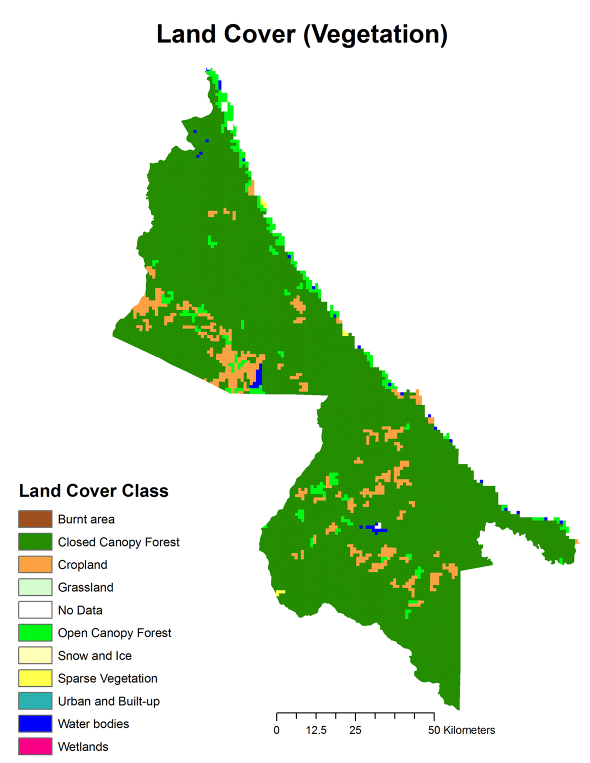
Vulnerability Analysis for Deforestation in Limón Province, Costa Rica

Project Description



Costa Rica has been a leader in forest conservation since the passing of its Forestry Law 7575 in 1996, which institutionalized its Payments for Environmental Services (PSA) program and introduced strict regulation of the harvesting of forests. Since then, Costa Rica has seen great success in its reversal of deforestation trends and reforestation.

The purpose of this project is to examine the risk factors that increase the vulnerability for clearing of a forested area and to test if those locations identified as most vulnerable have been targeted in current conservation efforts. This project will be narrowed to the province of Limón, located on the Caribbean coast of Costa Rica as it is one of the most forested provinces in the country. According to the year 2000 land cover data set used in this analysis, about 93% of the province is covered by either open or closed canopy forest.

The main spatial questions that this project seeks to answer are: 1) Which areas are most vulnerable to deforestation? And 2) which areas, based on extreme vulnerability, would be prime candidates for designation as a protected area or increased targeting for the Payments for Environmental Services program already underway?

Methodology

Using existing literature as a guide, a list of four deforestation pressures were identified: slope, population density, proximity to main roads, and proximity to rivers. The four factor maps were generated using the Euclidean distance tool and the Slope tool, then reclassified on a scale of 1 to 5 representing low to high pressure for deforestation. In the final weighted overlay, all but the forested land use classes were restricted, and the four factor maps were given equal weight. The results were then compared to the district boundaries using Zonal Statistics.

The administrative geography and the vector river data were obtained from Gfk Macon through Tufts University. The gridded population data and the digital elevation model used to derive the slope were obtained from CIESIN at Columbia University. The vector road network was acquired from Open Street Map, and the land use raster set was from the Global Land Cover 2000 project.

Tufts

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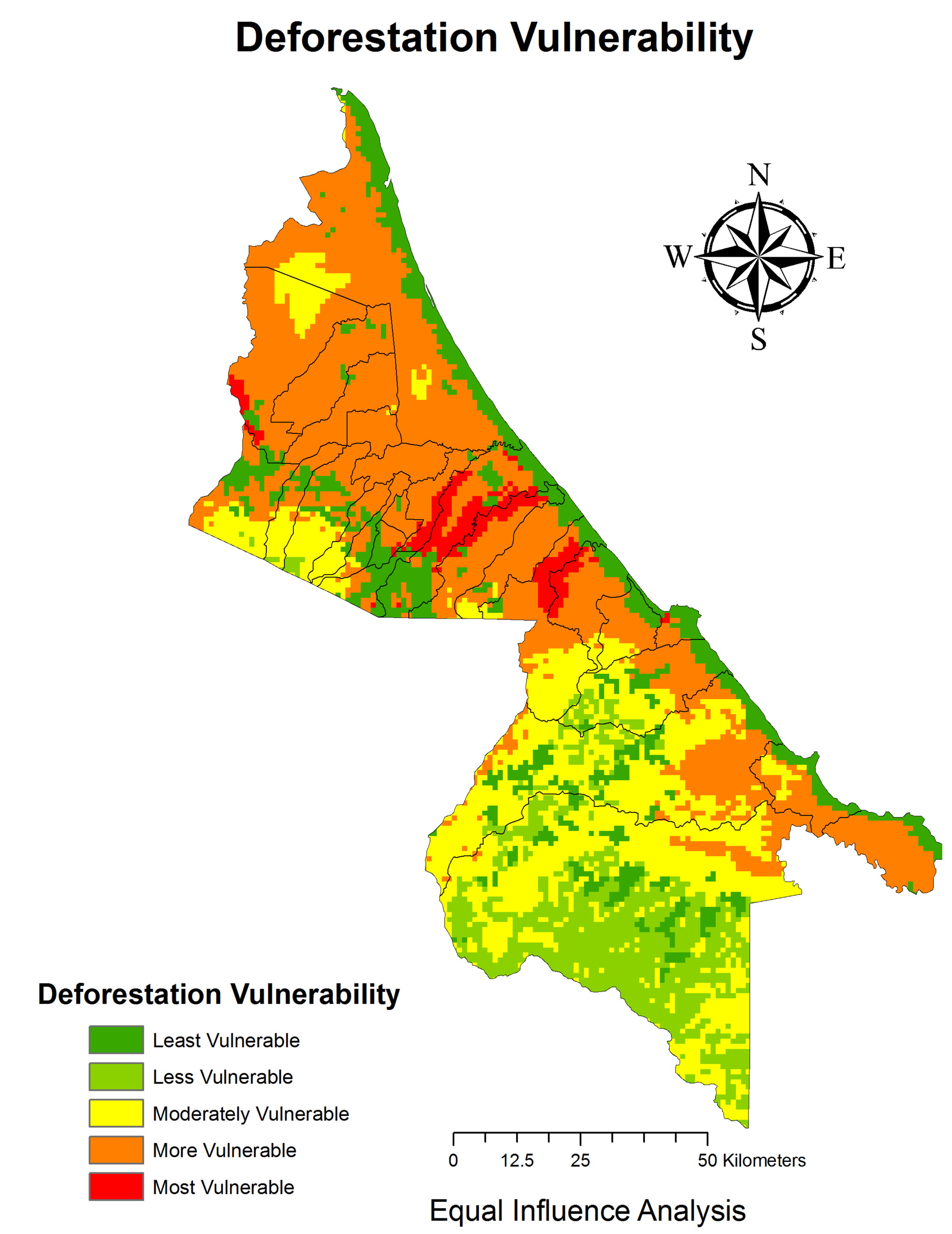

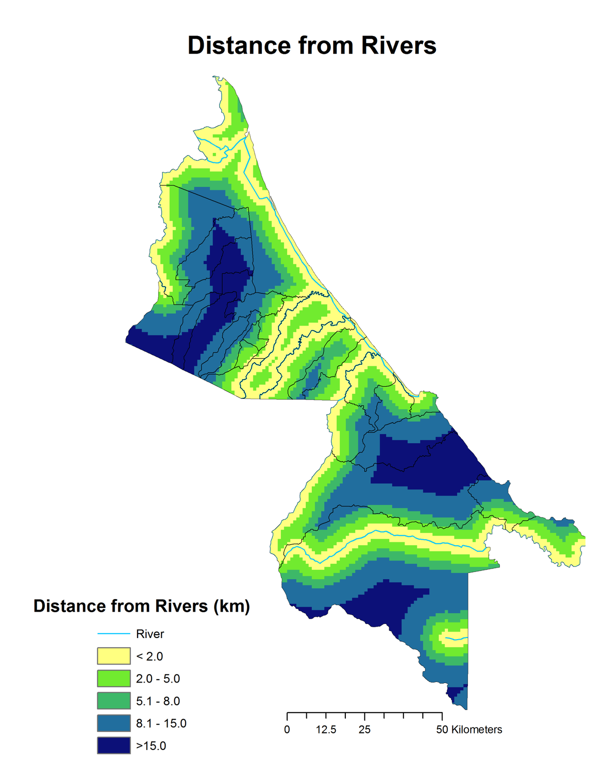

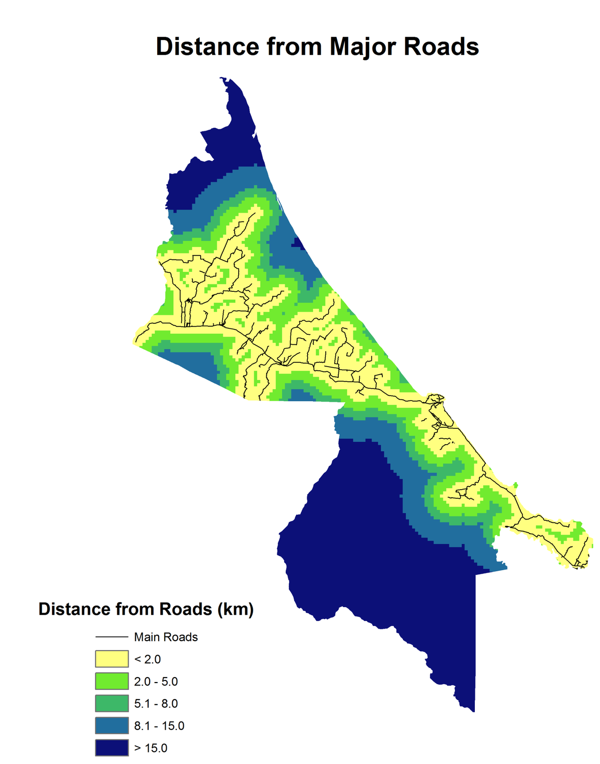

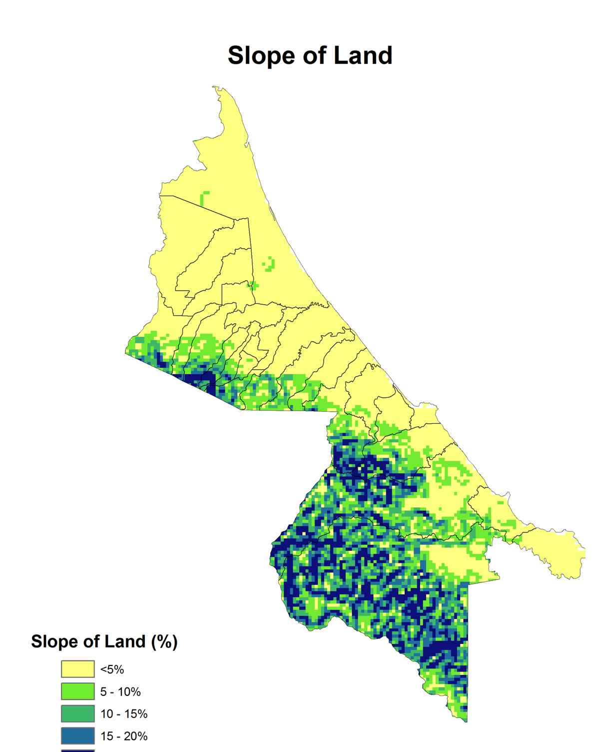

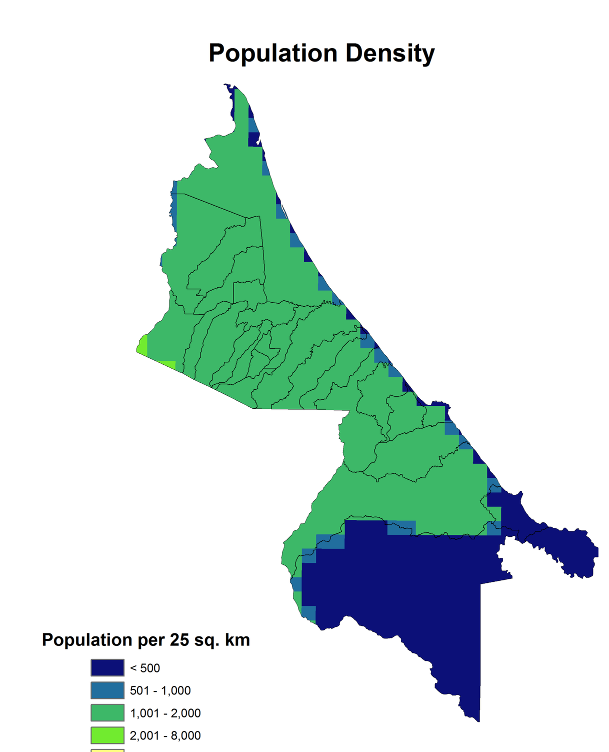

Findings

The overlay results revealed a total of 303 sq. km classified as "most vulnerable" and 3,809 sq. km (or approximately 45% of the forested area) classified as "more vulnerable". Siquirres, Pacuarito and Matina were among the districts most at risk with high proportions of their forested lands classified as either "most vulnerable" or "more vulnerable".

DISTRICT	AREA (SQ. KM)	
	More Vulnerable	Most Vulnerable
Limon	24	3
Valle La Estrella	306	0
Rio Blanco	80	0
Matama	114	0
Guapiles	109	1
Jimenez	43	0
Rita	357	25
Roxana	169	0
Cariari	236	0
Colorado	798	0
Siquirres	119	100
Pacuarito	141	52
Florida	23	1
Germania	29	2
Cairo	69	31
Alegria	17	3
Bratsi	117	0
Sixaola	185	0
Cahuita	103	0
Matina	143	50
Batan	145	1
Carrandi	124	35
Gaucimo	89	0
Mercedes	40	0
Pocora	38	0
Rio Jimenez	115	0
Duacari	76	0

As shown by both the table and the map (left), the majority of the "most vulnerable" areas are concentrated in three continuous patches, which would make them easily targetable for designation as a protected area/national park or for stronger marketing of the PSA forest conservation program.

However, when the results were compared to district-level participation in the PSA program, there was no obvious correlation between districts with high enrolment in PSA and those without when looking at the deforestation vulnerability results by district. Very simply, this might suggest that PSA targeting is independent of the vulnerability factors explored in this analysis.

Limitations

This leads to a wider criticism of this analysis, which is that other human-related pressures, not considered here, may be much more important for forest clearing than those considered here. If this is so, it would reduce the degree to which the findings of this analysis would reflect the true vulnerability to deforestation.

The main limiting factor in this analysis was time. Much more time would have been necessary to consider a fuller range of vulnerability pressures. I would like to have included the following variables: income, monetary returns to agriculture, proximity to major markets, and historical deforestation. The accuracy of the analysis was also constrained by data availability. For example, the population data for Costa Rica was made available at 25 km grid cells, which are quite large. The vector administrative and topographic data layers were also problematic as both the source scale and the accuracy were unknown.

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