos Naturales.

Ramírez Caicedo, J. 2018. Interpretación ambiental y cálculo de capacidad de carga para los senderos de la Reserva Natural Las Palmeras, Cubarral, Meta, Colombia. Tesis de grado. Ingeniería Ambiental. Universidad Distrital Francisco José de Caldas. Facultad de Medio Ambiente y Recursos Naturales.

Ruiz González, N. 2017. Instalación y monitoreo de nidos artificiales para la conservación del loro orejiamarillo (Ognorhynchus icterotis). Reserva Natural las Palmeras Cubarral, Meta. Tesis de grado. Licenciatura en Ciencias. Universidad Distrital Francisco José de Caldas. Facultad de Ciencias y Educación.

Pedroza Padilla, D. 2016. Estructura poblacional de la palma bombona Dictyocaryum lamarckianum (Mart.) H. Wendl. en un bosque muy húmedo premontano del piedemonte llanero, Departamento del Meta. Tesis de grado. Ingeniería Forestal. Universidad Distrital Francisco José de Caldas. Facultad de Medio Ambiente y Recursos Naturales.