El Zota Biological Field Station

Data Collection and Mapping

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Abstract -

El Zota is located in Northeastern Costa Rica near the Barro Del Colorado Reserve. El Zota Biological Field Station was first a saw mill, until 1991 when Hiner Remierez bought the plantation and decided to turn the plantation into a conservation area. The purpose of this project is to establish baseline conditions of El Zota, to support monitoring of primary and secondary forest, and to provide a survey of anthropogenically impacted areas of El Zota. Data was

collected by using two GPS units. Track lines were used to quantify the areas of Melina Plantations, T.I.N swamp, primary and secondary forest, and hiking trails. Track lines were imported into ArcGIS using DNR-Garmin. Multiple layers of polygons constructed from the track lines were compiled in ArcGIS. The resulting map of El Zota shows the distribution of Melina plantations, T.I.N. Swamp, primary forest, and secondary forest. The Baseline data gathered by this project will be useful to quantify how much the field station has changed as students and researchers continue to monitor the field station. It was determined that both the primary and secondary forests were anthropogenically impacted, but the impact was much higher in the secondary forest areas. The distinct distribution of primary forest in the northeastern quadrant of the reserve and secondary forest in the southeast is evidence that most of the impact has been concentrated in the southeastern portion of the park. With the help of these baseline conditions, further studies can be done on monitoring primates, water quality testing in the rivers, and transect line surveys. If the research and field work from this project are continued on a regular six to twelve month basis, El Zota will produce an excellent case study of how a tropical reserve has been affected by human impacts and the natural response to those impacts.

Introduction -

El Zota Field Station is located in Northeastern Costa Rica near the Barro Del Colorado Reserve (figure 1). The station is located approximately eighteen miles east of the Caribbean Sea, seventy-five miles northwest of Lake Nicaragua and eighty miles south of the Golfo De Nicoya. El Zota is over two thousand acres and has many different habitats including lowland forest, swamps, primary and secondary forestry. Primary forest can be described as having attained

great age, exhibits unique biological features, and is very densely vegetated. The primary forest is also an area that has not been fully disturbed by humans. The secondary forest can be described as forest that has re grown after a major disturbance such as a forest fire, insect infestation or tree harvest. El Zota is also surrounded by pastureland and plantations where bananas and Melina trees are grown. The pasture land is filled with cows, horses, and goats. Throughout El Zota Field Station there are also many river's and small ponds.

Objectives -

The objectives of this study were: 1) to establish baseline conditions of El Zota, 2) to establish a base map for future monitoring of primary and secondary forest, and 3) to provide a survey of anthropogenically impacted areas of El Zota.

Figure 1: Map of Costa Rica indicating the location of El Zota Field Station (Planet Ware, 2009)

Methodology-

Data was collected using two Global Positioning System units (GPSMAP 60CSx). Multiple "GPS" units were used to prevent errors in waypoint location and tracking lines, as well as providing a backup in case of data loss. This approach made it possible to overcome memory shortage and diminish the effect of signal loss in the field. Waypoints were taken at the Melina plantations, T.I.N Swamp and hiking trails. Track lines were used to quantify the areas of Melina

Plantations, T.I.N swamp, primary and secondary forest, and hiking trails. Waypoints were also taken when a notable plant or animal that was significant to the study was sighted such as a pineapple plant or a patch of secondary forest. Such plants or areas were documented to establish baseline data and encourage future monitoring.

Data Analysis -

The waypoints and track lines were imported into ArcGIS using DNR-Garmin software. The most reliable tracks were selected and used to build polygons for each type of ground cover. Polygons were constructed from the track lines to represent the areas of Melina Plantations and T.I.N. Swamp as well as primary forest and secondary forest. A map was created by combining the polygons and waypoints as multiple layers. A different color and texture was assigned to each layer, making it easier to discriminate each type of ground cover.

Results -

The map that was produced is a multi-layer GIS product that depicts each type of ground cover as a different color and texture, and documents the location and extent of current trails and roads (Figure 2). Waypoints are represented by green dots. The bridges and rivers, represented by blue fence icons, are used to indicate where water quality testing, collection of specimens and observations could be obtained. There are nine trails documented, ranging from 101m-941m in length (Table 1). The trails are indicated by red lines. The main road is displayed in yellow and is approximately 5,368 m long (Table 2). The two Melina plantations, labeled Melina 2 and De Lac, are eleven and twelve acres respectively (Table 3). The plantations are denoted by orange and yellow stripes in the south central and northwestern quadrants of the map. The water icon is

used for T.I.N. swamp. The area of T. I. N swamp is approximately eleven acres (Table 4). The primary and secondary forest is also shown on the map. Each section of the primary and secondary forest is estimated to be 2,019 acres (Table 5). The primary forest dominates the northeastern section of the El Zota , when the secondary forest is dominant in the southwestern section. The primary forest is displayed with a dark green color. One of the many benefits to having an undisturbed area for scientific research and study is, you are able to observe all natural elements of the different forest structures in that specific area, for example Animal species and plants and how they cohabitate differently within an undisturbed area. This would be in comparison to how an animal or plant species would adapt to a disturbed area in a forest. Another illustration would be enjoying a challenge to work for your research, pushing through dense areas of the forest that have not been anthropogenically disturbed or jumping across banks of water without bridges. This is the so called "Thinking outside the box" technique. Having an undisturbed area to work in allows you to freely observe any and all aspects anyway you desire in your research.
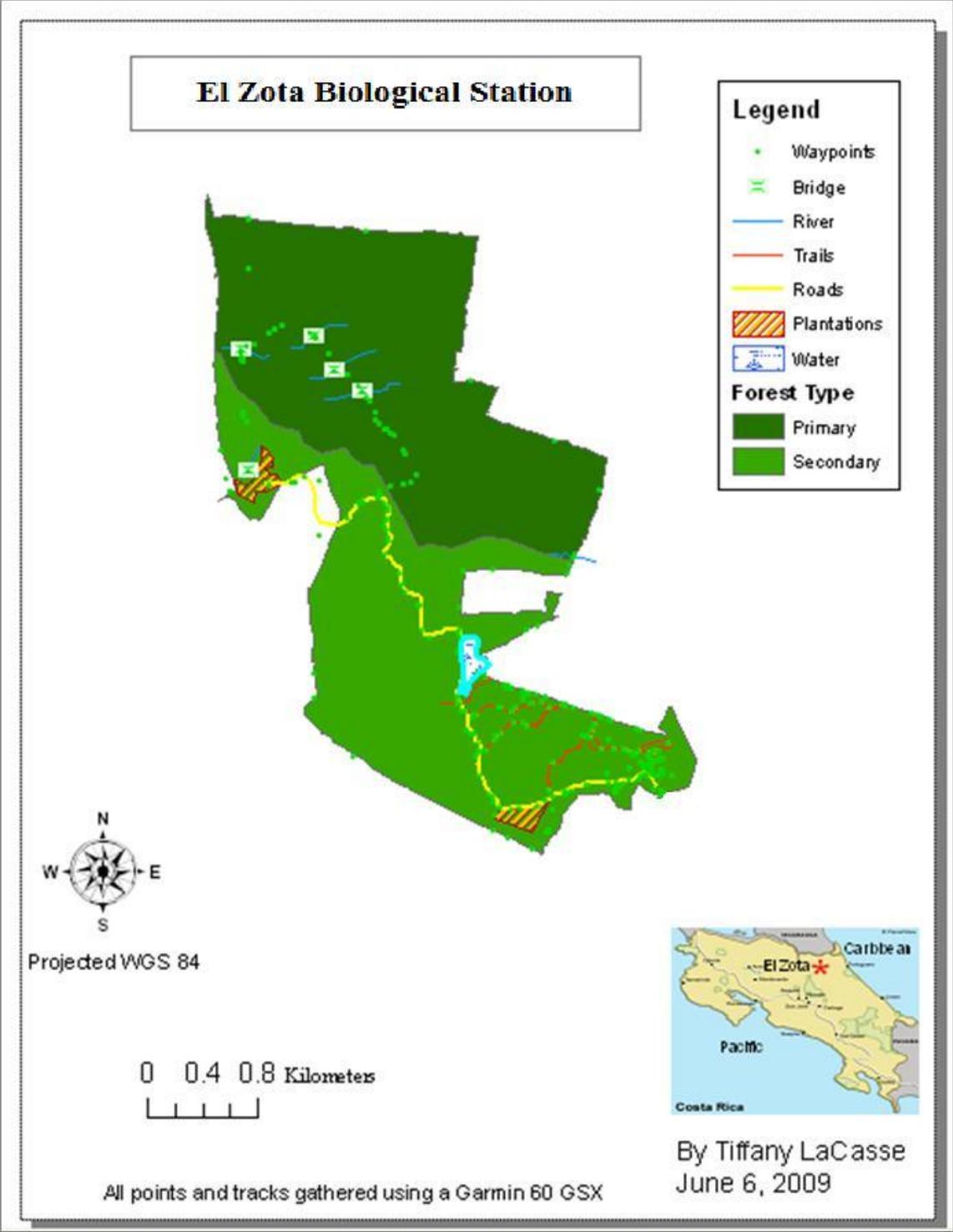
Figure 2: A map of El Zota showing the distribution of Melina plantations, primary forest, and secondary forest.

Table 1: Trail Attributes, showing distance in Meters.

Attributes of Trail

FID	Shape *	Id	Name	Distance_m
8	Polyline	0	Srn1	101
3	Polyline	0	Sts	190
5	Polyline	0	St	190
4	Polyline	0	Scl	300
7	Polyline	0	Srn2	586
6	Polyline	0	Sco	587
2	Polyline	0	Ss	684
1	Polyline	0	Sd	912
0	Polyline	0	Sla	941

Table 2: Road Attributes showing the area in Meters.

Attributes of Roads

FID	Shape	Id	Name	Distance_m
0	Polyline	0	Main Ro	5368.03973476556

Table 3: Melina Plantation attributes showing the area in Meters, Hectares, and Acres.

Attributes of Plantations

FID	Shape *	Id	area_m	area_Ha	area_Acre	type	name
0	Polygon	0	43841	4	11	Melina	Melina2
1	Polygon	0	49554	5	12	Melina	De Lac

Table 4: T.I.N. Swamp attributes showing the area in Meters, Hectares, and Acres.

Attributes of ez_h20

FID	Shape *	Id	Name	Area_meter	Area_Ha	Area_acre
0	Polygon	0	TinPond	44874	4	11

Table 5: Primary and Secondary Forest attributes showing the area in Meters, Hectares, and Acres.

Attributes of forest_types

FID	Shape *	Id	Name	Area_m	Area_Ha	Area_Acres	Owner	
0	Polygon	0	Estacion Biologica El Zota	8172219	817	2019	Hiner	Secondary
1	Polygon	0	Estacion Biologica El Zota	8172219	817	2019	Hiner	Primary

Discussion

Baselines

Baselines were established and will be useful for future studies on the Melina plantations or distribution of primary or secondary forest. The baseline data in the map can be used in the future to quantify certain types of land-use or ground cover in hectares, acres, or meters (Tables 1,2,3,4 and 5). This data will be useful as baseline data to quantify how much the field station has changed as students and researchers continue to monitor the field station.

Forest Monitoring

This project supports forest monitoring by initially quantifying each type of ground cover. This allows others to continue the monitoring effort in the future and determine any changes. These areas are becoming increasingly impacted by humans. If the monitoring is continued, then it can be determined whether or not the forest areas are in fact affected by anthropogenic influence.

Human Impact

Human impacts were visible throughout the reserve. The stark distribution of primary forest in the northeastern quadrant of the reserve and secondary forest in the southeast is evidence of that most of the impact has been concentrated in the southeastern portion of the park. The anthropogenic impact was less noticeable in the primary forest. The trail floors were littered with fallen branches, leaves, vines, tall grasses. The wildlife was populated by howler monkeys, tapirs, frogs, insects and snakes. The secondary forest had cut down trees, heavy undergrowth, holes in the ground and very little animal activity. It will be useful in the future to use the

baseline data gathered in this project to determine if the primary forest has diminished and if it is directly due to human impacts.

Conclusions

The objectives of this project have successfully been met. Baseline data has been gathered, and the current areas of each ground cover have been determined. By establishing the baselines for each type of ground cover, future studies can determine how the ecosystem is changing at the field station by continuing to monitor primary and secondary forest acreage. The field station can also now monitor how the human impacts change through time and quantify the increases or decreases in anthropogenic impacts made to the reserve.

It was determined that the baseline condition of El Zota was a very densely vegetated area that is anthropogenically impacted. With the help of these baseline conditions, further studies can be done on monitoring primates, water quality testing in the rivers, and transect line surveys. It was also determined that the primary and secondary forest have both been anthropogenically impacted.

One of the most important impacts in the future will be the economic importance of Melina tree growth. A possible future study would consist of leaving one Melina plantation undisturbed and simultaneously plant native species in a second Melina plantation and observe the biodiversity of each plantation and determine which produced the most Melina trees. Other possible research projects include: assessment of monoculture systems encroachment into diverse primary and secondary systems, degradation of primary, and secondary systems, and continuing data collection of the Melina plantations and T.I.N swamp. If the research and field

work from this project are continued on a regular six to twelve month basis, El Zota will produce

an excellent case study of how a tropical reserve has been affected by human impacts and the

natural response to those impacts.

References

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Acknowledgments