FAST ECOLOGICAL ASSESSMENT OF THE METROPOLITAN PARK MARÍA LUCIA

ANA MARIA CASTAÑEDA GONZALEZ[1]

1. Biologist, Friedrich Schiller University Jena Germany, Specialist in Microbiology Friedrich Schiller University Jena Germany and Management of Natural Resources and Environmental Education UPTC MSc Rural Development UPTC Chief of the Research Engineering Center Technologies and Basic Sciences

ABSTRACT

Results are presented in a fast ecological assessment in the Metropolitan Park "Maria Lucia "Villavicencio, Meta, Colombia.   The samplings were conducted in an area by a multidisciplinary group of professionals from the University Corporation Meta and the National University of Colombia; the samples were performed in the entire park and its associated aquatic environments. Taxonomic composition and structure was analyzed from the union of communities assessed on the basis of intensive inventories. At least 33 mammals, 45 amphibians, 76 birds and 43 fish, including some endangered extinction forms from the Red Book • The fish group showed the highest taxonomic richness and union complexity, while mammals had the lowest taxonomic richness which is explained by the absence or reduction of tree layer, fragmentation of woodlands, decrease in the availability of resources and the impact of livestock. In some areas dominated by Moriches exceptionally high, taxonomic diversity was recorded and relatively complex guild structure, by the association of these ecosystems with swamp forests. The attributes of the evaluated communities could be influenced also by the characteristic pattern of seasonal flooding in the region, the biases of sampling and the degree of evolution of some habitats. It highlights the importance of results for the conservation of local biodiversity and recommends some complementary lines of research.

Se presentan resultados de una evaluación ecológica rápida realizada en el Parque Metropolitano María Lucia, Villavicencio Meta Colombia. Los muestreos fueron realizados en el área por un grupo multidisciplinario de profesionales de la Corporación Universitaria del Meta y la Universidad Nacional de Colombia. Se analizó la composición taxonómica y estructura gremial de las comunidades evaluadas, sobre la base de inventarios intensivos. Al menos 33, 45 especies de anfibios, 76 especies de aves y 43 especies de peces, que incluyen algunas formas en peligro de extinción en el libro rojo. El grupo de los peces mostro la mayor riqueza taxonómica y complejidad gremial, mientras que los mamíferos presentaron la menor riqueza, lo que se explica por ausencia o reducción del estrato, fragmentación de masas boscosas, disminución de la disponibilidad de recursos y los efectos de la ganadería. En algunas áreas dominadas por morichales se registró una diversidad taxonómica excepcionalmente elevada y una estructura gremial relativamente compleja, por la asociación de estos ecosistemas con estratos boscosos o mata de monte. Los atributos de las comunidades evaluadas estarían influenciados también por el patrón de inundación estacional característico de la región, los sesgos derivados de los muestreos y el grado de evolución de algunos hábitats. Se resalta la importancia de los resultados obtenidos para la conservación de la biodiversidad local y se recomiendan algunas líneas de investigación complementarias.

INTRODUCTION

 The forest ecosystems of the tropical region, correspond to more complex biological diverse biosphere, whose services meet the needs of society and human groups who live there about fruits, timber, fuel wood, fiber, medicines, wild animals to take animal protein, climate regulation and water among others, which makes it an inva1uab1e system for the human kind as a basis for sustainability. In accordance with the above, any strategy to generate sustainable management must start from the knowledge of both their form and function, to ensure the conservation of biodiversity and the rational use of its services. In the piedmont plains region and specifically in the foothills of the department of Meta, in the last 40-50 years there have been dramatic changes in vegetation cover, soil and environment in general, mainly due to colonization. Social process that has accelerated agricultural and residential activities. As a result of this phenomenon, it is possible that has led to the disappearance of plant and animal species many possibly new to science.

In the piedmont forest region an specifically in the Meta Department piedmont forest foothills in the last 40 or 50 years wooded area had drastic change in the uniform running down due to Colonization. In consequence the social process had accelerated the farming and housing activities. As a result of this phenomenon probably had disappear animal and vegetable species, many of them new for the science. Generally speaking the piedmont forest in transition with the eastern flank of the mountain range   until Venezuela was a deep forest vegetation , according to many authors, but mainly for direct observations in many relict primary forest located in the piedmont and foothills, in the Meta department, we can deduce that these forests had a very high diversity, in trees, shrubs, lianas and epiphytes, according to preliminary studies by F. Castro and others in these relics, it could say that many Amazonian species rose by this forest formation to department goal, this statement is based botanical collection with typically Amazonian species, which is deposited in the herbarium of the University of the Llanos, these species are still some relict piedmont, The richness of these forests is mainly due to the interplay of in ~ several factors, but mainly to the confluence of several landscapes in the area; on one hand the Amazon and Andean influences and on the other the influence of the northern savannas and foothills.

As part of the project named Maria Lucia Metropolitan Park, the Corporation Meta University has been coordinating a research program aimed to planning and sustainable management of this property, whose activities included a fast ecological assessment of communities of vertebrates, communities, terrestrial and aquatic ecosystems at the park are typical of the plains named "Llanos". The corresponding results in this area are presented in this paper.

Study Area

The rapid ecological assessment was conducted on the campus of Metropolitan Park Mary Lucia, property located in the department of Meta; which is like the rest of the country, in a low equatorial zone or intertropical latitude, therefore there is sunning ongoing throughout the year with peak during the equinoxes, that is, in the last days of the months of March and September. The temperature swing to month basis is slight; it being noted rather significant diurnal temperature differences. The distribution of rainfall depends of the latitudinal displacement of the (CIT). Town of Villavicencio; capital of the department which is the largest core population, economic, administrative and cultural center of the eastern plains. It is located northwest of the department, in the foothills of the eastern range of the margin Guatiquía left of the river, located at 04 ° 09´ 12

"north latitude and 73 ° 38 '06" of west longitude at an altitude of 467 m s n m l in the Llanerita Village that is located in the district No. 7 of this Municipality.

Figure 1 Location: Metropotlitan Park María Lucia
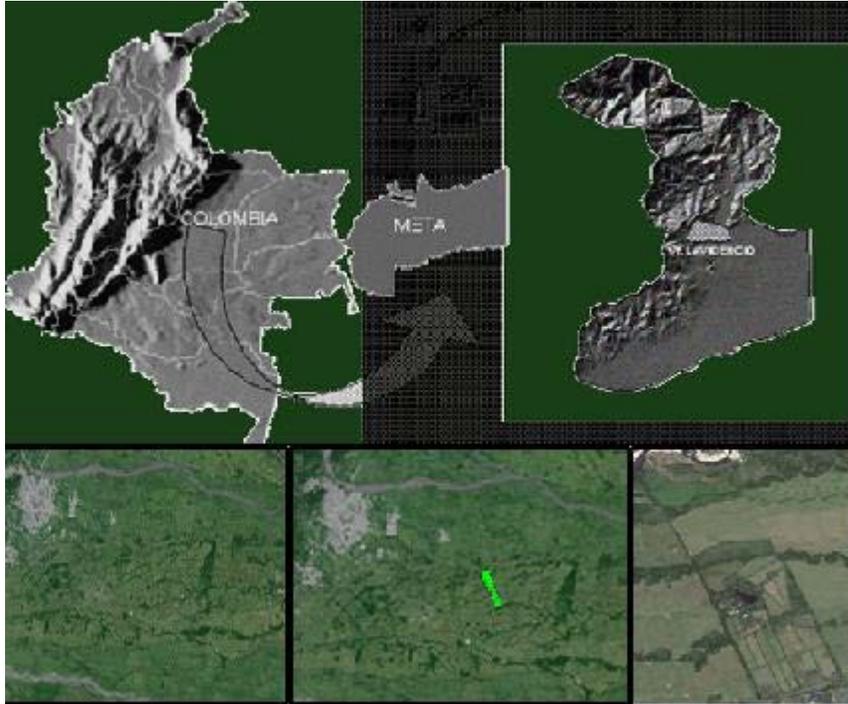
Source: This study 1:25.000

Table l. METROPOLITAN MARIA LUCIA PARK

Location	Municipality of Villavicencio, Corregimiento No. 7 Vereda La Llanerita.
Coordinates	High 337 meters, 4° 05'51.38" North 73°30'27.78' West.

METHODOLOGY

Fast Ecological Assessment "EER"

This methodology is understood as a process of identifying areas and aspects priority in the conservation and gives support to management plans and management natural resources; fundamental aspects of the EER are:

- It addresses specific objectives
- Flexibility in handling scales and working methods
- It is based on satellite and aerial images
- Use stratified sampling and
- Among its final products become more relevant maps
- Steps to develop EER:
- Definition of Objectives
- Data Acquisition
- Data Analysis
- Verification Analysis
- Product generation
- Recommendations and Applications

Methodological application

One of the main purposes of the FAST ECOLOGICAL ASSESSMENT EER; is the generating information for the "Design of Monitoring and Evaluation Biological Indicators ", as such methodologies for capturing information major taxa of wildlife have been design to correspond to the generation of information that allows the formulation of the design, sampling methodologies (capture information), had as its main feature the ease of sampling; the speed with which be performed, the local stakeholders and generating databases that allow tracking research.

Figure 2. Cartographic Map, general view
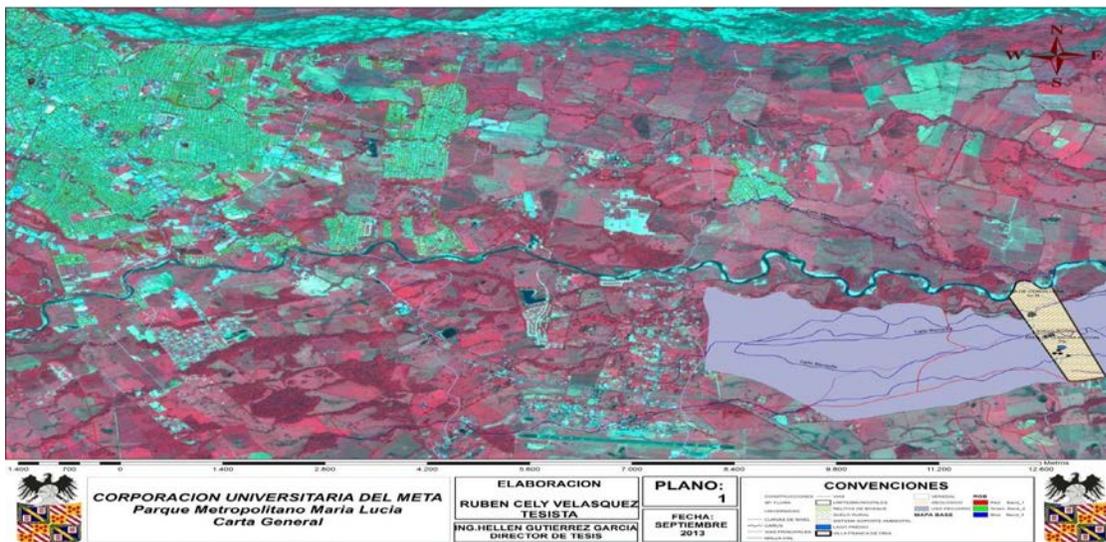
Source: Rubén Cely

Caracterization area

GEOLOGY 1 sector study overall, are the current sedimentary deposits of low consolidation that are dissected by streams such as pipes and Ocoa River. These deposits are composed of lime and sand materials yellowish mixed with gravel and sand, with possible outcrops exhibiting large blocks. Its origin lies in the extinct pipes and the old bed of Ocoa River in this region. The presence of isolated mounds and internal depressions in the park, due to erosive factors tertiary runoff derived from glaciers reversals and regional tectonic development Eastern Cordillera which led to the flexing of the foreland basin that defines the altillanura sector in the Vereda La Llanerita.

HYDROLOGY ground surface is contributing to runoff into the channel main and its tributaries, bounded by the watershed or imaginary line that is located in points of higher topographic elevation.

Table 3. Hydrology

BASIN	HECTÁREAS	SQUARE METRES	SQUARE KILOMETERS
Basin 1: Caño Soquemonte	27.238	272.380	0.27
Basin 2: Caño Blanquita	38,687	386.867	0,39
Basin 3:Caño Piñalito	41,838	418.383	0,42

Source: Rubén Cely

SOIL

High alluvial terrace: This position occupies the highest level within the terraces. It is near ridges. The terrain is flat to gently rolling, with collations gently convex and concave, among which are the estuaries. The slope ranges between 0 - 6%. The deepest part of the accumulations is made up of boulders size from gravel stone and sandstone with a high degree of alteration. The nature of the materials belongs to highly weathered fine alluvium.

Valles: Under this heading are grouped lots that are located all Ocoa lake river drainage serving the study area. The build material is alluvium and colluvium. In some valleys dominates the colluvium material on the alluvial and other soils opposite happens. The matrix may vary from sand and clay the relief is flat with a slope ranging between 0 and 3%.

HEATED FLOORS: The predominant thermal floor in the study area is the warm moist; having in mind that the study area is 300 meters above sea level and an average temperature of 25 ° C. The region in 2013 an average temperature of 25° C and behavior throughout the year showed an almost monomodal trend with a period of higher temperature, which usually runs from January to April, where stands February as the hottest with 26 ° C temperature and a period from May to December lower temperature, which emphasizes the months of June and July as the month less hot 2S ° C temperature.

Precipitation: The total is 3,300 mm. Generally has a longer rainfall extending from April to December, were May is the rainiest with 574 mm. The period of reduced rainfall is January to March, where January exceeded with 20.5 mm and was the wettest April with 300 mm. The average rainfall in the last ten years is 3,674 mm.

The condition that normally presents the air in relation to its content of water vapor or relative humidity is 85% on average. The occurrence of greater humidity of the year 2013 occurs during the month of June with 890% the lowest in January with 77%.

The region presents Alisios from the SE, have a NEY local winds manifested by rising air currents. The solar brightness is 1468 horas light /year, representing an average day 4 hours sunshine. Their behavior throughout the year projecting the month of January and August with 172 and 170 hours of light and a period March to July 48 hours light.

Use and land cover

It has two units of land use, which identified as artificial and improved pasture land and natural grasses and weeds improved. Improved pasture: The most widespread use of the area for their livestock vocation Brachiaria de cumbens protruding grass as the most use. It is common practice overgrazing. Currently has a high water and biological potential, in addition to its soil great deal that gives you the opportunity to self-regulate strategic ecosystems, addition to the native flora in the natural regeneration process, it is important to mention that. This process can be enhanced using techniques that promote the efficiency of this process. another great feature that can be found in the land use is being contemplated the suitability of land use sector in relation to forest establishments management of conservation areas through ecological restoration, and ecotourism research., there are some.

VEGETATION: The dominant vegetation in the area is presented in not very densely. It is characterized by the abundance of lean individuals and few large trees scattered. This shows that are operated or very young forests, state recovery process after a natural perturbation human intervention in the case primary forests, as the result of the analysis shows the diametric classes typical trend of "inverted f', since they come from a process of intervention, since primarily for timber harvesting by locals in which have mainly extracted more grades trees. Among the most characteristic species important of these forests are: Bathysabracteosa, Bocconíaintegrifolia, Ladenbergiaoblongifolia, Bactrissetulosa, Chamaedoreasp, AnthuriUmformosum, Wettiniapraemorsa, Oenocarpusbataua, Terminalia Amazonia, lriarteadeltoidea, Tabebuiaserratifolia, Cordianodosa, Tovomitasp, Dílkeasp, Joosia umbelliferous.

Table 3 Vegetation in the area

Familia	Numero de individuos	porcentaje %
combretaceae	1	1.25
piperaceae	4	5
poaceae	1	1.25
dilleniaceae	1	1.25
acanthaceae	2	2.5
leguminosae	2	2.5
smilaceae	3	3.75
solanaceae	1	1.25
moraceae	4	5
clusiaceae	1	1.25
annonaceae	1	1.25

ZONAS DE MUESTREO

Fauna [3]

Development of the monitoring
The monitoring starts from the moment it leaves the starting point to the point where the route which makes walking is performed, also as noted in the respective blogs designed for this purpose.

Once in place of the previously selected sample, it proceeds to a description of the area and then start to make the trip trying to locate wildlife land or air, also traces and / or tracks, nests and trails are sought. A different animals or findings were making their photographic record (when possible).

BIRDS: Citing this group and taking into account the geographical and climatic situation, there a wide range and variety of species, some of extraordinary beauty.

For the birds must take into account the climatic fluctuations in the different sectors the transepts you are obviously given by: a) the time of year (migratory birds); b) lluvias contribution of ecosystems; e) flooding patterns d) fluctuations established by man.

Thus, the areas covered by native vegetation will expand and contract, producing a edge communities of plants adapted to the conditions; establishing thus an availability of habitat for different species of birds. Because of this we could recorded in the different transects tours, 63 species of both aquatic environments, open and closed environments, native and planted forest type environments. Also in some sampling points could be contacted the presence of plantations of introduced tree species that had adapted to this type of environments created by the man.

For the assessment of state of any ecosystem is vital assessment certain taxonomic groups, in this case, the birds have advantages because its identification to species level is easy, requiring less time and less intervention because specimens capture is not needed. The farm Villa Franca de Oria sampling fragments were performed through the use of networks fog, direct observation and auditory record with different units of effort in days and number of fragments analyzed in order to

achieve an estimation of the importance unit shows a good approximation of that combination of methodologies (Stiles & Bohorquez, 2000) .

Visual and audio recordings were made by direct observation methods illustrated using field guides and binoculars and trapping in 63 individuals 35 species and seven orders in mist nets six and 12 meters with mesh size 25 millimeters. From the taxonomic proposal Hilty & Brown (2001) were recorded in total 137 bird species representing 21 orders and 49 families. Ecological analysis establishes a composition similar species in the sampled points and distinguishes diversity of niches exploited by birds, especially insectivores are 78 species. They are distinguished by the presence and abundance Catharusustulatus species ,Thraupispalmarum, Turdusleucomelas and Phaethomisanthophjlus. Finally, given measures morphology can be established by principal component analysis of the correlation two of the seven components can observe the creation of three artificial groups related by similarity in beak and body size; additionally, on the tarsus and wing you can understand the habits of the species, identifying their preference for perch or walk, or flight.

Figure 4.: Biodiversity Indicators

	Simpson Indicator	Shanon-Weaver,Indicator
Home	9,3	2._3
Lagoon	8.2	2._3
Piñalito Caño	7.7	2. 3
Galleria forest	6.4	1,9
Orangerie	6,2	1,9

Diversity indicators: According to the diversity indices calculated by the formulas Simpson and Shanon-weaver, can be seen in Table 1 that the site's diversity of bird species present is the home of the FMCA Villa Franca de Oria as reported a value of 9.3 with the Simpson index and 2.3 with Shannon-weaver index, followed by near the lagoon which reports a value of 8.2 with the Simpson index and the index of 2.3 Shannon-weaver, and the pipe Piñalito reporting a value of 7, 7 and Simpson index 2.3 with Shannon-weaver index. This greater diversity found near the house farm Villa Franca de Oria is probably due to human presence causes absence of predators, and buildings, as well as fruit trees and floral supplies decorative, provide safe nesting sites and food.

Professors Associated Science Institute National University

PECES

FISH: A total of 43 species were found, but quite possibly the number of species

fish present is higher than for the present study, because the sampling concentrated only in some bodies of water lotic water system in one period climate, and it is possible that this number will increase new collections. The species grouped in 6 orders, 19 families and 39 genera The most representative orders for this water system is of the Order Characiformes to 52% of species (27 sp), Order Siluriformes with 29%, orders, during fishing operations of individuals were collected total of 43 species, in which the Order is the most representative Characiformes 27 species within this family is more representative, Characidae 16 species, followed by Cichlidae families Loricariidae and five species and family Heptapteridae four species, the remaining families are represented by one or two species. During sampling the existence of one or more species that were was not evidenced strongly dominant in the area as a high number of species is presented and the bodies characteristic of water are fairly similar, most species can be found in two locations given the great variability of environments presents each locality.

Presenting abundances species are not reflective of the preference microenvironments by fish, but the evidence of the complexity and heterogeneity in the organization of fish assemblages (Mojica et al. 1999). Assessing stations sampling has to be the greatest species richness is l Piñalito spout with 38 species, high fish diversity found in this pipe is linked to the multiplicity of microhabitats allowing the establishment of more species, these water bodies present on its banks a gallery forest preserved and moderately dense canopy, this feature allows ecosystem is constantly entering the aquatic system allochthonous material, which allows a high density of fish is maintained. For an area such is surprising to find this small number of species (11% of the 378 species for the Meta River basin), especially considering the advanced stage of intervention anthropic and proximity to the city of Villavicencio.

Although the Colombian eastern plains are one of the most unexplored areas of the ichthyologic country, it is still interesting to see how this new study with seven species must distribution for the Meta River sub basin and two new species for the country distribution.

Figure 5. Percentage of species captured

Source: Professors Associated Science Institute National University

INSECTS

As for families, comparing the results with the studious Morales Castaño & Medina (2009) we can see that the number of families having a great difference, because in that study 15 families were recorded, while the value obtained in our case was 85. Nevertheless, the results agree that the order

was richer Hymenoptera. Comparando the study by Urrego • Sánchez (1994) Caño Limon Arauca, there is agreement with the results in eight orders. More families are Hemiptera, Coleoptera and Hymenoptera in both studies. The difference between the number of families is not very high, although the number of families a little higher in the study by Sánchez Urrego ~. Coincidences in families of the same Order ranging between 57% and 81%, with greater overlap in Hymenoptera and lower in

In the study of Hemiptera Arauca, the fourth order with more families is Lepidoptera, but in our study we only have a family, this can be explained by that time and sampling effort in our work was men <> c Other orders which both work the same, but with a much smaller number of families represented (maximum 4 Are Odonata Orthoptera, Psocoptera, Thysanoptera such coincidences families ranging between 50 and 75%.

Table 7 Wealth of families and morph species total abundances of insects captured seven methods through sampling.

Orden	Bandeja amarilla			Jameo 100 Pases			Jameo 100 Pasos			Malaise			Pitfall			Winkler			TOTAL INDIVIDUOS
	No. Fam.	No. M-spp	No. Ind.	No. Fam.	No. M-spp	No. Ind.	No. Fam.	No. M-spp	No. Ind.	No. Fam.	No. M-spp	No. Ind.	No. Fam.	No. M-spp	No. Ind.	No. Fam.	No. M-spp	No. Ind.	
Blattodea	0	0	0	1	3	3	1	1	1	0	0	0	1	1	1	1	2	4	9
Coleoptera	1	1	1	9	35	57	4	7	12	16	47	63	1	1	1	5	17	27	161
Diplura	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Hemiptera	2	2	2	13	22	26	8	18	24	17	47	113	1	1	1	6	9	16	182
Hymenoptera	5	13	50	6	23	84	7	14	80	21	99	423	5	12	42	1	18	1030	1709
Lepidoptera	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Odonata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11
Orthoptera	0	0	0	2	2	2	2	3	5	4	6	19	1	3	3	0	0	0	29
Psocoptera	0	0	0	0	0	0	1	1	3	0	0	0	0	0	0	0	0	0	3
Thysanoptera	0	0	0	0	0	0	1	1	1	0	0	0	1	1	1	1	2	29	31
TOTAL	8	16	53	31	85	172	24	45	126	58	199	618	10	19	49	15	49	1107	2137

Source: Professors Associated Science Institute National University

MAMMALS

We recorded in total 33 species, over 6 orders and 13 families. The orders with more species were Chiropteran and Primates, 15 and 5 species respectively. Families with more species were Phyllostomidae (10 species), Myrmecophagidae (3 species) and Didelphidae (3 species). Overall there was very little wealth and abundance uncommon species, on the other hand, species considered common or specific points surgery had a very high abundance analysis for a found fauna.

A comparison between theoretical fauna product of a previous literature review was performed and wildlife found product samples for different groups, also made an further comparison between the wildlife and fauna found at the Ocarros Biopark considered representative fauna of the biogeographic region studied. Furthermore, for the presentation of results and their analysis was

emphasized in 4 groups taxonomic particular: Primates ~ Chiropteran (bats), Rodential (Rodents) and Domestic mammals, however corresponding analysis were also made to other orders of mammals found in the study site. They found a total of 33 species distributed in 6 masto orders and l3 families wildlife along the study area.

These are organized as follows: (this Fauna), for animals registered to methods of capture, Direct Observation and camera traps, further (Fauna possible) for animals that were recorded through interviews and observation Each of these indirect identified mostly to species and arranged so taxonomic, as presented in the resting tables have lower percentages: Perciformes 9°/°, Gymnotiforms 6% Cyprinodontiformes Synbranchiformes and 2% each. This highest number recorded by comparing species Lasso et al. 2004, who report 378 species for the entire river Meta basin.

For analysis of animals found a comparison between theoretical animals was performed, product of a previous literature review and found product samples wildlife different groups, a further comparison between the found was also performed and wildlife at the Biopark the Ocarros, considered representative fauna of the region biogeographic study. In addition to the presentation of results and analysis same emphasis was on 4 individual taxonomic groups: Primates, Chiropteran (bats), prudential (Rodents) and domestic mammals, but also made related analysis to the other orders of mammals found in the place of study.

Figure 6. Found species
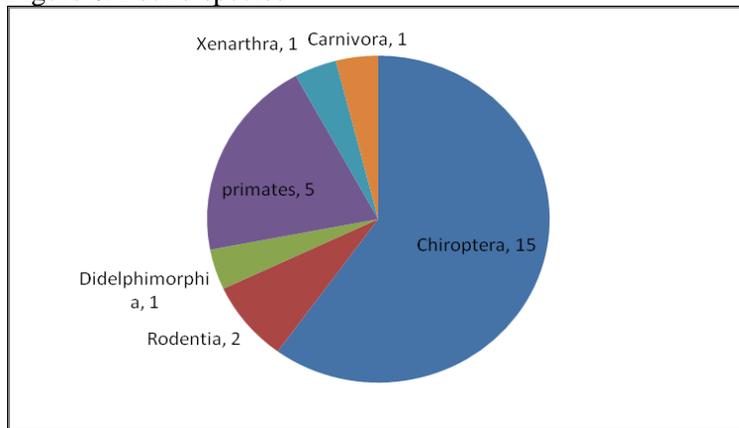
Source: Professors Associated Science Institute National University

Table 9. Present Wildlife

Possible Wildlife				
Order	Family	Genre	Specie	Method
	Cerdocyon	thous		EN/H
Carnivorous	Camfvorous	Urocyon	cinereoarsenteus	EN
	Gallct:is	vittata		EN
	Mustelidae			EN
	DidelphiS present marsupialis			EN/H EN EN•
Didelphlmorphia	t>idelphidae	*Phifander*	andersoni	

Primates	Aotidae	Aotus	brumbacki	EN*
	Atelidae	*Alouatta*	senic.lus	EN/01
	Cebus	Apella		EN*
	Cebidae	*Sairnlrí*	sciureus	EN*
Rodential	cunkulldae	*Cuniculus*	caca	EN
Xenarthra	*Cyclopes* didactylus mynnecophagldae			EN EN*
	Myrrne<:ophaga tridactVIa			EN
	Tarnandua tetradactyla			

Source: Professors Associated Science Institute National University

Conservation Decisions

Ultimately for decision-making about biodiversity protectionist need not rely solely on the presence or absence of certain number of species, because this is a rough approximation and preliminary unreliable alone. It is necessary to address biological, economic, geographic and thematic evolutionary species; the human component as well as ecological, social and cultural level.

BIBLIOGRAFIA

ALVAREZ L, H.igyg. Introducción a las Aves de Colombia. Biblioteca Banco Popular. Cali, Colombia. Universidad del Valle. Departamento de Biología.

ANDRADE G., ROSAS M. & REP1ZZO A. Notas preliminares sobre la avifauna y la integridad biológica de Carpanta. Avifauna Carpanta, 207-228.

ARANCO C. 1995. Monitoreo de la avifauna en tres sectores de Risaralda: Parque regional Ucumarí, parque Tatamá y sector alto de Pisones. Corporación Autónoma de Risaralda. Bogotá.

ARAYA B. & MILLIE G. 2005. Guía de campo de las aves de chile. Editorial universitaria. Novena edición. Online: [citado 22 de enero de 2012]. Disponible en google books: <http://books.google.cl/books/about/Gu%C3%ADa_de_campo_de_las_aves_de_chile.html?id=uw EFKkUc1ecC>

CARO C, BRAVO M., MORENO D., GÓNGORA A. & OCAMPO A. 2007. Avifauna Del municipio de Villavicencio (Lista Preliminar). Universidad de los llanos, 2007. P: 77. Comisión estatal del agua y el medio ambiente (CEAMA): Bosques y Selvas. Online: [citado 22 de enero de 2012]. Disponible en: www.ceamamorelos.gob.mx/secciones/ambiente/bosques_y_selvas/bosques_y_selvas. html

FEINSINGER P. 2004. El diseño de estudios de campo para la conservación de la bíodiversidad. Editorial Fundación Amigos de la Naturaleza. Capítulo 7: Métodos para el análisis de dato: Una aplicación para los resultados provenientes de caracterizaciones de biodiversidad. Santa Cruz de la Sierra, Bolivia.

HILTY S. & BROWN W. 2001. Guía de aves de Colombia. Princenton University Press. New Jersey.

HURLBERT S. 1984. Pseudoreplication and the design of ecológica! field experiments. Ecological monographs. Ecological Society of America. 54: p. 187-211. Online: [citado 07 de noviembre de 2011]. Disponible en: <http://www.jstor.org/pss/l94266l>

HUSTON M. 1994. Biologícal diversity: The coexistence of species on changing landscapes. Press syndicate of the University of Cambridge. Primera edición. Cambridge, United Kingdom. p. 1-615. Online: [citado 07 de noviembre de 2011]. Disponible en google books: <http://books.google.com/books?hl=es&lr=&¡d=VA7CtUikC&oi=fnd&pg=PRi5&dq=Biological+ diversity:+the+coexistence+of+species+on+chang¡ng+landscapes&ots=gMCC2f2J5h&sig=YPPD¡ 3rCLNcL6IyWTwkoBXdXsxE#v=onepage&q&f=false> 181

EVALUACIÓN ECOLÓGICA RÁPIDA Y ZONIFICACIÓN AMBIENTAL PARQUE METROPOLITANO MARÍA LUCIA

IDEAM-Información Metereolgica Aeronáutica 2011-2012. Online: [citado 22 de enero de 2012]. Disponible en: <http://bart.ideam.gov.co/index.html>

KATTAN G., SERRANO B. & APARICIO. 1996. Aves de escálete: Diversidad, estructura trófica y organización social. Cespedesia Vol 21(68): 920.
MACHADO M. & PEÑA G. 2000. Estructura numérica de la comunidad de aves del orden paseriformes en dos bosques con diferentes grados de intervención antrópíca en los corregimientos de Salero y San Francisco de Icho. U.T.CH. Facultad de Ciencias Básicas. Tesis de pregrado Chocó - Colombia.

MAGURRAN A. 1988. Ecológica! diversity and its measurement. Princeton University Press.
Online: [Consultado 07 de noviembre de 2011]. Resumen disponible en: http://press.princeton.edu/titles/4238.html

MCNISH T. & STILES G. 1992. Aves del Llano. Villegas editores.

MCNISH T. 2007. Las Aves de los Llanos de la Orinoquía. Editorial M&B LTDA. Colombia.

MORENO C. 2001. Métodos para medir la biodiversidad. M&T - Manuales y tesis SEA. vol. 1. p. 1-84.
Online: [citado 07 de noviembre de 2011], Disponible en pdf: <http://tecrenat.fcien.edu.uy/Cursos/reconcimiento_de_fIora/Bibliograf%C3%ADa_%20de_apoyo _para_curso_20io/Tema_5_Biodiversidad_y_Conservaci%C3%B3n/Metodosparam edirbiodiversidad_Moreno.pdf>. ISSN 1576 - 9526.

NARANJO L & CHACÓN. 1997. Diversidad de insectos y aves insectívoras de sotobosque en hábitats perturbados de selva lluviosa tropical. Caldasia 19(3): 507-530.

OLIVARES, A. 1982. Aves de la Orinoquia Colombiana. Editorial Nacional. Segunda edición. Universidad Nacional de Colombia. Instituto de Ciencias Naturales. Ornitología.

RIPPSTEIN G., ESCOBAR G. & MOTTA F. 2001. Agroecología y biodiversidad de las Sabanas de los Llanos Orientales de Colombia. Centro Internacional de Agricultura Tropical (CIAT).
Online: [citado 07 de noviembre de 2012] Disponible en:

<http://books.google.cl/books?íd=iCHGuojoTzsC&printsec=frontcover&hl=e5#v=onepage&q&f=false>

SPELLERBERG I. 1991. Monitoring ecológica! change. Press syndicate of the University of Cambridge. Segunda edición. Cambridge, United Kingdom. pp. 334. Online: [citado 07 de noviembre de 2011]. Disponible en google books: <http://books.google.com/books?hUes&lr=&id=68ap9hdp8D8C&oi=fnd&pg=PR7&dqMonitoring+ecolog¡caI+change&ots

SALAMAN P., STILES F., BOHÓRQUEZ C., ÁLVAREZ M., UMAÑA A., DONEGAN T. & CUERVO A. 2002. New and noteworthy bird records from the east slope of the Andes of Colombia. Caldsia 24(1): 157-189.

STILES F. 1993. La avifauna en Colombia Pacífico. Tomo I. Proyecto Biopacífico. Fondo para la protección del medio ambiente José Celestino Mutis. FEN. Colombia: 149-255.

STILES F. & BOHÓRQUEZ C. 2000. Evaluando el estado de la biodiversidad: El caso de la avifauna de la serranía de las Quinchas, Boyacá, Colombia. Caldasia 22(1): 61-92.

STILES F. & ROSSELLI L. 1998. Inventario de las aves de un bosque altoandíno: Comparación d de dos métodos. Caldasia 20(1): 29-43.

USMA J. & TRUJILLO F. 2011. Biodiversidad del Casanare: Ecosistemas estratégicos del departamento. Gobernación del Casanare - WWF Colombia. Bogotá.

WHITTAKER, R. 1972. Evolution and measurement of species diversity. Taxon. May. 1972, 21(2/3). P- 213-251.
Online: [citado 07 de noviembre de 2011]. Disponible en: http://www.jstor.org/pss/i2i8i90