

Community Interface Resource Management Area Land Suitability Supplementary materials

Interactive Qualifying Project Proposal



An Interactive Qualifying Project is submitted to the faculty of
WORCESTER POLYTECHNIC INSTITUTE
in partial fulfillment of the requirements for the Degree of Bachelor of Science

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Appendix A: Community Organization Leader email template and questions

Hello _____,

We are a team of students from Worcester Polytechnic Institute in Worcester, Massachusetts. We are currently working with the US Forest Service to create a plan that helps the organizations around the Community Interface Resource Management Area to identify suitable lands for recreation and resource development. We are hoping to conduct interviews to gauge community desires for developments within the CIRMA region and were hoping you might be able to provide some input on this aspect.

Your participation in this interview is completely voluntary and you may opt out at any time. If you would prefer we could accommodate by including your comments as anonymous. We can also supply a copy of your results as needed.

We would sincerely appreciate your inclusion in this research in order for us to get an understanding of the opinions of people around the Community Interface Resource Management Area.

What is your availability for the next few weeks? We are still working on developing the suitability map but as soon as we complete that we'd love to set up a meeting with you to get some feedback.

Appendix B: General Interview Questions (No particular order):

- Do you or community members understand the CIRMA and what it provides? Do you have any opinions on the management strategies used within the CIRMA region?
- How could the US Forest Service better manage the CIRMA region?
- How does you/your organization utilize the area and resources of the forest on a weekly basis?
 - How does the utilization of the area and resources change seasonally?
- What resources within the CIRMA are used by the community?
 - How are the current uses different than that of 15-20 years ago?
- What are the community's recreation priorities? What activities from this list would community members in Rio Grande/Pasto Seco like to have more developments of?
 - Potential Developments: Research areas, hiking/biking/trail areas, camping areas, wildlife or scenic viewing areas

- What resource management practices or resource utilization methods does the community feel need to be addressed?
 - How could the utilization of the Rio Espirito Santo/Rio Fajardo watersheds be better managed to suit the needs of the community?
 - What are the community's priorities related to water use?
 - How is the community affected by the utilization of these watersheds; how do community members' livelihood depend on this resource?
- What projects/developments would benefit tourism in the area?
 - How is the community affected by tourism? Are there aspects of this that the community would like to be different?
- Do you/community members feel included in the current park and resource management within CIRMA and are their aspects of this you think could be handled differently?

Questions for Ecotourism Organizations/Businesses:

- What benefits to the community do specific tourism activities provide?
- Can you give some examples of specific land uses that would help increase tourism to the forest or local community businesses?
- Are there any land uses lacking in the forest currently that you or community members think that could be included in the future?
- Are there any land uses the community wants that might not be attractive to tourists?
- Are there any concerns the community has about increasing tourism or creating developments for tourists?
- Are there any issues with accessibility to these activities due to lack of road infrastructure?
- What areas of the forest are most suitable for activities similar to what you do and what characteristics define this suitability?
- What features are important for deciding where your activities take place?

Questions for Conservation and Trail Restoration Organizations/Businesses:

- What are the specific conservation and trail restoration projects your organization participates in?
- Where are recreational trails needed most?
- What trails need to be better maintained, where are these and what are the issues with these trails?
- What sort of recreational developments would better facilitate education about conservation?
- How many trails would you like to see added to the CIRMA region, or areas around ...?
- Are there any criteria for trails that we haven't considered?

Facilities Management:

- What are the current challenges regarding management of facilities?
- How is accessibility to facilities and resources currently limited by lack of infrastructure?
- What types of infrastructure would be helpful and where would this be most useful?
- Are there seasonal differences in accessibility issues we need to consider like streams or roads becoming unusable due to floods and mud? Where are these issues located relative to other landmarks like rivers, cities, and facilities centers? What infrastructure could help improve these?
- How often do facilities' teams need access within CIRMA or other regions of EYNF?
- How many new facilities/ roads do you think might be needed to enable better management of the recreation areas and resources?

Map Questions

1. What are some of the potential land uses the community wants that we haven't considered?
2. Are there any negative effects of our proposed land uses?
3. Is there anything we haven't considered?
 - a. Quality of trails, facilities, roads, etc.
 - b. Land features
 - c. Land uses in less developed areas

Appendix C: Examples of Geographic Maps

The figure below shows examples of a variety of different ArcGIS layers. The GIS layers are composed of different types of data such as elevation, roads and bodies of water. These particular layers are from the United States Forest Service and are of the CIRMA area within El Yunque National Forest in Puerto Rico. The layers will help us visualize all the graphical data at once.

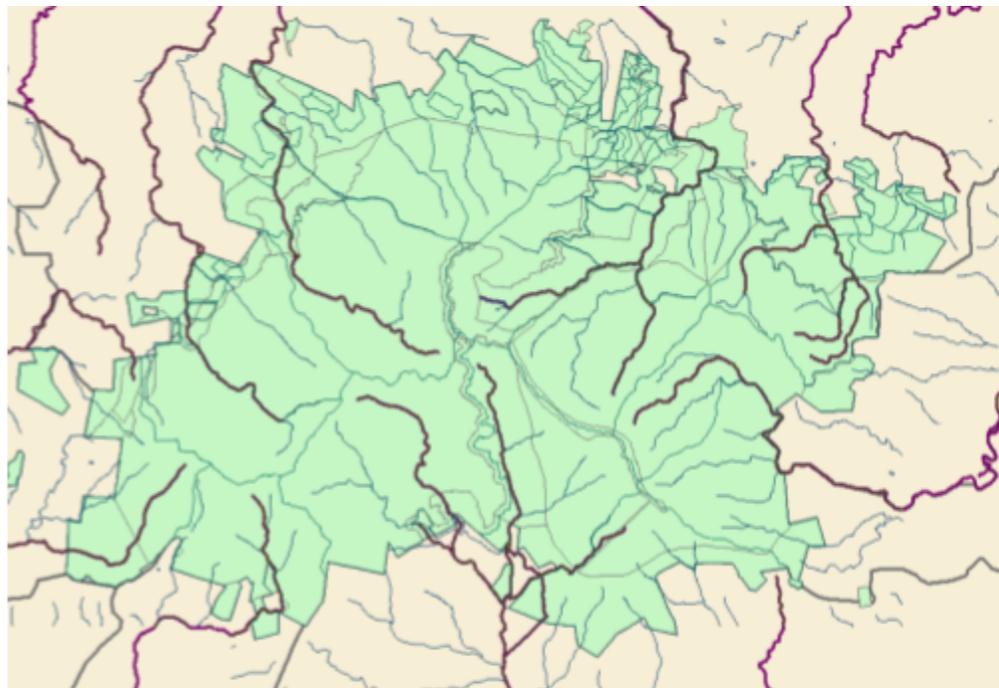


Figure 5: Figure Hydrographic Map of the El Yunque National Forest.

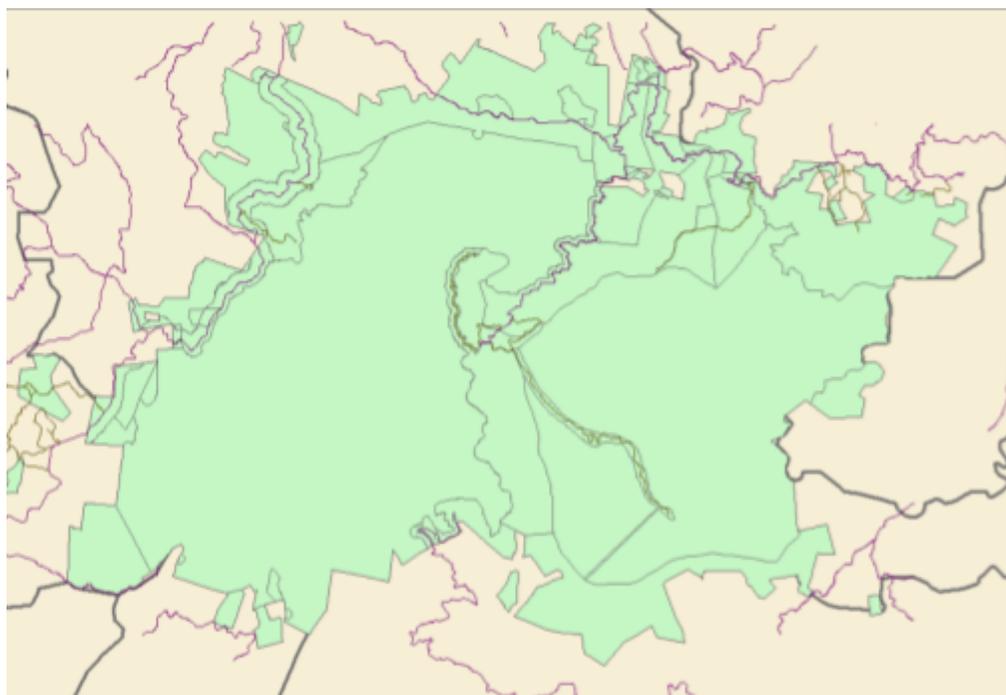


Figure 6: Road Map of the El Yunque National Forest.

Appendix D: Suitability Matrix spreadsheet

The below set of matrices display the used layers and model data for every submitted suitability map. They were used as an organizational tool to hold all of the data before the models were made.

The slope data was accumulated from the elevation and gradient layers. They were also used to create a hillshade which did not affect the models or maps. The rivers and streams were condensed into one feature file consisting of all water running through El Yunque National Forest. The road data was from a combination of the state and public roads that run through and around the forest. The trails existed as a single file of the hiking trails within the buffer zone. Geo Life is the layer that consists of the general locations of endangered plant species. These are rare in the CIRMA region due to the area consisting mostly of secondary forest and invasive species. Soils is the most complicated row because different files are used depending on the proposed land use. The plasticity index is the value given for how malleable or mobile an area of land is. Higher values are more “plastic” and thus more likely to slide and shift. The depth to water table is included for water based activities which states how deep the resting level of water is. This is often important for the creation of wells and water infrastructure. Organic Matter holds the data relative to useful organic matter within the soil. This layer was only used for gardening. Lastly Hydrologic data which addressed how likely areas were prone to water collecting in one spot versus running off.

	Hiking/Trails/Backpacking		
	Weight %	Ideal value	Rationale
Slope	30	Slope gradient<20%	Avoid areas that are too steep
River/Streams	10	Min 50ft away	Buffer to avoid water contamination
Roads	24	Within 0.5 mile	Walkable distance to trail heads
Trails	20	Present	Areas with existing trails are preferred
Geo life	Null	Avoid endangered species	To protect these Species
Soils	16	< Plasticity Index (PI) 17	Avoid the soils with high plasticity
Private areas	Null	Avoid	Not apart of CIRMA

	Campgrounds		
	Weight %	Ideal value	Rationale
Slope	30	Slope gradient<5%	Too steep makes it hard to camp
River/Streams	10	Min 100ft away	Buffer to avoid water contamination
Roads	30	50ft<0.5mil	Walk able distance to camp
Trails	10	Min 30ft away	Forest regulations
Geo life	Null	Avoid endangered species	To protect these Species
Soils	20	Avoid C, D and C/D soils	Avoid soils with slow water filtration
Private areas	Null	Avoid	Not apart of CIRMA

	Biking		
	Weight %	Ideal value	Rationale
Slope	30	Slope gradient <8%	Avoid areas that are too steep to bike
River/Streams	10	Min 500ft away	Buffer to avoid flooding and trail damage
Roads	25	Within 0.5 mile	Close proximity to biking trails
Trails	15	Present	Areas with existing trails are preferred
Geo life	Null	Avoid endangered species	To protect these Species
Soils	20	< Plasticity Index (PI) 17	Avoid the soils with high plasticity
Private areas	Null	Avoid	Not apart of CIRMA

	Water Activities		
	Weight %	Ideal value	Rationale
Slope	35	Slope gradient<15%	Prevent steep regions of water
River/Streams	25	Within 500ft	Close proximity to water
Roads	20	Within 0.5 mile	Walkable distance to road
Trails	N/A	N/A	N/A
Geo life	Null	Avoid endangered species	To protect these Species
Soils	20	Water depth> 24 inches	Areas of higher water depth
Private areas	Null	Avoid	Not apart of CIRMA

General Infrastructure			
	Weight %	Ideal value	Rationale
Slope	35	Slope gradient<5%	Too steep makes it hard to build
River/Streams	20	Min 50ft away	Buffer to avoid contamination
Roads	25	Within 0.5 mile	Easy access through roads
Trails	N/A	N/A	N/A
Geo life	Null	Avoid endangered species	To protect these Species
Soils	25	Avoid C, D and C/D soils	Avoid soils with slow water filtration
Private areas	Null	Avoid	Not apart of CIRMA

Water Treatment			
	Weight %	Ideal value	Rationale
Slope	35	Slope gradient<5%	Too steep makes it hard to build
River/Streams	20	Within 0.5 miles away	Buffer to avoid contamination
Roads	25	Within 1 mile	Easy access through roads
Trails	N/A	N/A	N/A
Geo life	Null	Avoid endangered species	To protect these Species
Soils	20	< Plasticity Index (PI) 17	Avoid the soils with high plasticity
Private areas	Null	Avoid	Not apart of CIRMA

Planting/Gardening			
	Weight %	Ideal value	Rationale
Slope	30	Slope gradient<5%	Flat lands are more suitable for plants
River/Streams	17	Within 1000ft	Close to a water source
Roads	18	Within 0.5 mile	Walkable distance road
Trails	N/A	N/A	N/A
Geo life	Null	Avoid endangered species	To protect these Species
Soils	35	Organic matter >7 % and AWC >0.17	Higher supply of organic matter as well as high water capacity to support plant life
Private areas	Null	Avoid	Not apart of CIRMA

Feature Descriptions

Slope	Most uses requires flatter land in order to operate well
River/Streams	Proximity to running waters can be beneficial to some uses, but detrimental to others
Roads	Access to areas by vehicles is often beneficial
Trails	Beneficial factor for some users
Geo life	used to avoid protected species of plants an animals
Soils	Plasticity, organic matter, and hydration (water table depth) effect all uses
Private areas	restricted areas withing the CIRMA regions