

Landscape Development Index (LDI)

Application of the LDI Index in References's Wetlands

The Land Development Intensity Index (LDI) estimates the potential impact of human activities on ecological systems, using land use data and a measure of development intensity, derived from non-renewable energy consumption per unit area (Brown & Vivas, 2004). The measurement of this energy consumption is carried out through the *Emergy* metric, a concept developed by Odum(1995), which is based on the availability of energy (exergy) of a type used in transformations directly and indirectly to generate a product or provide a service (Odum, 1995) cited by Brown & Vivas (2004). Data from LDI applied to reference and impaired wetlands sites is presented.

Materials and Methods

Selected sites for the reference wetland sites are: Forested sites (El Manantial -Vega Baja, Finca Virginia - Loíza, Palmas del Mar - Humacao) and Emergent sites (Finca La Esperanza B - Manatí, Arroyo I-Arroyo, Corredor Ecológico A - Luquillo). Impacted wetland sites are: Selected Impaired Wetland sites are: Pasto Viejo - Humacao, Río Grande - Río Grande, Manantial - Laguna Tortuguero - Vega Baja, Laguna Cartagena - Lajas, Plaza Canóvanas - Canóvanas, PR-3 - Luquillo) (Table 2 and Figure 5).

Table 2. Selected wetlands sites

	Name	Lat_DD	Lon_DD	Area (ha)
1	El Manantial	18.468492	-66.423153	189.58
2	Finca Virginia I	18.416339	-65.912722	198.45
3	Palmas del Mar	18.092878	-65.800600	50.78
4	La Esperanza B	18.465542	-66.503300	70.07
5	Arroyo I	17.963800	-66.043283	116.20
6	Corredor Ecológico A	18.363844	-65.695622	84.90
7	Pasto Viejo	18.160804	-65.777437	406.18
8	Río Grande	18.399278	-65.825162	246.43
9	Laguna Tortuguero	18.469074	-65.452310	20.90
10	Laguna Cartagena	18.013979	-67.098724	146.41
11	Plaza Canóvanas	18.380443	-65.886776	236.05
12	PR-3	18.379994	-65.748757	54.58

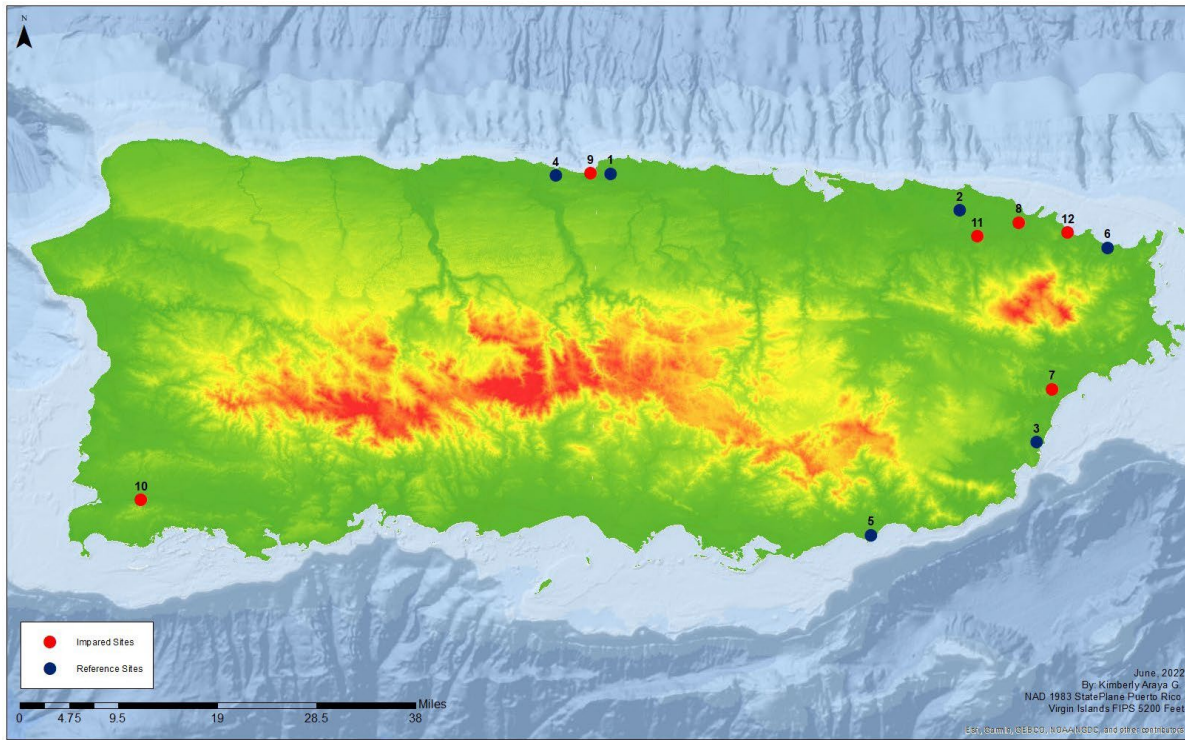


Figure 5. Location of the study sites

The delimitation of the sites includes the main ecosystem (wetland) and its respective recharge zone. Next, the buffer zone is delineated at 100 m, a distance considered sufficient to “capture” the disturbance gradient exerted on the wetland (Lane et. al, 2000). Once the delimitation of each system is complete, the land uses are classified according to the Florida Land Use and Cover Classification System (FLUCCS) using the adaptation made by Brown & Vivas (2004) (Appendix 1).

The digitization of land uses was carried out at a scale of 1:1000 using the ESRI World Imagery base map that provides 0.5 m resolution Maxar satellite images in the United States for the year 2018.

Next, the intensity of each activity is quantified by means of Emergy units (use of emergy per unit area per time). Emergy is energy corrected for different qualities and is expressed in Joules of solar *Emergy* per hectare per year (sej/ha/yr). This project uses the *Emergy* consumption data generated and reported by Brown & Vivas (2004).

With the Emergy calculated for each category and the area, total areal empower intensity (AEI) or power densities are obtained with formula (1). This value is the quantity resulting from expressing resource flows in their emergy equivalents per unit of time and area ($\text{sej time}^{-1} \text{ area}^{-1}$) (Chinners et. al., 2014).

$$AEI = \text{sej/ha/yr} * \text{ha}$$

The natural logarithm (\ln) of the AEI is calculated and normalized to a scale of 1.0 to 10.0, taking as point 1.0 the use of less intensity (natural/protected lands) and 10.0 for the use of greater intensity; to obtain the LDI coefficient of each polygon (see example in Table 3¹).

Table 3. LDI Coefficient - Corredor Ecologico A, Luquillo.

Land Use	Shape_area ha	Emergy sej	Areal Empower Intensity sej/ha/yr	LN Areal Empower Intensity (AEI)	LDI Coefficient
Terreno abierto de mediana intensidad	0.450	1230	553.076	6.32	6.5
Terreno abierto de mediana intensidad	0.579	1230	712.307	6.57	6.8
Terreno abierto de mediana intensidad	0.464	1230	570.290	6.35	6.6
Terreno abierto de mediana intensidad	0.435	1230	535.146	6.28	6.5
Terreno abierto de mediana intensidad	0.429	1230	528.139	6.27	6.5
Terreno abierto de mediana intensidad	4.672	1230	5746.946	8.66	9.0
Terreno abierto de mediana intensidad	1.314	1230	1615.633	7.39	7.6
Tierras naturales/protegidas	72.075	0	0.000	0.00	0.0
Tierras naturales/protegidas	0.171	0	0.000	0.00	0.0
Transporte de alta intensidad	3.115	5020	15638.088	9.66	10.0
Transporte de alta intensidad	0.614	5020	3082.541	8.03	8.3
Transporte de baja intensidad	0.076	3080	233.867	5.45	5.6
Transporte de baja intensidad	0.044	3080	134.864	4.90	5.1
Transporte de baja intensidad	0.079	3080	244.447	5.50	5.7
Transporte de baja intensidad	0.380	3080	1171.213	7.07	7.3
TOTAL	84.897				

Once the LDI coefficient has been generated for each polygon according to land use, the densities are calculated using a geostatistical procedure in ArcGIS using the Kernel Density tool, which calculates a magnitude per unit area from point or line features using the kernel function to fit a smoothly tapered surface to each point or line (only those features that fall within a neighborhood are taken) (ESRI, 2021). This geoprocess produces a raster file with a cell size that varies depending on the numeric value used as the population field (Figure 2). In Appendix 5 all maps with the power densities for each reference wetland are included.

¹ The calculations for the rest of the wetlands are presented in Appendix 3

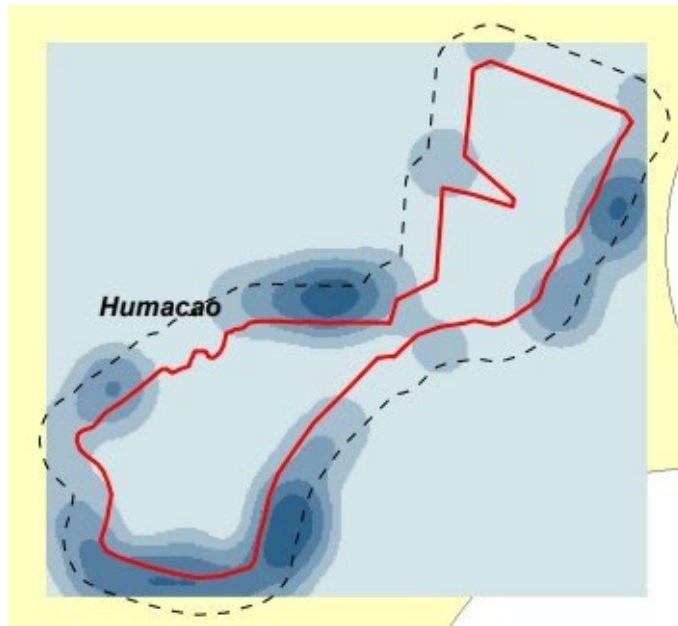


Figure 6. Kernel Density for PMD-Humacao Wetland

Once the LDI coefficients are assigned to each land use or cover, they are weighted by area by activity. Through the use of GIS, the total area and the percentage of the total area occupied by each of the land use categories are determined and the following equation is applied to obtain the *total weighted LDI*:

$$\text{total weighted LDI} = \sum \%LU_i * LDI_i$$

Where:

total weighted LD = LDI ranking for the landscape unit, in this case, the wetland as a complete system.

LU_i = Percentage of the total area of influence in land use i

LDI_i = LDI coefficient for land use i

The results for El Manantial wetland site are presented in Table 4 (the data for the rest of the wetlands are presented in Appendix 4).

Table 4. Total LDI - El Manantial, Vega Baja

Land Use	Total area	LU	Areal Empower Intensity	LN Areal Empower Intensity	LDI Coefficient	TOTAL LDI
	ha	%	sej/ha/yr			
Agricola general	7.053	3.72	755.635	6.628	6.7	24.930
Institucional	0.391	0.21	1579.502	7.365	7.4	1.535

Pastizales mejorados (sin ganado)	30.866	16.28	530.899	6.275	6.3	103.284
Residencia multifamiliar de baja densidad	2.673	1.41	19757.524	9.891	10.0	14.100
Residencia unifamiliar de alta densidad	6.827	3.60	16192.634	9.692	9.8	35.288
Residencia unifamiliar de baja densidad	3.113	1.64	3353.039	8.118	8.2	13.478
Residencia unifamiliar de mediana densidad	0.827	0.44	1799.639	7.495	7.6	3.307
Tierras naturales protegidas	136.705	72.11	0.000	0.000	0.0	0.000
Transporte de baja intensidad	1.120	0.59	3449.994	8.146	8.2	4.866
TOTAL	189.576	100				200.787

Results

Reference Wetland Sites

According to the land cover classification a total of 167 polygons distributed in the six study sites were obtained. The categories most represented are natural or protected lands, open lands of low and medium intensity, and improved grasslands. The Luquillo and Loiza wetlands have the less diversity of land use categories, while the Humacao and Manatí wetlands have the greatest number of economic activities (Appendix 7). The land use maps are presented in Appendix 6.

Regarding the index of the total LDI, Palmas del Mar wetland presents the highest degree of intensity of landscape development, despite being the smallest in area (Table 5). The Corredor Ecológico A wetland, in the municipality of Luquillo, has the lowest LDI of all the reference sites, demonstrating a greater degree of preservation of the water system.

Table 5. LDI Index - Reference Wetlands

Name	Municipality	Type	Latitude	Longitude	Area (ha)	LDI Index
El Manantial	Vega Baja	PFW	18.468492	-66.423153	189.58	2.0
Finca Virginia	Loíza	PEW	18.416339	-65.912722	198.45	3.2
Corredor Ecológico A	Luquillo	PFW	18.363844	-65.695622	84.90	1.4
La Esperanza B	Manatí	PEW	18.465542	-66.503300	70.07	2.0
Arroyo 1	Arroyo	PEW	17.963800	-66.043283	116.20	2.2
Palmas del Mar	Humacao	PFW	18.092878	-65.800600	50.78	6.9

Impaired Sites

A total of 170 polygons were obtained from the land cover classification distributed in the six impaired wetland sites. The categories most represented are low intensity transport, low-intensity improved grassland (with cattle) and all types of residentials.

The Tortuguero wetland at Vega Baja is the least disturbed ecosystem, it only has one road crossing the north area (Table 6). Pasto Viejo and Río Grande wetlands are surrounded by extensive cattle ranching while Plaza Canóvanas and PR-3 at Luquillo are dominated by urban and other economic activities (Appendix 7). The land use maps are presented in Appendix 6.

Table 6. LDI Index - Impaired Wetlands

Name	Municipality	Type	Latitude	Longitude	Area (ha)	LDI Index
Pasto Viejo	Humacao	PEW	18.160804	-65.777437	406.18	4.3
Río Grande	Río Grande	PEW	18.399278	-65.825162	246.43	3.1
Laguna Tortuguero	Vega Baja	PFW	18.469074	-66.452310	20.90	0.1
Laguna Cartagena	Lajas	PEW	18.013979	-67.098724	146.41	6.0
Plaza Canóvanas	Canóvanas	PFW	18.380443	-65.886776	236.05	6.2
PR3	Luquillo	PFW	18.379994	-65.748757	54.58	8.6

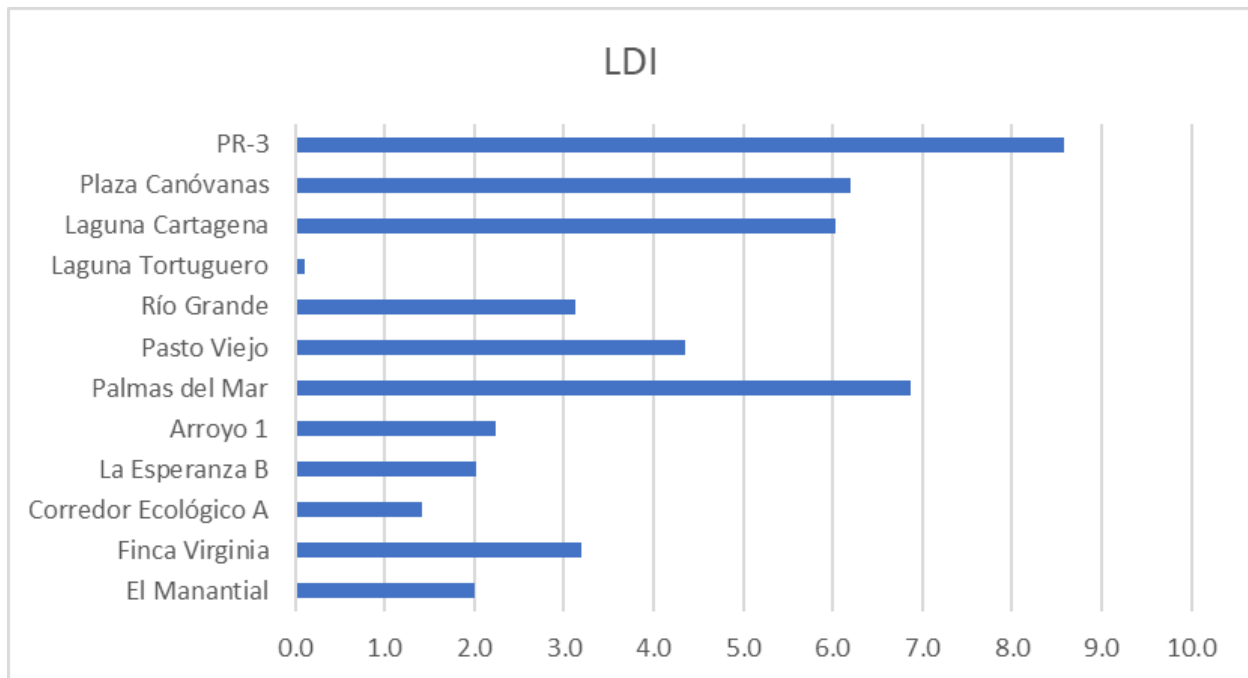


Figure 7. LDI for Reference and Impaired wetland sites under study

The LDI by itself should not be used as a final indicator of the status of sites of environmental vulnerability such as wetlands. Its correlation with other biophysical indicators that reflect the impact of human activities at the ecosystem and biological levels is necessary.

The LDI as is therefore one more input it contributes the generation of an important database on the energy consumption of many economic activities.

References

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APPENDIX 1

Land Use Categories

Land Use	Description
General Agricultural	Areas with unknown crops other than citrus or vegetables
Commercial - High Intensity	Shopping malls with storage buildings, associated parking garages, hotels, convention centers, and theme parks.
Commercial - Low Intensity	Commercial strip
Row Crops	Areas dedicated to the production of all types of vegetables, generally cultivated in rows (in production or not).
Central Business District - Low Intensity	Central business districts with an average of 2 floors.
Industrial	Material/product manufacturing, assembly or processing areas and associated buildings. It includes extractive areas and mining operations, supply and treatment plants for water and solid waste.
Institutional	Government buildings (military, school, university, health, institutional, religious, and others).
Improved Pastures (with livestock)	Areas where the natural vegetation has been altered by drainage, irrigation, etc., for the grazing of domestic animals with a density of less than 1.2 animals/ha
Improved Pastures (no livestock)	Areas of natural vegetation altered by drainage, irrigation, animal grazing, and others. Does not include cattle.
Forest Plantations	Land dedicated to forestry with different population densities.
Multi-Family Residential - High Density	Areas with multi-family residential units such as condominiums and apartment buildings with 3 floors or more.
Multi-Family Residential - Low Density	Areas with multi-family residential units such as condominiums and apartment buildings with up to 2 floors.
Single-Family Residential - Low Density	Residential areas with a density of less than 10 units/ha.
Single-Family Residential - Medium Density	Residential areas with a density between 10 and 20 units/ha.
Single-Family Residential - High Density	Residential areas with a density greater than 20 units/ha.
Open/Recreative Lands - Low Intensity	Areas of natural vegetation considered natural parks. Includes undeveloped land occupied by some vegetation in agricultural or urban landscapes. Includes access roads within protected and/or conservation lands.

Open/Recreative Lands - Medium Intensity	Areas with grassy lawns in urban landscape including recreational land such as playgrounds, ball fields, and swimming beaches. Also applies to land that has been cleared and prepared for construction, dirt roads, barren land, and open areas surrounding power lines. Includes human-created water bodies (retention ponds, canals, reservoirs, etc)
Open/Recreative Lands - High Intensity	Stadiums not associated with public institutions such as schools or universities. Applies to golf fields and racetracks.
Natural/Protected Lands	Open water, upland, or wetland with very little manipulation (ie, state parks, refuges, reserves, and other protected lands).
Highway - 2 lane	2-lane paved highways (including sidewalks), railroads, and transportation channels.
Highway - 4 lane	Paved roads with more than 2 lanes (including sidewalks), airports, railway terminals and public transport, port facilities and bus parking lots.

APPENDIX 2

Emergy evaluation presented by Brown & Vivas (2005).

Item	Units	Eq	Value	Reference
Sunlighth				
Annual energy		(Avg. Total annual insolation)(area)(1-albedo)	5.93E+13	
Insolation	J/m ² /yr		6.90E+09	NCDC
Area	m ²		10000	
Albedo			0.14	Odum 1987
Rain				
Annual energy		(in/yr)(area)(0.0254 m/in)(1e6 g/m ³)(4.94 J/g)(1-runoff)	2.71E+10	
Rain	in/yr		54	NCDC
Area	m ²		10000	
Runoff coeff	est		6.00E-01	
Wind kinetic energy	J/yr	(area)(air density)(drag coef)(velocity)	2.36E+11	
Area	m ²		10000	
Density of air	kg/m ³		1.3	

Avg. annual wind velocity	mps		5	NCDC
Geostrophic wind	mps		8.33	
Drag Coeff			1.00E-03	Miller 1964 quoted by Kraus 1972
Net topsoil loss				
Erosion rate	g/m ² /yr		5	Pimentel et al. 1995
% organic in soil	est		0.04	
Energy cont/g organic	kcal/g		5.4	
OM in topsoil used up		(total mass of topsoil)(% organic)		
Net loss of topsoil		(farmed area)(erosion rate)		
Energy loss		(loss of organic matter)(5.4 kcal/g)(4186 J/kcal)		
Annual energy			4.52E+07	
Natural gas				
Annual energy		(therms)(1.055e+8 J/therm)	3.29E+10	
Therms			3.12E+02	Gainesville Regional Utilities, 2002
Electricity				
Annual energy	J	(KWh)(3.3e+6 J/KWh)	6.22E+09	
KWh			1.73E+03	Gainesville Regional Utilities, 2002
Water				
Annual consumption		(gallons)(3785 cm ³)(1 g/cm ³)(4.94 J/g)	3.61E+09	
Gallons	gal		1.93E+05	Gainesville Regional Utilities, 2002
Food				
Annual consumption		(2500 Cal/day)(4187 J/Cal)(4 per/household)	4.19E+07	
Goods				
Annual consumption	\$		1.50E+04	

Pesticides		Pesticides, fungicides, herbicides		
Annual consumption	g/ha	est	1.59E+04	
Phosphate				
P per ha		(g fertilizer active ingredient)(31 gmol P/132 gmol DAP)	3.59E+04	
Annual consumption			8.44E+03	
Nitrogen				
N per ha		(g fertilizer active ingredient)(28 gmol P/132 gmol DAP)	1.07E+05	
Annual consumption			2.26E+04	
Construction materials				
Mass	g	(total weight)(50 yrs)	3.04E+07	
Total weight			1.52E+09	Haukoos 1994

APPENDIX 3

LDI Coefficient - Reference Wetlands

La Esperanza - Manatí

Land Use	Shape_Area	Emergy	Areal Empower Intensity	LN Areal Empower Intensity	LDI Coefficient
	ha	sej	sej/ha/yr		
Cultivos en hileras	1.252	107.13	134.107	4.90	4.9
Pastizales mejorados (sin ganado)	5.701	17.2	98.056	4.59	4.6
Pastizales mejorados (sin ganado)	4.296	17.2	73.888	4.30	4.3
Pastizales mejorados (sin ganado)	3.300	17.2	56.754	4.04	4.0
Plantaciones Forestales	0.518	5.1	2.641	0.97	1.0
Plantaciones Forestales	5.115	5.1	26.084	3.26	3.2

Residencial Multifamiliar Baja Densidad	1.122	7391.5	8290.166	9.02	9.0
Residencial Multifamiliar Baja Densidad	3.145	7391.5	23249.845	10.05	10.0
Residencial Multifamiliar Baja Densidad	0.252	7391.5	1866.021	7.53	7.5
Residencial Multifamiliar Baja Densidad	1.260	7391.5	9316.343	9.14	9.1
Residencial Unifamiliar Baja Densidad	0.497	1077	535.734	6.28	6.2
Residencial Unifamiliar Baja Densidad	0.123	1077	132.533	4.89	4.9
Residencial Unifamiliar Baja Densidad	1.218	1077	1312.233	7.18	7.1
Residencial Unifamiliar Baja Densidad	1.773	1077	1909.894	7.55	7.5
Residencial Unifamiliar Mediana Densidad	0.225	2175	488.927	6.19	6.2
Residencial Unifamiliar Mediana Densidad	0.107	2175	232.357	5.45	5.4
Terreno Recreativo/abierto Baja Intensidad	1.694	6.55	11.098	2.41	2.4
Terreno Recreativo/abierto Baja Intensidad	1.959	6.55	12.832	2.55	2.5
Terreno Recreativo/abierto Baja Intensidad	1.299	6.55	8.508	2.14	2.1
Tierras naturales/protegidas	2.803	0	0.000	0.00	0.0
Tierras naturales/protegidas	0.402	0	0.000	0.00	0.0
Tierras Naturales/protegidas	18.025	0	0.000	0.00	0.0
Tierras Naturales/protegidas	0.989	0	0.000	0.00	0.0
Tierras Naturales/protegidas	0.748	0	0.000	0.00	0.0
Tierras Naturales/protegidas	0.001	0	0.000	0.00	0.0
Tierras Naturales/protegidas	0.323	0	0.000	0.00	0.0
Tierras Naturales/protegidas	11.033	0	0.000	0.00	0.0
Transporte Baja Densidad	0.115	3080	353.137	5.87	5.8
Transporte Baja Densidad	0.074	3080	228.939	5.43	5.4
Transporte Baja Densidad	0.013	3080	41.312	3.72	3.7
Transporte Baja Densidad	0.066	3080	204.121	5.32	5.3
Transporte Baja Densidad	0.023	3080	71.505	4.27	4.2
Transporte Baja Densidad	0.086	3080	265.635	5.58	5.6
Transporte Baja Densidad	0.394	3080	1214.589	7.10	7.1
Transporte Baja Densidad	0.051	3080	157.773	5.06	5.0
Transporte Baja Densidad	0.063	3080	193.655	5.27	5.2
TOTAL	70.069				

Finca Virginia - Loiza

Land Use	Shape_Area	Emergy	Areal Empower Intensity	LN Areal Empower Intensity	LDI Coefficient
	ha	sej	sej/ha/yr		
Residencial multifamiliar de baja densidad	0.200	7391.5	1480.591	7.300	9.7
Residencial unifamiliar de media densidad	0.844	2175	1834.967	7.515	10.0
Terreno abierto de baja intensidad	3.156	6.55	20.669	3.029	4.0
Terreno abierto de baja intensidad	0.940	6.55	6.158	1.818	2.4
Terreno abierto de baja intensidad	1.302	6.55	8.527	2.143	2.9
Terreno abierto de baja intensidad	45.614	6.55	298.772	5.700	7.6
Terreno abierto de baja intensidad	24.563	6.55	160.886	5.081	6.8
Tierras naturales/protegidas	65.588	0	0	0	0.0
Tierras naturales/protegidas	53.208	0	0	0	0.0
Tierras naturales/protegidas	3.033	0	0	0	0.0
TOTAL	198.448				

Palmas del Mar - Humacao

Land Use	Shape_area	Emergy	Areal Empower Intensity	LN Areal Empower Intensity	LDI Coefficient
	ha	sej	sej/ha/yr		
Comercial de alta intensidad	0.271	12661	3425.231	8.14	8.1
Distrito comercial central de baja intensidad	0.589	16150.3	9512.559	9.16	9.1
Distrito comercial central de baja intensidad	0.781	16150.3	12618.569	9.44	9.4
Industrial	0.939	5210.6	4894.984	8.50	8.5
Residencial multifamiliar de alta densidad	0.190	12825	2437.738	7.80	7.8
Residencial multifamiliar de alta densidad	0.764	12825	9796.107	9.19	9.1
Residencial multifamiliar de alta densidad	1.068	12825	13695.086	9.52	9.5
Residencial multifamiliar de alta densidad	0.718	12825	9203.400	9.13	9.1
Residencial multifamiliar de alta densidad	0.739	12825	9480.137	9.16	9.1
Residencial multifamiliar de alta densidad	0.072	12825	924.426	6.83	6.8
Residencial multifamiliar de alta densidad	1.803	12825	23122.154	10.05	10.0
Residencial multifamiliar de alta densidad	0.049	12825	628.002	6.44	6.4

Residencial multifamiliar de alta densidad	0.663	12825	8500.538	9.05	9.0
Residencial multifamiliar de alta densidad	1.057	12825	13554.217	9.51	9.5
Terreno abierto de baja intensidad	0.031	6.55	0.201	-1.60	-1.6
Terreno abierto de baja intensidad	0.005	6.55	0.030	-3.50	-3.5
Terreno abierto de mediana intensidad	0.271	1230	333.173	5.81	5.8
Terreno abierto de mediana intensidad	2.691	1230	3309.780	8.10	8.1
Terreno abierto de mediana intensidad	2.946	1230	3623.922	8.20	8.2
Terreno abierto de mediana intensidad	0.117	1230	143.414	4.97	4.9
Terreno abierto de mediana intensidad	0.232	1230	285.643	5.65	5.6
Terreno abierto de mediana intensidad	3.688	1230	4535.867	8.42	8.4
Terreno abierto de mediana intensidad	0.659	1230	810.864	6.70	6.7
Terreno abierto de mediana intensidad	0.526	1230	647.251	6.47	6.4
Terreno abierto de mediana intensidad	7.374	1230	9069.856	9.11	9.1
Terreno abierto de mediana intensidad	0.132	1230	162.429	5.09	5.1
Terreno abierto de mediana intensidad	3.405	1230	4188.555	8.34	8.3
Terreno abierto de mediana intensidad	0.693	1230	852.645	6.75	6.7
Terreno abierto de mediana intensidad	0.032	1230	38.872	3.66	3.6
Terreno abierto de mediana intensidad	0.062	1230	75.954	4.33	4.3
Terreno abierto de mediana intensidad	1.048	1230	1289.245	7.16	7.1
Terreno abierto de mediana intensidad	0.193	1230	237.998	5.47	5.4
Tierras naturales/protegidas	3.380	0	0.000	0.00	0.0
Tierras naturales/protegidas	0.251	0	0.000	0.00	0.0
Tierras naturales/protegidas	0.901	0	0.000	0.00	0.0
Tierras naturales/protegidas	1.980	0	0.000	0.00	0.0
Tierras naturales/protegidas	4.553	0	0.000	0.00	0.0
Tierras naturales/protegidas	0.471	0	0.000	0.00	0.0
Tierras naturales/protegidas	0.498	0	0.000	0.00	0.0
Transporte de alta intensidad	1.495	5020	7505.051	8.92	8.9
Transporte de baja intensidad	0.075	3080	232.386	5.45	5.4
Transporte de baja intensidad	2.559	3080	7882.570	8.97	8.9
Transporte de baja intensidad	0.459	3080	1413.434	7.25	7.2
Transporte de baja intensidad	0.355	3080	1092.319	7.00	7.0
TOTAL	50.783				

Arroyo 1 - Arroyo

Land Use	shape_area	Emergy	Areal Empower Intensity	LN Areal Empower Intensity	LDI Coefficient
	ha	sej	sej/ha/yr		
Comercial de alta intensidad	4.974	12661	62973.383	11.05	10.0
Pastizales mejorados (sin ganado)	1.212	17.2	20.851	3.04	2.7
Pastizales mejorados (sin ganado)	1.058	17.2	18.197	2.90	2.6
Pastizales mejorados (sin ganado)	22.489	17.2	386.816	5.96	5.4
Pastizales mejorados (sin ganado)	0.692	17.2	11.898	2.48	2.2
Residencial unifamiliar media densidad	0.718	2175	1562.015	7.35	6.7
Residencial unifamiliar media densidad	1.724	2175	3750.698	8.23	7.4
Terreno abierto de baja intensidad	5.805	6.55	38.023	3.64	3.3
Terreno abierto de baja intensidad	1.395	6.55	9.138	2.21	2.0
Terreno abierto de mediana intensidad	0.393	1230	483.552	6.18	5.6
Tierras naturales/protegidas	14.872	0	0.000	0.00	0.0
Tierras naturales/protegidas	0.480	0	0.000	0.00	0.0
Tierras naturales/protegidas	0.910	0	0.000	0.00	0.0
Tierras naturales/protegidas	0.880	0	0.000	0.00	0.0
Tierras naturales/protegidas	4.548	0	0.000	0.00	0.0
Tierras naturales/protegidas	0.396	0	0.000	0.00	0.0
Tierras naturales/protegidas	15.174	0	0.000	0.00	0.0
Tierras naturales/protegidas	7.806	0	0.000	0.00	0.0
Tierras naturales/protegidas	27.556	0	0.000	0.00	0.0
Transporte de alta intensidad	1.043	5020	5237.883	8.56	7.7
Transporte de baja intensidad	0.195	3080	599.861	6.40	5.8
Transporte de baja intensidad	0.206	3080	634.197	6.45	5.8
Transporte de baja intensidad	0.189	3080	580.894	6.36	5.8
Transporte de baja intensidad	0.143	3080	439.183	6.08	5.5
Transporte de baja intensidad	0.059	3080	181.652	5.20	4.7
Transporte de baja intensidad	0.351	3080	1082.266	6.99	6.3
Transporte de baja intensidad	0.100	3080	306.648	5.73	5.2
Transporte de baja intensidad	0.464	3080	1429.893	7.27	6.6
Transporte de baja intensidad	0.369	3080	1137.629	7.04	6.4
TOTAL	116.202				

El Manantial - Vega Baja

Land Use	Shape_area	Emergy	Areal Empower Intensity	LN Areal Empower Intensity	LDI Coefficient
	ha	sej	sej/ha/yr		
Agricola general	7.053	107.13	755.635	6.63	7.2
Institucional	0.391	4042.2	1579.502	7.36	8.0
Pastizales mejorados (sin ganado)	7.620	17.2	131.062	4.88	5.3
Pastizales mejorados (sin ganado)	9.141	17.2	157.230	5.06	5.5
Pastizales mejorados (sin ganado)	13.005	17.2	223.684	5.41	5.9
Pastizales mejorados (sin ganado)	0.547	17.2	9.413	2.24	2.4
Pastizales mejorados (sin ganado)	0.553	17.2	9.511	2.25	2.4
Residencia multifamiliar de baja densidad	1.398	7391.5	10331.521	9.24	10.0
Residencia multifamiliar de baja densidad	0.804	7391.5	5945.486	8.69	9.4
Residencia multifamiliar de baja densidad	0.471	7391.5	3480.517	8.15	8.8
Residencia unifamiliar de alta densidad	2.485	2371.8	5893.608	8.68	9.4
Residencia unifamiliar de alta densidad	4.342	2371.8	10299.027	9.24	10.0
Residencia unifamiliar de baja densidad	0.143	1077	154.346	5.04	5.5
Residencia unifamiliar de baja densidad	0.861	1077	926.862	6.83	7.4
Residencia unifamiliar de baja densidad	0.715	1077	770.274	6.65	7.2
Residencia unifamiliar de baja densidad	1.378	1077	1484.361	7.30	7.9
Residencia unifamiliar de baja densidad	0.016	1077	17.196	2.84	3.1
Residencia unifamiliar de mediana densidad	0.827	2175	1799.639	7.50	8.1
Tierras naturales protegidas	7.636	0	0.000	0.00	0.0
Tierras naturales protegidas	0.056	0	0.000	0.00	0.0
Tierras naturales/protegidas	1.654	0	0.000	0.00	0.0
Tierras naturales/protegidas	83.440	0	0.000	0.00	0.0
Tierras naturales/protegidas	0.503	0	0.000	0.00	0.0
Tierras naturales/protegidas	11.438	0	0.000	0.00	0.0
Tierras naturales/protegidas	8.626	0	0.000	0.00	0.0
Tierras naturales/protegidas	0.851	0	0.000	0.00	0.0
Tierras naturales/protegidas	22.500	0	0.000	0.00	0.0
Transporte de baja intensidad	0.421	3080	1295.414	7.17	7.8

Transporte de baja intensidad	0.169	3080	520.304	6.25	6.8
Transporte de baja intensidad	0.082	3080	253.777	5.54	6.0
Transporte de baja intensidad	0.326	3080	1004.175	6.91	7.5
Transporte de baja intensidad	0.080	3080	247.484	5.51	6.0
Transporte de baja intensidad	0.042	3080	128.839	4.86	5.3
TOTAL	189.576				

LDI Coefficient - Impared Wetlands

Pasto Viejo - Humacao

Land Use	Shape_area	Emergy	Areal Empower Intensity	LN Areal Empower Intensity	LDI Coefficient
	ha	sej	sej/ha/yr		
Pastizales mejorados de baja intensidad (con ganado)	10.013978	33.31	333.566	5.81	6.2
Pastizales mejorados de baja intensidad (con ganado)	2.796919	33.31	93.165	4.53	4.8
Pastizales mejorados de baja intensidad (con ganado)	34.336998	33.31	1143.765	7.04	7.5
Residencial unifamiliar de alta densidad	5.139117	2371.8	12188.958	9.41	10.0
Residencial unifamiliar de baja densidad	0.708531	1077	763.088	6.64	7.1
Residencial unifamiliar de baja densidad	0.502781	1077	541.495	6.29	6.7
Residencial unifamiliar de baja densidad	0.078566	1077	84.616	4.44	4.7
Residencial unifamiliar de baja densidad	1.649433	1077	1776.439	7.48	8.0
Residencial unifamiliar de baja densidad	0.051998	1077	56.002	4.03	4.3
Residencial unifamiliar de baja densidad	1.511713	1077	1628.115	7.40	7.9
Residencial unifamiliar de baja densidad	0.394779	1077	425.177	6.05	6.4
Residencial unifamiliar media densidad	0.34837	2175	757.705	6.63	7.0
Residencial unifamiliar media densidad	1.116832	2175	2429.110	7.80	8.3

Residencial unifamiliar media densidad	0.768328	2175	1671.113	7.42	7.9
Terreno abierto de mediana intensidad	1.315494	1230	1618.058	7.39	7.9
Tierras naturales/protegidas	19.724432	0	0.000	0.00	0.0
Tierras naturales/protegidas	0.553297	0	0.000	0.00	0.0
Tierras naturales/protegidas	1.713714	0	0.000	0.00	0.0
Tierras naturales/protegidas	7.885333	0	0.000	0.00	0.0
Tierras naturales/protegidas	1.71571	0	0.000	0.00	0.0
Tierras naturales/protegidas	16.363172	0	0.000	0.00	0.0
Tierras naturales/protegidas	2.747896	0	0.000	0.00	0.0
Tierras naturales/protegidas	1.679042	0	0.000	0.00	0.0
Tierras naturales/protegidas	2.373631	0	0.000	0.00	0.0
Transporte de baja intensidad	0.715723	3080	2204.427	7.70	8.2
Transporte de baja intensidad	0.596196	3080	1836.284	7.52	8.0
Transporte de baja intensidad	0.139228	3080	428.822	6.06	6.4
Total	116.941211				

Río Grande - Río Grande

Land Use	Shape_area	Emergy	Areal Empower Intensity	LN Areal Empower Intensity	LDI Coefficient
		sej	sej/ha/yr		
Pastizales mejorados de alta intensidad (con ganado)	4.546223	46.74	212.490	5.36	7.8
Pastizales mejorados de alta intensidad (con ganado)	1.092922	46.74	51.083	3.93	5.7
Pastizales mejorados de alta intensidad (con ganado)	3.345574	46.74	156.372	5.05	7.3
Pastizales mejorados de alta intensidad (con ganado)	21.039238	46.74	983.374	6.89	10.0
Tierras naturales/protegidas	42.361411	0	0.000	0.00	0.0
Tierras naturales/protegidas	17.560733	0	0.000	0.00	0.0

Tierras naturales/protegidas	6.719044	0	0.000	0.00	0.0
Transporte de baja intensidad	0.280534	3080	864.045	6.76	9.8
Total	96.945679				

Laguna Tortuguero - Vega Baja

Land Use	Shape_Area	Emergy	Areal Empower Intensity	LN Areal Empower Intensity	LDI Coefficient
		sej	sej/ha/yr		
Tierras naturales/protegidas	43.411395	0	0.000	0.00	0.0
Tierras naturales/protegidas	5.632227	0	0.000	0.00	0.0
Transporte de baja intensidad	0.54122	3080	1666.958	7.42	10.0
Total	49.584842				

Laguna Cartagena - Lajas

Land Use	Shape_Area	Emergy	Areal Empower Intensity	LN Areal Empower Intensity	LDI Coefficient
		sej	sej/ha/yr		
Pastos mejorados (sin ganado)	55.260128	17.2	950.474	6.86	9.0
Residencial unifamiliar de mediana densidad	0.315621	2175	686.476	6.53	8.6
Residencial unifamiliar de mediana densidad	0.329846	2175	717.415	6.58	8.6
Residencial unifamiliar de mediana densidad	0.92098	2175	2003.132	7.60	10.0
Residencial unifamiliar de mediana densidad	0.778873	2175	1694.049	7.43	9.8
Residencial unifamiliar de mediana densidad	0.612534	2175	1332.261	7.19	9.5
Residencial unifamiliar de mediana densidad	0.807767	2175	1756.893	7.47	9.8
Tierras naturales/protegidas	17.022894	0	0.000	0.00	0.0

Transporte de baja intensidad	0.021537	3080	66.334	4.19	5.5
Transporte de baja intensidad	0.072624	3080	223.682	5.41	7.1
Transporte de baja intensidad	0.34512	3080	1062.970	6.97	9.2
Total	76.487924				

Plaza Canóvanas - Canóvanas

Land Use	Shape_area	Emergy	Areal Empower Intensity	LN Areal Empower Intensity	LDI Coefficient
		sej	sej/ha/yr		
Comercial de alta intensidad	5.518893	12661	69874.704	11.15	10.0
Comercial de alta intensidad	0.174563	12661	2210.142	7.70	6.9
Comercial de alta intensidad	0.364026	12661	4608.933	8.44	7.6
Comercial de baja intensidad	0.246648	3758	926.903	6.83	6.1
Comercial de baja intensidad	0.535406	3758	2012.056	7.61	6.8
Comercial de baja intensidad	0.155291	3758	583.584	6.37	5.7
Comercial de baja intensidad	0.482794	3758	1814.340	7.50	6.7
Industrial	2.157807	5210.6	11243.469	9.33	8.4
Industrial	1.900862	5210.6	9904.632	9.20	8.2
Industrial	0.573592	5210.6	2988.758	8.00	7.2
Industrial	6.606842	5210.6	34425.611	10.45	9.4
Industrial	1.021009	5210.6	5320.069	8.58	7.7
Institucional	0.866305	4042.2	3501.778	8.16	7.3
Institucional	3.669018	4042.2	14830.905	9.60	8.6
Institucional	0.202755	4042.2	819.576	6.71	6.0
Institucional	0.193291	4042.2	781.321	6.66	6.0
Institucional	1.622716	4042.2	6559.343	8.79	7.9

Institucional	2.869899	4042.2	11600.706	9.36	8.4
Pastizales mejorados (sin ganado)	25.120091	17.2	432.066	6.07	5.4
Residencial multifamiliar de baja densidad	0.09559	7391.5	706.553	6.56	5.9
Residencial multifamiliar de baja densidad	0.141105	7391.5	1042.978	6.95	6.2
Residencial multifamiliar de baja densidad	0.047719	7391.5	352.715	5.87	5.3
Residencial unifamiliar de alta densidad	0.893359	2371.8	2118.869	7.66	6.9
Residencial unifamiliar de alta densidad	0.070189	2371.8	166.474	5.11	4.6
Residencial unifamiliar de alta densidad	5.184423	2371.8	12296.414	9.42	8.4
Residencial unifamiliar de alta densidad	2.291327	2371.8	5434.569	8.60	7.7
Residencial unifamiliar de alta densidad	0.452289	2371.8	1072.739	6.98	6.3
Residencial unifamiliar de alta densidad	0.518421	2371.8	1229.591	7.11	6.4
Residencial unifamiliar de alta densidad	0.869023	2371.8	2061.149	7.63	6.8
Residencial unifamiliar de alta densidad	0.660192	2371.8	1565.843	7.36	6.6
Residencial unifamiliar de alta densidad	0.824633	2371.8	1955.865	7.58	6.8
Residencial unifamiliar de alta densidad	0.048796	2371.8	115.734	4.75	4.3
Residencial unifamiliar de alta densidad	0.998657	2371.8	2368.615	7.77	7.0
Residencial unifamiliar de alta densidad	0.140985	2371.8	334.388	5.81	5.2
Residencial unifamiliar de alta densidad	2.000921	2371.8	4745.784	8.47	7.6
Residencial unifamiliar de alta densidad	1.805777	2371.8	4282.942	8.36	7.5
Residencial unifamiliar de alta densidad	2.213751	2371.8	5250.575	8.57	7.7
Residencial unifamiliar de alta densidad	0.286647	2371.8	679.869	6.52	5.8
Residencial unifamiliar de alta densidad	1.568862	2371.8	3721.027	8.22	7.4
Residencial unifamiliar de alta densidad	0.837979	2371.8	1987.519	7.59	6.8

Residencial unifamiliar de alta densidad	0.273598	2371.8	648.920	6.48	5.8
Residencial unifamiliar de alta densidad	0.168375	2371.8	399.352	5.99	5.4
Residencial unifamiliar de alta densidad	2.299935	2371.8	5454.986	8.60	7.7
Residencial unifamiliar de alta densidad	0.441971	2371.8	1048.267	6.95	6.2
Residencial unifamiliar de alta densidad	0.600848	2371.8	1425.091	7.26	6.5
Residencial unifamiliar de alta densidad	1.119382	2371.8	2654.950	7.88	7.1
Residencial unifamiliar de alta densidad	0.503136	2371.8	1193.338	7.08	6.4
Residencial unifamiliar de alta densidad	2.133056	2371.8	5059.182	8.53	7.6
Residencial unifamiliar de baja densidad	0.068682	1077	73.971	4.30	3.9
Residencial unifamiliar de mediana densidad	1.002669	2175	2180.805	7.69	6.9
Residencial unifamiliar de mediana densidad	0.278306	2175	605.316	6.41	5.7
Terreno recreativo/abierto de baja intensidad	0.598159	6.55	3.918	1.37	1.2
Terreno recreativo/abierto de baja intensidad	1.657759	6.55	10.858	2.38	2.1
Terreno recreativo/abierto de baja intensidad	0.300893	6.55	1.971	0.68	0.6
Terreno recreativo/abierto de baja intensidad	3.395972	6.55	22.244	3.10	2.8
Terreno recreativo/abierto de baja intensidad	0.184288	6.55	1.207	0.19	0.2
Terreno recreativo/abierto de baja intensidad	1.166745	6.55	7.642	2.03	1.8

Terreno recreativo/abierto de baja intensidad	3.769606	6.55	24.691	3.21	2.9
Terreno recreativo/abierto de baja intensidad	0.832891	6.55	5.455	1.70	1.5
Terreno recreativo/abierto de baja intensidad	3.403244	6.55	22.291	3.10	2.8
Terreno recreativo/abierto de baja intensidad	0.857033	6.55	5.614	1.73	1.5
Terreno recreativo/abierto de baja intensidad	0.324882	6.55	2.128	0.76	0.7
Terreno recreativo/abierto de baja intensidad	0.528776	6.55	3.463	1.24	1.1
Terreno recreativo/abierto de baja intensidad	0.567814	6.55	3.719	1.31	1.2
Terreno recreativo/abierto de baja intensidad	0.555148	6.55	3.636	1.29	1.2
Terreno recreativo/abierto de baja intensidad	0.918347	6.55	6.015	1.79	1.6
Terreno recreativo/abierto de baja intensidad	1.638887	6.55	10.735	2.37	2.1
Terreno recreativo/abierto de baja intensidad	1.703242	6.55	11.156	2.41	2.2
Terreno recreativo/abierto de baja intensidad	0.406082	6.55	2.660	0.98	0.9
Tierras naturales/protegidas	4.420001	0	0.000	0.00	0.0
Tierras naturales/protegidas	24.783446	0	0.000	0.00	0.0
Transporte de alta intensidad	0.420591	5020	2111.367	7.66	6.9
Transporte de alta intensidad	0.507464	5020	2547.469	7.84	7.0
Transporte de alta intensidad	0.202747	5020	1017.790	6.93	6.2
Transporte de alta intensidad	0.61151	5020	3069.780	8.03	7.2
Transporte de alta intensidad	0.313899	5020	1575.773	7.36	6.6
Transporte de alta intensidad	0.270576	5020	1358.292	7.21	6.5
Transporte de alta intensidad	0.170505	5020	855.935	6.75	6.1
Transporte de alta intensidad	0.568365	5020	2853.192	7.96	7.1
Transporte de alta intensidad	1.001956	5020	5029.819	8.52	7.6
Transporte de alta intensidad	1.51253	5020	7592.901	8.93	8.0
Transporte de alta intensidad	1.583921	5020	7951.283	8.98	8.1
Transporte de alta intensidad	0.176889	5020	887.983	6.79	6.1
Transporte de baja intensidad	0.396846	3080	1222.286	7.11	6.4

Transporte de baja intensidad	0.204902	3080	631.098	6.45	5.8
Transporte de baja intensidad	0.060423	3080	186.103	5.23	4.7
Transporte de baja intensidad	0.081726	3080	251.716	5.53	5.0
Transporte de baja intensidad	0.082746	3080	254.858	5.54	5.0
Transporte de baja intensidad	0.092042	3080	283.489	5.65	5.1
Transporte de baja intensidad	1.003711	3080	3091.430	8.04	7.2
Transporte de baja intensidad	0.109376	3080	336.878	5.82	5.2
Transporte de baja intensidad	0.147076	3080	452.994	6.12	5.5
Transporte de baja intensidad	0.07959	3080	245.137	5.50	4.9
Transporte de baja intensidad	0.206771	3080	636.855	6.46	5.8
Transporte de baja intensidad	0.14139	3080	435.481	6.08	5.4
Transporte de baja intensidad	0.113188	3080	348.619	5.85	5.2
Transporte de baja intensidad	0.459268	3080	1414.545	7.25	6.5
Transporte de baja intensidad	0.367027	3080	1130.443	7.03	6.3
Transporte de baja intensidad	0.202297	3080	623.075	6.43	5.8
Transporte de baja intensidad	0.237804	3080	732.436	6.60	5.9
Total	148.462762				

PR-3 - Luquillo

Land Use	Shape_Area	Emergy	Areal Empower Intensity	LN Areal Empower Intensity	LDI Coefficient
		sej	sej/ha/yr		
Comercial de baja intensidad	1.723934	3758	6478.544	8.78	8.4
Comercial de baja intensidad	0.759717	3758	2855.016	7.96	7.6
Residencial unifamiliar de mediana densidad	0.359368	2175	781.6254	6.66	6.4
Residencial unifamiliar de mediana densidad	6.03259	2175	13120.88	9.48	9.1
Residencial unifamiliar de mediana densidad	0.082425	2175	179.2744	5.19	5.0

Terreno recreativo/abierto de alta intensidad	27.433355	1230	33743.03	10.43	10.0
Terreno recreativo/abierto de alta intensidad	1.93263	1230	2377.135	7.77	7.5
Terreno recreativo/abierto de alta intensidad	0.038706	1230	47.60838	3.86	3.7
Terreno recreativo/abierto de alta intensidad	1.519804	1230	1869.359	7.53	7.2
Terreno recreativo/abierto de mediana intensidad	7.470017	1230	9188.121	9.13	8.8
Terreno recreativo/abierto de mediana intensidad	0.68419	1230	841.5537	6.74	6.5
Terreno recreativo/abierto de mediana intensidad	6.651096	1230	8180.848	9.01	8.6
Terreno recreativo/abierto de mediana intensidad	2.687871	1230	3306.081	8.10	7.8
Tierras naturales/protegidas	7.149415	0	0	0.00	0.0
Transporte de alta intensidad	1.392367	5020	6989.682	8.85	8.5
Transporte de baja intensidad	0.207729	3080	639.8053	6.46	6.2
Transporte de baja intensidad	0.057644	3080	177.5435	5.18	5.0
Transporte de baja intensidad	0.194578	3080	599.3002	6.40	6.1
Transporte de baja intensidad	0.042382	3080	130.5366	4.87	4.7
Transporte de baja intensidad	0.211689	3080	652.0021	6.48	6.2
Transporte de baja intensidad	0.102616	3080	316.0573	5.76	5.5
Total	66.734123				

APPENDIX 4

Total LDI- Reference Wetlands

La Esperanza - Manatí

Land Use	Total area	LU	Areal Empower Intensity	LN Areal Empower Intensity	LDI Coefficient	TOTAL LDI
	ha	%	sej/ha/ye			
Cultivos en hileras	1.252	1.79	134.107	4.899	4.6	5.751
Pastizales mejorados (sin ganado)	13.296	18.98	228.699	5.432	5.1	67.744
Plantaciones Forestales	5.632	8.04	28.726	3.358	3.1	17.738
Residencial Multifamiliar Baja Densidad	5.780	8.25	42722.375	10.662	10.0	57.799
Residencial Unifamiliar Baja Densidad	3.612	5.16	3890.394	8.266	7.8	28.005

Residencial Unifamiliar Mediana Densidad	0.332	0.47	721.284	6.581	6.2	2.047
Terreno Recreativo/abierto Baja Intensidad	4.952	7.07	32.438	3.479	3.3	16.160
Tierras naturales/protegidas	34.325	48.99	0.000	0.000	0.0	0.000
Transporte Baja Densidad	0.887	1.27	2730.666	7.912	7.4	6.579
TOTAL	70.069	100	50488.689			201.823
					LDI INDEX	2.0

Corredor Ecológico A - Luquillo

Land Use	Total area	LU	Areal Empower Intensity	LN Areal Empower Intensity	LDI Coefficient	TOTAL LDI
	ha	%	sej/ha/ye			
Terreno abierto de mediana intensidad	8.343	9.83	10261.536	9.236	9.4	92.26
Tierras naturales/protegidas	72.246	85.10	0.000	0.000	0.0	0.00
Transporte de alta intensidad	3.729	4.39	18720.629	9.837	10.0	43.93
Transporte de baja intensidad	0.579	0.68	1784.392	7.487	7.6	5.19
TOTAL	84.897	100.00	30766.557			141.38
					LDI INDEX	1.4

Finca Virginia - Loiza

Land Use	Total area	LU	Areal Empower Intensity	LN Areal Empower Intensity	LDI Coefficient	TOTAL LDI
	ha	%	sej/ha/ye			
Residencial multifamiliar de baja densidad	0.200	0.10	1480.591	7.300	9.7	0.980560847
Residencial unifamiliar de media densidad	0.844	0.43	1834.967	7.515	10.0	4.251309498
Terreno abierto de baja intensidad	75.574	38.08	495.013	6.205	8.3	314.4307137
Tierras naturales/protegidas	121.829	61.39	0.000	0	0.0	0
TOTAL	198.448	100				319.66
					LDI INDEX	3.2

Palmas del Mar - Humacao

Land Use	Total area	LU	Areal Empower Intensity	LN Areal Empower Intensity	LDI Coefficient	TOTAL LDI
	ha	%	sej/ha/ye			
Comercial de alta intensidad	0.271	0.53	3425.231	8.14	7.1	3.80
Distrito comercial central de baja intensidad	1.370	2.70	22131.128	10.00	8.8	23.63
Industrial	0.939	1.85	4894.984	8.50	7.4	13.76
Residencial multifamiliar de alta densidad	7.122	14.02	91341.805	11.42	10.0	140.25
Terreno abierto de baja intensidad	0.035	0.07	0.231	-1.46	-1.3	-0.09
Terreno abierto de mediana intensidad	24.069	47.40	29605.467	10.30	9.0	427.22
Tierras naturales/protegidas	12.032	23.69	0.000	0.00	0.0	0.00
Transporte de alta intensidad	1.495	2.94	7505.051	8.92	7.8	23.00
Transporte de baja intensidad	3.448	6.79	10620.709	9.27	8.1	55.11
TOTAL	50.783	100	169524.604			686.68
					LDI INDEX	6.9

Arroyo 1 - Arroyo

Land Use	Total area	LU	Areal Empower Intensity	LN Areal Empower Intensity	LDI Coefficient	TOTAL LDI
	ha	%	sej/ha/ye			
Comercial de alta intensidad	4.974	4.28	62973.383	11.050	10.0	42.80
Pastizales mejorados (sin ganado)	25.451	21.90	437.763	6.082	5.5	120.54
Residencial unifamiliar media densidad	2.443	2.10	5312.714	8.578	7.8	16.32
Terreno abierto de baja intensidad	7.200	6.20	47.161	3.853	3.5	21.61
Terreno abierto de mediana intensidad	0.393	0.34	483.552	6.181	5.6	1.89
Tierras naturales/protegidas	72.622	62.50	0.000	0	0.0	0.00
Transporte de alta intensidad	1.043	0.90	5237.883	8.564	7.7	6.96
Transporte de baja intensidad	2.075	1.79	6392.223	8.763	7.9	14.16
TOTAL	116.202	100				224.28
					LDI INDEX	2.2

Total LDI- Impared Wetlands

Pasto Viejo - Humacao

Land Use	Total area	LU	Areal Empower Intensity	LN AEI	LDI Coefficient	LDI TOTAL
	ha	%	sej/ha/ye			
Pastizales mejorados de baja intensidad (con ganado)	47.1479	40.32	1570.49	7.359	7.8	315.36
Residencial unifamiliar de alta densidad	5.139117	4.39	12188.95	9.408	10.0	43.95
Residencial unifamiliar de baja densidad	4.897801	4.19	5274.93	8.571	9.1	38.15
Residencial unifamiliar media densidad	2.23353	1.91	4857.92	8.488	9.0	17.23
Terreno abierto de mediana intensidad	1.315494	1.12	1618.05	7.389	7.9	8.83
Tierras naturales/protegidas	54.75623	46.82	0	0.000	0.0	0.00
Transporte de baja intensidad	1.451147	1.24	4469.53	8.405	8.9	11.09
Total	116.9412	100.00				434.62
					LDI INDEX	4.3

Río Grande - Río Grande

Land Use	Total area	LU	Areal Empower Intensity	LN AEI	LDI Coefficient	LDI TOTAL
	ha	%	sej/ha/ye			
Pastizales mejorados de alta intensidad (con ganado)	30.0239	30.97	1403.320	7.247	10.0	309.699
Tierras naturales/protegidas	66.6411	68.74	0	0.000	0.0	0.000
Transporte de baja intensidad	0.28053	0.29	864.045	6.762	9.3	2.700

Total	96.9456	100.0				312.399
					LDI INDEX	3.1

Laguna Tortuguero - Vega Baja

Land Use	Total area	LU	Areal Empower Intensity	LN Areal Empower Intensity	LDI Coefficient	LDI TOTAL
	ha	%	sej/ha/ye			
Tierras naturales/protegidas	49.04362	98.91	0.000	0.000	0.0	0.000
Transporte de baja intensidad	0.54122	1.09	1666.958	7.419	10.0	10.915
Total	49.58484	100.00				10.915
					LDI INDEX	0.1

Laguna Cartagena - Lajas

Land Use	Total area	LU	Areal Empower Intensity	LN Areal Empower Intensity	LDI Coefficient	LDI TOTAL
	ha	%	sej/ha/ye			
Pastos mejorados (sin ganado)	55.26013	72.25	950.47	6.857	7.6	549.8
Residencial unifamiliar de mediana densidad	3.765621	4.92	8190.23	9.011	10.0	49.2
Tierras naturales/protegidas	17.02289	22.26	0	0.000	0.0	0.0
Transporte de baja intensidad	0.439281	0.57	1352.985	7.210	8.0	4.6
Total	76.48792	100.00				603.6
					LDI INDEX	6.0

Plaza Canóvanas - Canóvanas

Land Use	Total area	LU	Areal Empower Intensity	LN Areal Empower Intensity	LDI Coefficient	LDI TOTAL
	ha	%	sej/ha/ye			
Comercial de alta intensidad	6.06	4.08	76693.78	11.248	10.0	40.8
Comercial de baja intensidad	1.42	0.96	5336.88	8.582	7.6	7.3
Industrial	12.26	8.26	63882.54	11.065	9.8	81.2
Institucional	9.42	6.35	38093.63	10.548	9.4	59.5
Pastizales mejorados (sin ganado)	25.12	16.92	432.07	6.069	5.4	91.3
Residencial multifamiliar de baja densidad	0.28	0.19	2102.25	7.651	6.8	1.3
Residencial unifamiliar de alta densidad	29.21	19.67	69272.05	11.146	9.9	194.9
Residencial unifamiliar de baja densidad	0.07	0.05	73.97	4.304	3.8	0.2
Residencial unifamiliar de mediana densidad	1.28	0.86	2786.12	7.932	7.1	6.1
Terreno recreativo/abierto de baja intensidad	22.81	15.36	149.40	5.007	4.5	68.4
Tierras naturales/protegidas	29.20	19.67	0.00	0.000	0.0	0.0
Transporte de alta intensidad	7.34	4.94	36851.58	10.515	9.3	46.2
Transporte de baja intensidad	3.99	2.68	12277.44	9.416	8.4	22.5
Total	148.46	100.00				619.8
					LDI INDEX	6.2

PR-3 - Luquillo

Land Use	Total area	LU	Areal Empower Intensity	LN Areal Empower Intensity	LDI Coefficient	LDI TOTAL
	ha	%	sej/ha/ye			
Comercial de baja intensidad	2.48	3.72	9333.56	9.14	8.7	32.3
Residencial unifamiliar de mediana densidad	6.47	9.70	14081.78	9.55	9.1	87.9
Terreno recreativo/abierto de alta intensidad	30.92	46.34	38037.13	10.55	10.0	463.4

Terreno recreativo/abierto de mediana intensidad	17.49	26.21	21516.60	9.98	9.5	248.0
Tierras naturales/protegidas	7.15	10.71	0.00	0.00	0.0	0.0
Transporte de alta intensidad	1.39	2.09	6989.68	8.85	8.4	17.5
Transporte de baja intensidad	0.82	1.22	2515.25	7.83	7.4	9.1
Total	66.73	100.00				858.1
					LDI INDEX	8.6

APPENDIX 5

Land Use Distribution by category

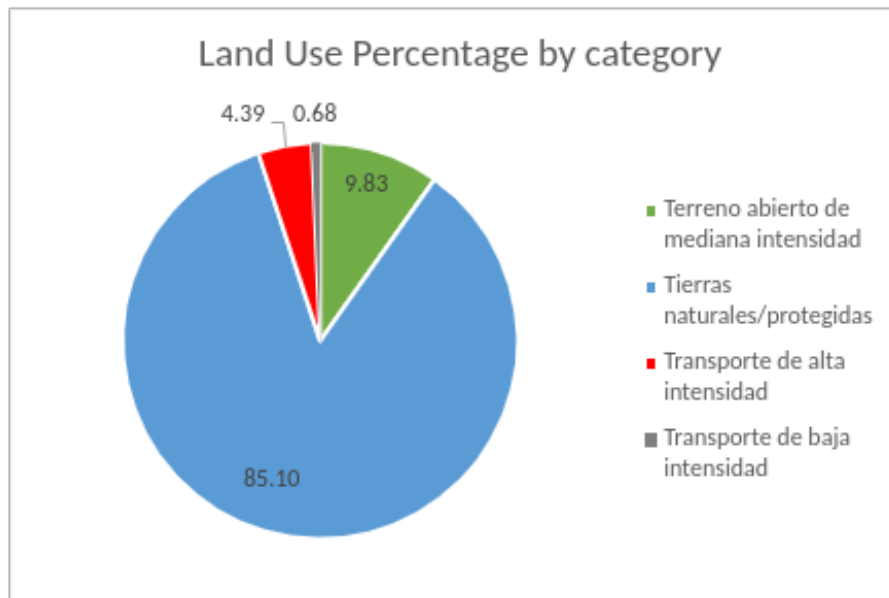


Figure 3. Land Use Categories - Corredor Ecologico A, Luquillo

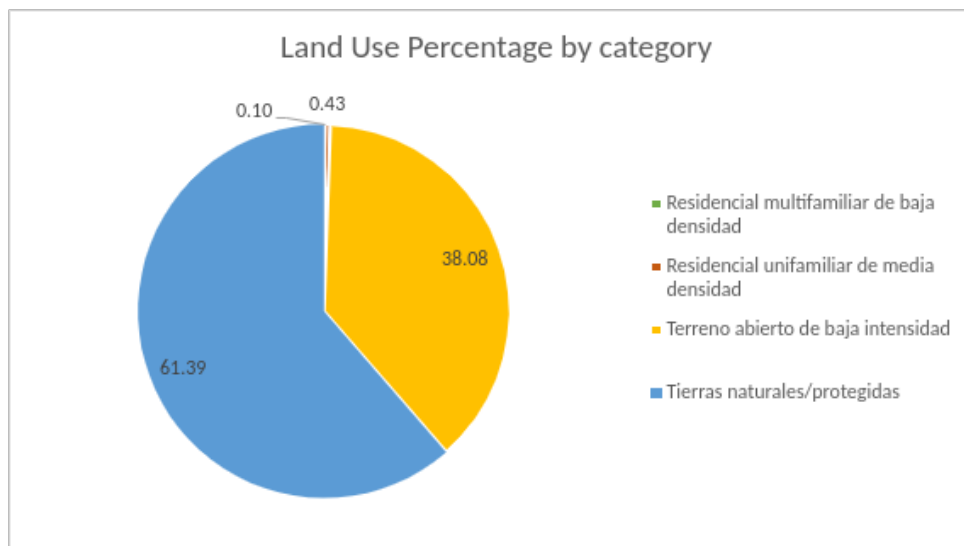


Figure 4. Land Use Categories - Finca Virginia, Loiza

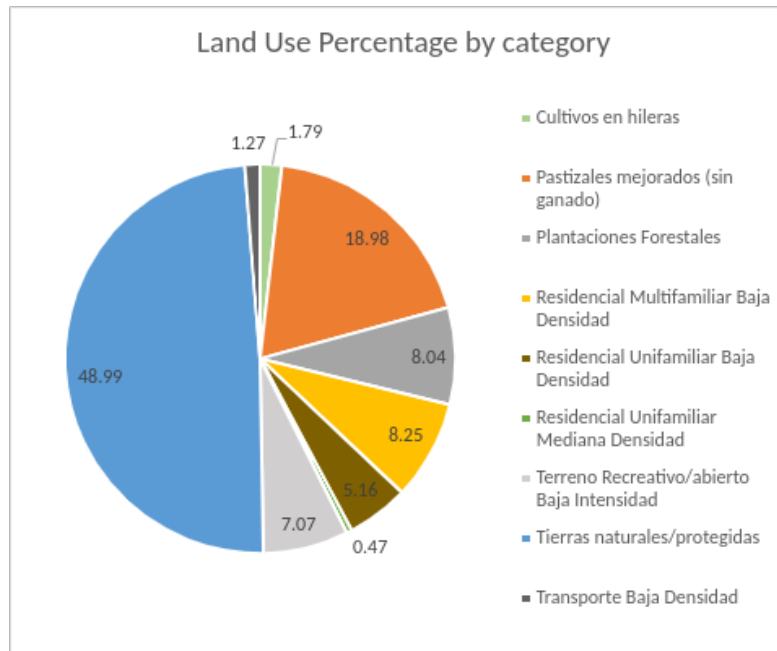


Figure 5. Land Use Categories - La Esperanza B, Manati

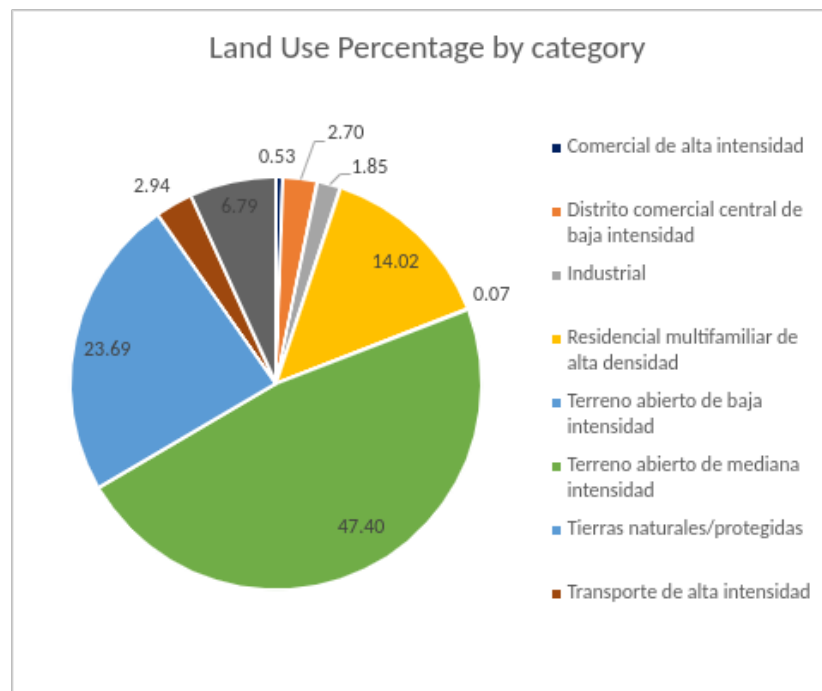


Figure 6. Land Use Categories - Palmas del Mar, Humacao

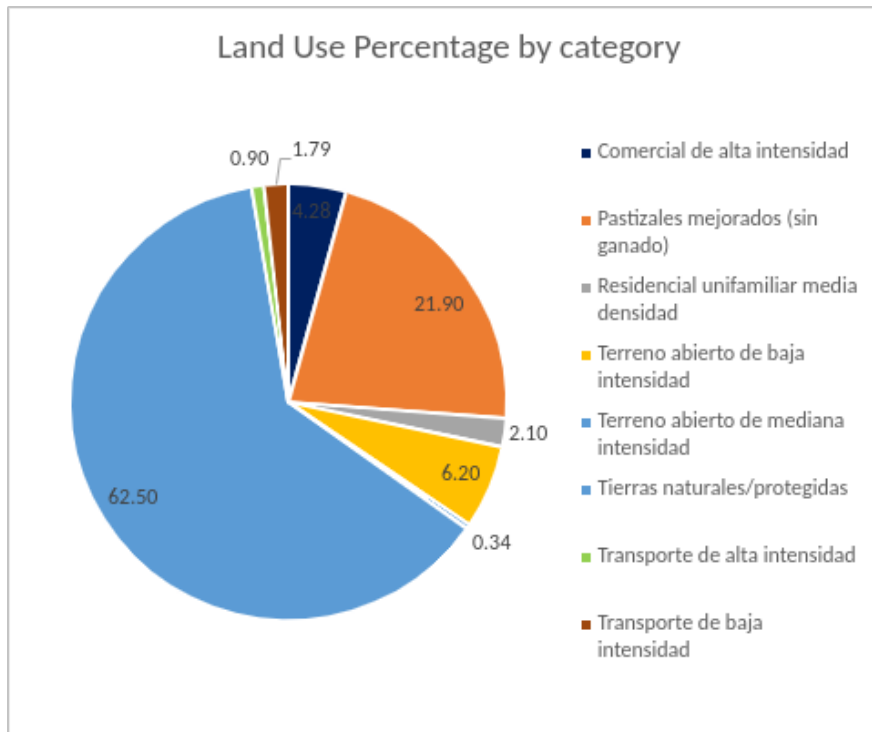


Figure 7. Land Use Categories - Arroyo 1, Arroyo

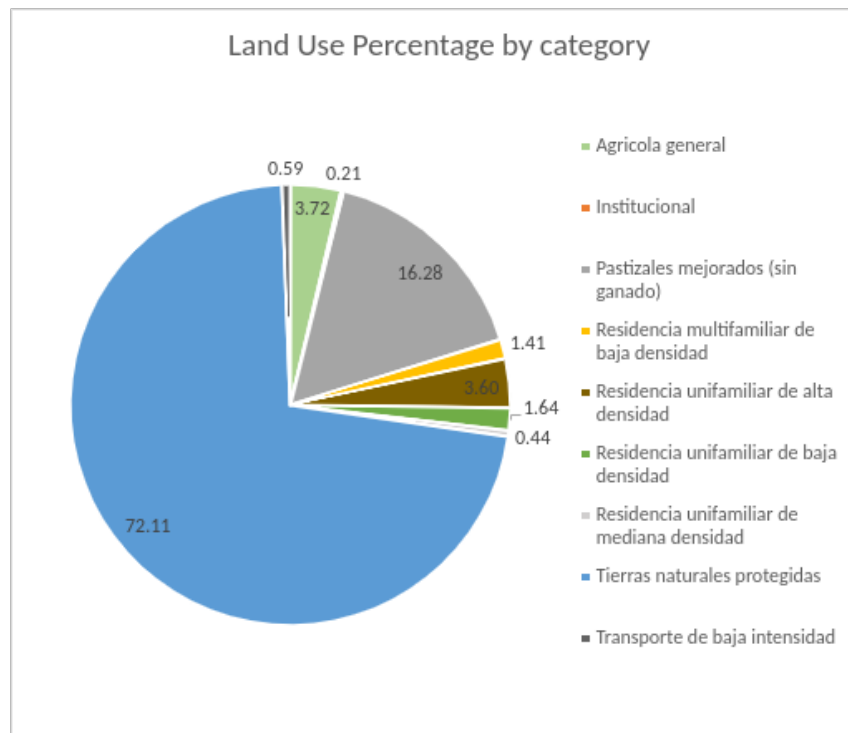


Figure 8 Land Use Categories - El Manantial, Vega Baja

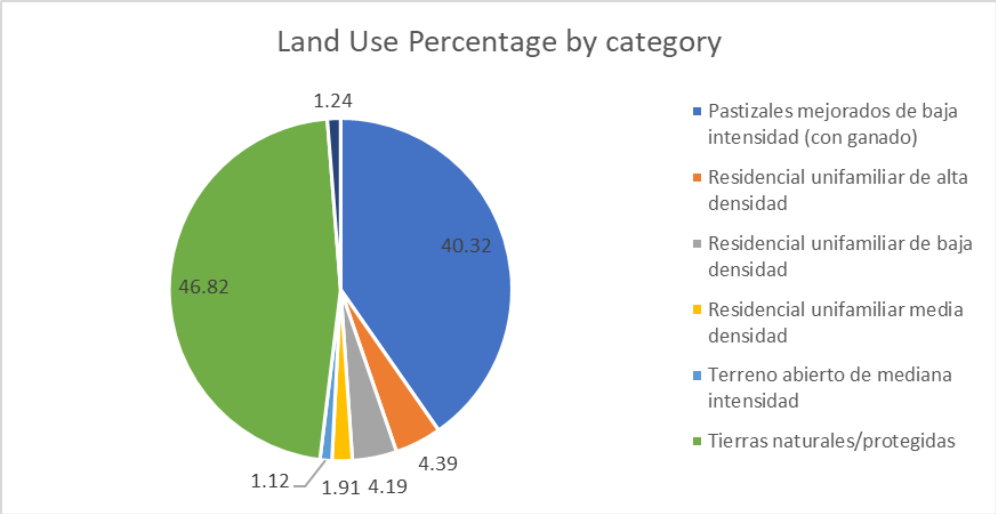


Figure 8 Land Use Categories - Pasto Viejo, Humacao

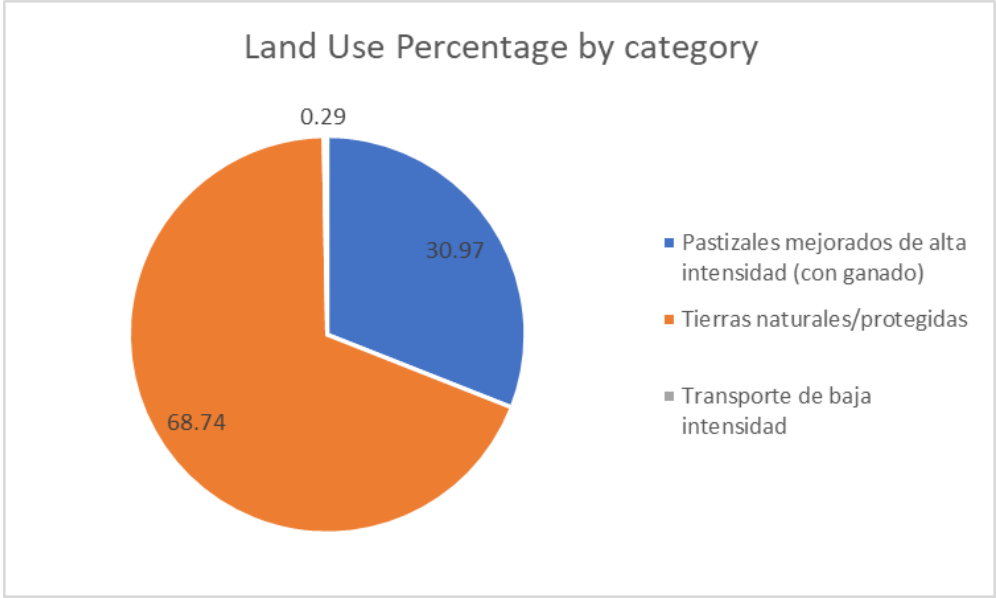


Figure 9 Land Use Categories - Rio Grande, Río Grande

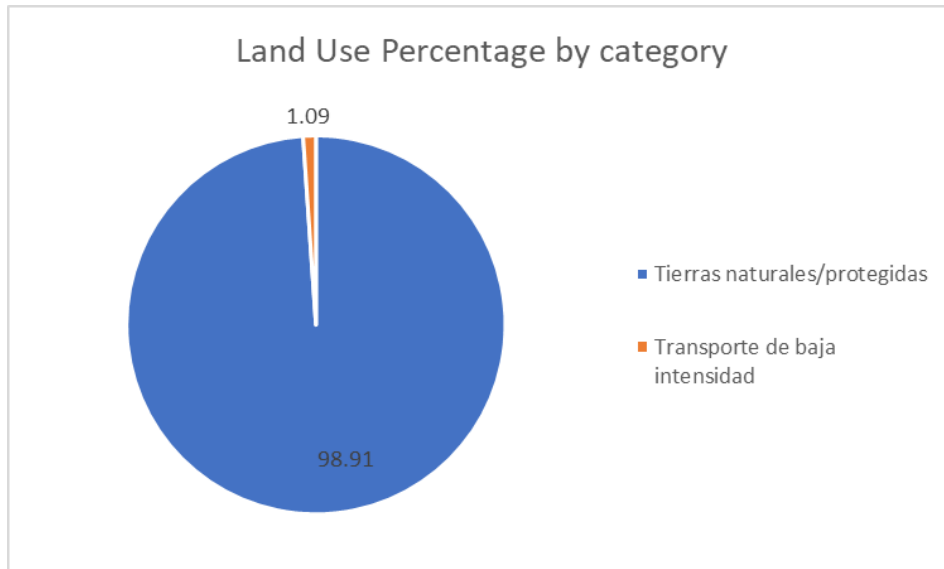


Figure 9 Land Use Categories - Laguna Tortuguero, Vega Baja

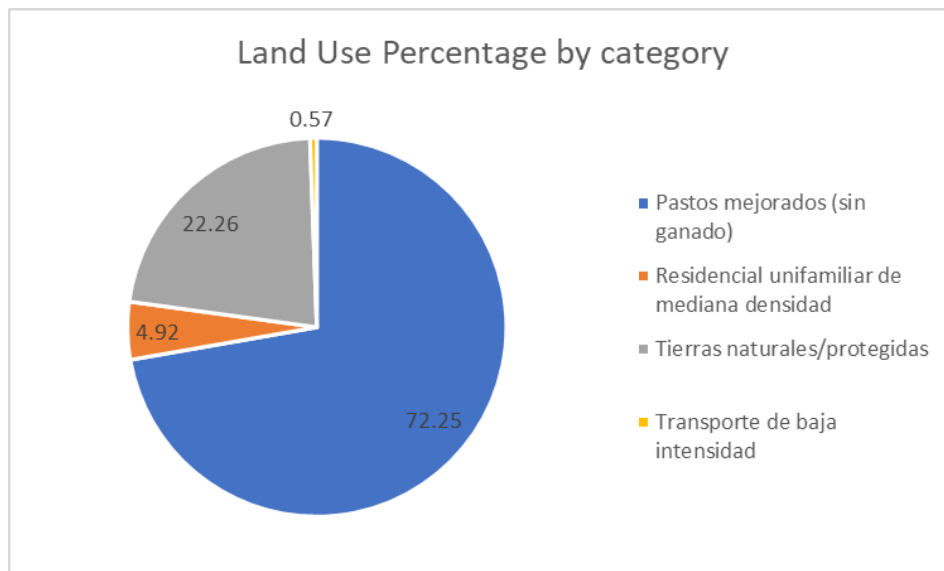


Figure 9 Land Use Categories - Laguna Cartagena, Lajas

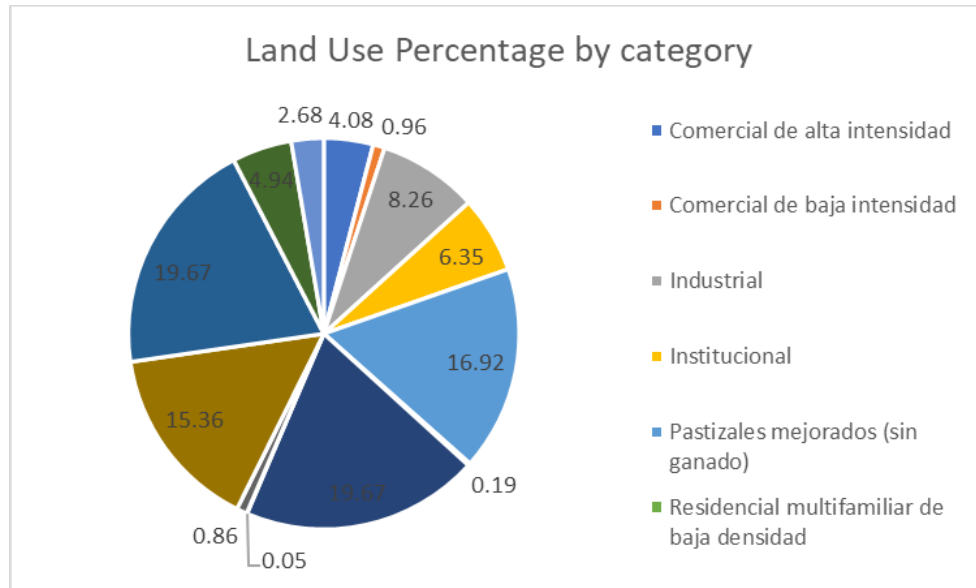


Figure 9 Land Use Categories - Plaza Canóvanas,
Canóvanas

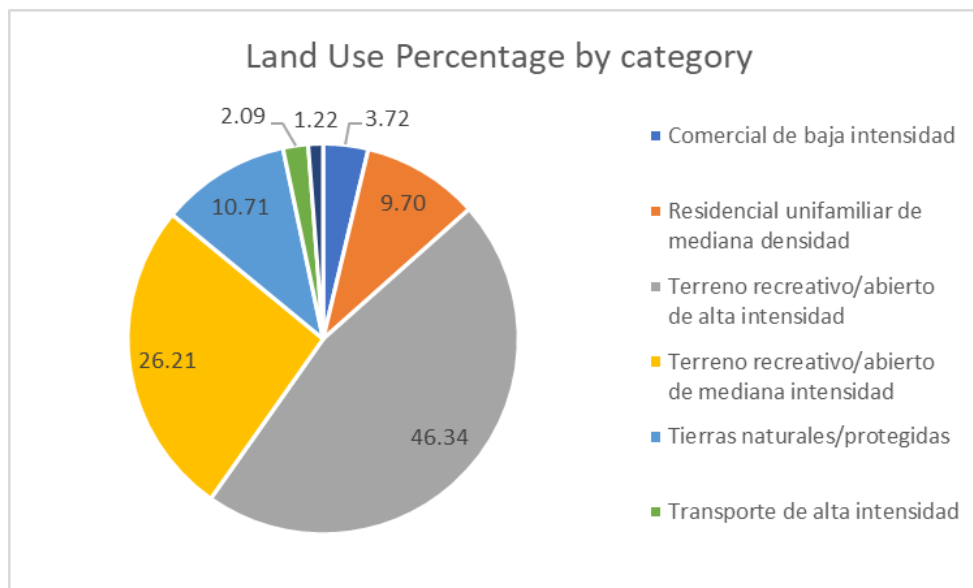


Figure 9 Land Use Categories - PR3, Luquillo