International Bird Conservation: An analysis of the bird and vegetation biodiversity in the Gallon Jug, Punta Gorda, Cockscomb Basin, and Belmopan regions of Belize

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BIO-315-10518-M01 Ecological Principles/Methods

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INTRODUCTION

Biodiversity is at the center of species survival, and it determines if an ecosystem flourishes. This study is based on research conducted in an environment close to the equator in Central America and considered a biodiverse hotspot, Belize. Belize's climate is subtropical and has wet and dry seasons. Additionally, the costal terrain is full of mangroves and floods often, inland consists of jungles, steep hills, and mountains. This study is relevant to the scientific community by providing a collective report of bird species richness and abundance. A select set of species in biodiverse hotspots only exist in that area due to the rich environment provided by the climate which makes this analysis that much more important. Scientists can account for endemic species, rare species, and possibly new species of bird. The challenge within this type of scientific research is navigating the land to conduct a survey of bird and vegetative species. A common technique for scientists to observe and evaluate bird populations is referred to as the MacKinnon method. Mackinnon method is a rapid assessment designed to estimate species richness and abundance indices in difficult environmental conditions. (O'Dea et al., 2004). Using this method, we will be able to determine which parcel of land in Belize is the most appropriate for purchase by the International Bird Conservation. Data is collected locally or at the site of each of the four possible land parcels and regionally surveying the broader area surrounding each parcel. Once data has been collected, we will compare each region. If the local parcels of land and the regional areas surrounding the parcels of land in Belize are diverse and abundant in bird species and vegetation, then it will be best suited for bird conservation.

METHODS

Field Collection

In this study, the most effective strategy to collect data is the MacKinnon method based on the geographical location. To accurately collect data on species richness and abundances in a highly diverse area with geographical challenges can lead to inaccurate data. According to MacLeod et al, in the topics where species richness is high, species density is low, and the environment is structurally complex monitoring species becomes quite the challenge (2011). Other approaches to collecting data in this type of environment can be expensive, take more time, and need a team of experts. For these reasons more scientists have used the MacKinnon method to collect data. This method produces rapid results, is easily understood, and produces consistent results, thus making this the best method for study.

Analysis

There are many different levels of data to compare to determine which parcel of land is most suitable for purchase. Therefore, we will be analyzing data by each parcel location then filter down each location by data relevance. The most impactful relevant data collected is the species diversity indices and the graphical analysis. This field data will be effective in making the bulk of our decision. Additionally, we will compare the vegetation communities and land use for each location. This secondary information will help us evaluate the environment the species resides in and what vegetative species support the environment. Once we have gathered and organized data gathered for each parcel of land then we can region our overall analysis of which parcel of land is ideal for purchase by The International Bird Conservation.

RESULTS

Parameters

The focus of the data is primarily on bird occurrences and abundances. Species diversity indices based on single-day bird surveys conducted by teams of observers within 15-mile-diameter circles that include the four sites being considered for conservation purchase. The 15-mile-diameter parcels of land are centered at Belmopan (17.146 °N, 88.729 °W), Cockscomb Basin (16.797 °N, 88.379 °W), Gallon Jug (17.561 °N, 89.044 °W), and Punta Gorda (16.165 °N, 88.883 °W). The data is recorded in five different parameters: Taxa (S), Individuals, Dominance (D), Shannon (H), Equitability (J) for each region. The secondary focus of data collection is on the presence of vegetation communities and land use parameters within each of the 15-mile-diameter regional circles and within each of the local parcels being examined for purchase.

Punta Gorda

Bird occurrences and abundances within the parcel of land Punta Gorda resulted in species richness, Taxa (S) - 240, Individuals – 1855, Dominance (D) – 0.00443, Shannon (H) – 5.446, and Equitability (J) – 0.9936. Vegetation communities and land use using regional data set, researchers found that the Punta Gorda parcel is comprised of agricultural use (49%), lowland broadleaf forest (47%), lowland pine forest, urban, water, and wetland (1%). Vegetation communities and land use using local data set, researchers found that the Punta Gorda parcel is comprised of mainly agricultural use (88%) and lowland broadleaf forest (12%).

Cockscomb Basin

Bird occurrences and abundances within the parcel of land Cockscomb Basin resulted in species richness, Taxa (S) – 240, Individuals – 3080, Dominance (D) –0.05034, Shannon (H) –4.411, and Equitability (J) –0.8049. Vegetation communities and land use using regional data set, researchers found that the Cockscomb Basin parcel consists of lowland broadleaf forest (53%), lowland savannah (18%), agricultural uses (17%), mangrove and littoral forest (5%), lowland pine forest (4%), wetlands (2%), and water (1%). Vegetation communities and land use using local data set, researchers found that the Cockscomb Basin parcel consists of lowland broadleaf forest (66%), agricultural uses (31%), lowland pine forest (2%), and water (1%).

Belmopan

Bird occurrences and abundances within the parcel of land Belmopan resulted in species richness, Taxa (S) –97, Individuals – 1802, Dominance (D) – 0.01101, Shannon (H) – 4.535, and Equitability (J) – 0.9913. Vegetation communities and land use using regional data set, researchers found that Belmopan parcel is mainly lowland broadleaf forest (75%), agricultural lands (13%), submontane pine forest (6%), submontane broadleaf forest and lowland savannah (2%), urban and lowland pine forest (1%). Vegetation communities and land use using local data set, researchers found that Belmopan parcel is mainly lowland broadleaf forest (83%) and the remaining area is agricultural lands (17%).

Gallon Jug

Bird occurrences and abundances within the parcel of land Gallon Jug resulted in species richness, Taxa (S) –96, Individuals – 1740, Dominance (D) – 0.10690, Shannon

(H) – 3.008, and Equitability (J) – 0.6591. Vegetation communities and land use using regional data set, researchers found that Gallon Jug parcel is mostly lowland broadleaf forest (97%), agricultural use (2%), and wetlands (1%). Vegetation communities and land use using local data set, researchers found that the Gallon Jug parcel has the most vegetation population in the form of lowland broadleaf forest (100%).

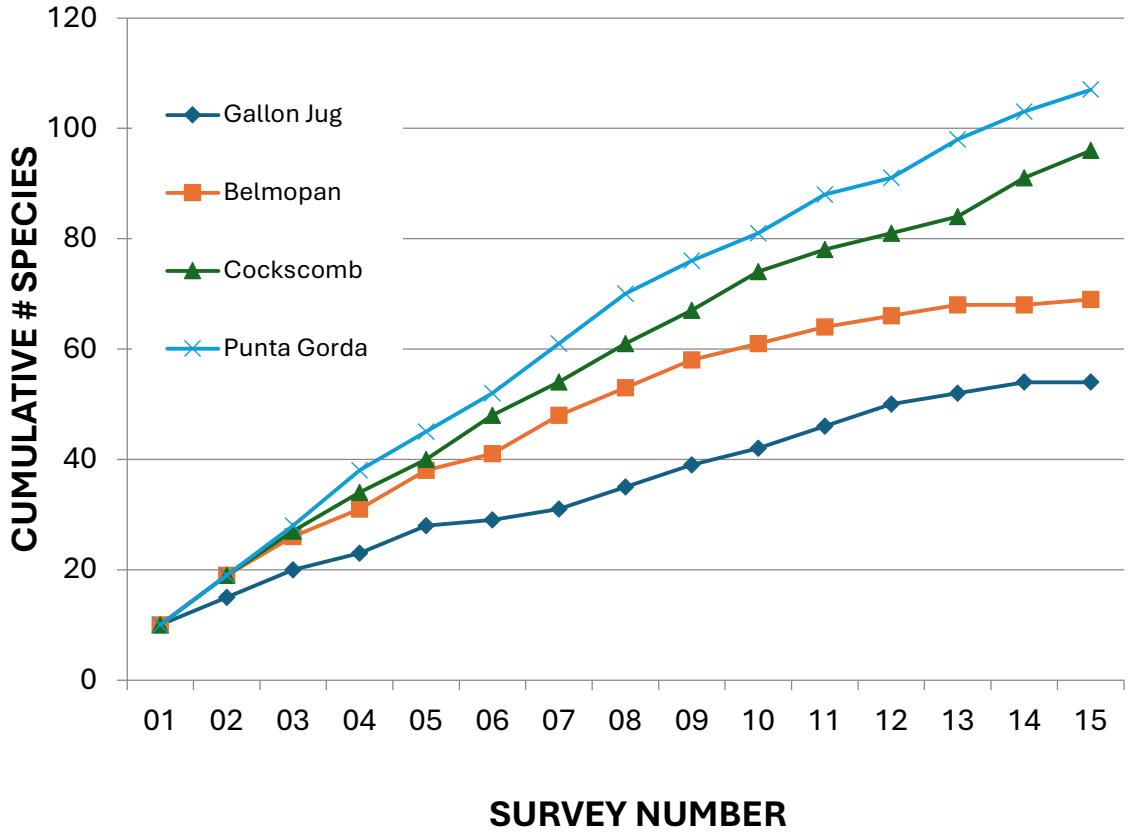
Graphical Analysis

Additionally, species detection for each parcel was collected using the MacKinnon method. Through a single day observation, over a 15-mile diameter, all observed species were recorded into surveys. Then each survey was analyzed, and every new species present per observation was recorded. Then calculated to create a cumulative result for each parcel and graphed with the other parcels to provide a total comparison of species detection per parcel.

	Punta Gorda	Cockscomb Basin	Belmopan	Gallon Jug
Taxa (S)	240	240	97	96
Individuals	1855	3080	1802	1740
Dominance (D)	0.00443	0.05034	0.01101	0.10690
Shannon (H)	5.446	4.411	4.535	3.008
Equitability (J)	0.9936	0.8049	0.9913	0.6591

SURVEY	Gallon Jug	Belmopan	Cockscomb	Punta Gorda
01	10	10	10	10
02	15	19	19	19
03	20	26	27	28
04	23	31	34	38
05	28	38	40	45
06	29	41	48	52
07	31	48	54	61
08	35	53	61	70
09	39	58	67	76
10	42	61	74	81

11	46	64	78	88
12	50	66	81	91
13	52	68	84	98
14	54	68	91	103
15	54	69	96	107



DISCUSSION

Comparing bird diversity indices across the four regions within the 15-mile diameter circles we can see that the Punta Gorda and Cockscomb Basin regions have greater species richness and individual populations than the Belmopan and Gallon Jug regions. The Cockscomb Basin has a significantly higher number of individuals which means this area is supporting a large bird population the easiest. This result is important when determining which parcel of land is best suited for purchase. Regarding species

occurrence the Punta Gorda area has the most diversity based on the species richness compared to individuals in the community. Analyzing land value from bird occurrences I would suggest Punta Gorda the most ideal for purchase. Analyzing land value from bird abundance I would suggest Cockscomb as the most ideal for purchase. Whereas the Belmopan and Gallon Jug areas are much less populated and diverse.

Analyzing vegetation communities and land use using a regional data set, I found that the Gallon Jug parcel is mostly lowland broadleaf forest with some small agricultural use, and wetland areas. This does not reflect diverse land or a diverse vegetation environment nor does it have water access for birds. Additionally, there isn't an urban population so there is less human interference with the land and thus less of a need to preserve for bird species.

The Belmopan parcel is mainly lowland broadleaf forest and has some agricultural lands, submontane pine forest, submontane broadleaf forest and lowland savannah, urban and lowland pine forest. This area has plant species diversity but in a very small amount because the lowland broadleaf forest dominates most of the land. There is an urban community sharing the land so more human interference however there is not a water source for bird species.

The Punta Gorda parcel is comprised of mainly agricultural use and lowland broadleaf forest covering almost all the land with some small areas of lowland pine forest, urban, water, and wetland. This area does have a water source for birds, a small urban community, and plant diversity yet minimal. Therefore, I would consider the Punta Gorda vegetation communities and land use as a candidate for purchase.

Approximately half of the Cockscomb Basin parcel consists of lowland broadleaf forest with some areas of lowland savannah, agricultural uses, mangrove and littoral forest, lowland pine forest, wetlands, and water. This area has great vegetation diversity compared to the other areas; each plant community has a decent population size. Also, there is a water source and an urban community. Therefore, I would consider the Cockscomb Basin vegetation communities and land use as a candidate for purchase.

Comparing all the data across bird occurrences and abundances as well as vegetation communities and land use we can see that the Cockscomb Basin and Punta Gorda are the most ideal for purchase. Cockscomb Basin has a larger bird population than Punta Gorda yet they both have the same species richness. Furthermore, Cockscomb Basin has a larger, more stable, and diverse vegetation communities as well as a variety of land uses. Based on this information I would recommend to the International Bird Conservation Organization that Cockscomb Basin is the best area for purchase of the four parcels of land.

LITERATURE CITED

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