Effects of Population Growth in Cameron County on Habitat Loss

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1 Abstract

Cameron County is found at the southernmost tip of Texas and boasts a subtropical ecoregion. Many different types of ecosystem types can be found across the county with coastal prairies, Tamaulipan thornscrub, and Texas Ebony resaca forests dominating the region (Cooper). These varied ecosystems support various types of amphibians, reptiles, small mammals, and birds. However, as urban centers expand, habitat for these species is threatened primarily through urban development. The purpose of this project is to do exploratory data analysis between population growth, urbanization, and habitat loss through Python and Geographic Information Systems. In order to do this, population census data, and National Land Cover Data (NLCD) will be used. Habitat pixels and urbanization classifications will be analyzed across the 2001, 2006, and 2011 NLCD data sets. A model will then be developed to predict habitat loss for 2030 and 2050 if current trends are followed.

2 Background

As the human population grows and continues to shift from rural areas to more densely clustered urban centers, we transform the environment into anthropogenic landscapes. These modifications to landscapes can have negative effects on a plethora of ecological factors. Such ecological factors include changes in population dynamics for flora/fauna, changes in ecosystem function and structure, and disruptions in ecosystem integrity. Throughout various studies, it has been shown that anthropogenic habitat loss is often positively correlated with biodiversity loss (Brooks). In the case of Cameron County in Texas, the population grew from 16,000 in the 1900s to around 420,000 present day. Although the population growth rate has stabilized at around 2,000 per year, it is vital to observe spatial trends in relation to urbanization. Knowledge of urbanization rates, population growth rates, and forest loss rates is imperative for the proper analysis of ecological impacts.

Thornscrub.jpg

Figure 1: Tamulipan Thornscrub

3 Significance

A model that predicts habitat loss in relation to urbanization and population growth rates would be very useful to make Cameron County a sustainable urban center. It would ultimately help preserve habitat that not only supports great biodiversity but also supplies social and economic value to the area.

4 Hypothesis

Population growth rates will be highly correlated with urban development. Most habitat pixels will likely change to low intensity urbanization pixels while low intensity urbanization pixels will increase in urbanization intensity. Due to this, population growth rates will be correlated with habitat loss.

5 Proposed Methods

Population excel data will be organized to make a table with population in Cameron County per year. A population growth rate for each year will be calculated using Numpy and Xarray. From this, a population growth rate model

Figure 2: Nature Tourism brings in millions in the Valley

will be developed for the prediction of habitat losses at a later stage. NLCD data is split into raster pixels containing a number that identifies with a land cover classification. Pixels containing irrelevant data, such as barren rock, will be filtered out through masking. This will be done to NLCD 2001, 2006, and 2011. Next, a boolean analysis using Python operators will be conducted to determine which cells changed and to what they changed. Assuming a constant rate of urbanization and habitat loss between NLCD data sets, a 5 year rate of urbanization and habitat loss rate will be created for 2001 to 2006, and 2006 to 2011. Urbanization rates and population growth rates will then undergo a linear regression analysis. This will be done because an increasing population does not necessarily mean concentrated, high intensity urban development will occur. Habitat loss rates will then be correlated to urbanization rates and population growth rates. Using the rates for habitat loss, population growth, and urbanization, a predictive model will be built to estimate these factors for 2030 and 2050.

6 Broad Impacts

The Lower Rio Grande Valley is home to "1,200 plants, 300 butterflies, and approximately 700 vertebrates, of which at least 520 are birds (U.S. Fish and Wildlife)." This amount of biodiversity is supported by the various habitats

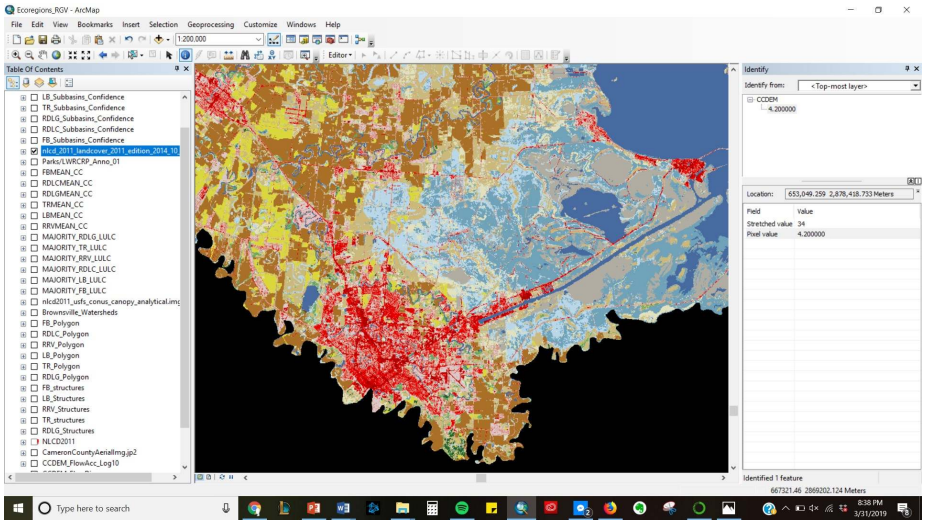

Figure 3: National Land Cover Data

found in the RGV. Various endangered and threatened species, such as the South Texas Sirens, Ocelots, Texas-horned Lizards, Black-Spotted Newts, and White-Faced Ibis, all rely on these various habitats. Furthermore, nature ecotourism is a major economic force in the valley as invertebrate festivals and world-class birding centers drive in 300 million dollars annually (Texas AM). Urban development and proper natural resource management must work hand in hand to preserve these unique ecological, social, and economic virtues of the Rio Grande Valley. Urban development threatens habitats that support these gems of the RGV, and knowledge of urbanization rates and impacts aids in formulating proactive mitigation.

7 Timeline

Weekly Schedule:

Week 1: Data Preparation - Excel Population Data must be fixed to contain yearly population estimates. NLCD data must be filtered out to represent habitat. This data must be able to be uploaded for Python analysis. Rates of population growth, urbanization, and habitat loss will be calculated.

Week 2: Data Analysis - Rates of population growth, urbanization, and habitat loss will be checked for correlation.

Week 3: Data Modeling - A model to predict habitat loss for 2030 and 2050 will be developed.

Week 4: Conclusions and Reporting - A final report stating conclusions, limitations, and possible future work will be developed.

[2] [3] [1]

References

[1] Wildlife and Habitat - Lower Rio Grande Valley - U.S. Fish and Wildlife Service.

[2] Thomas M. Brooks, Russell A. Mittermeier, Cristina G. Mittermeier, Gustavo A. B. Da Fonseca, Anthony B. Rylands, William R. Konstant, Penny Flick, John Pilgrim, Sara Oldfield, Georgina Magin, and Craig Hilton-Taylor. Habitat Loss and Extinction in the Hotspots of Biodiversity. *Conservation Biology*, 16(4):909–923, 2002.

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