Land Use Land Cover Change Trajectories in the Ecuadorian Amazon

Demographic and Socioeconomic Drivers

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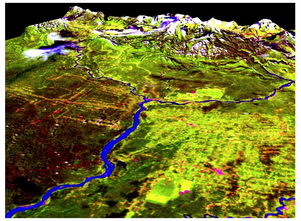
Introduction

- Global deforestation is recognized as one of the core problems of global change
- According to FAO, 146,000 km2 of forest is cleared per year.
- Deforestation rate at the continent level: Africa 0.8%, Asia 0.1%, Oceania 0.4%, North America and Central America 0.1 %, and South America 0.4%.
- Ecuador had the highest deforestation rate in South America in the last two decades
- Investigations of LULC change are limited by a lack of understanding of how demographic, socioeconomic, and biophysical factors drive deforestation patterns.

Objectives

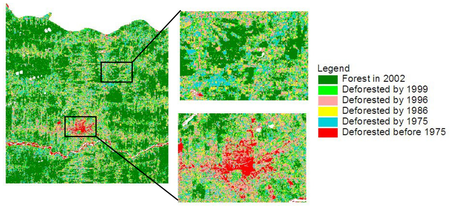
- Quantify deforestation in the Northern Ecuadorian Amazon
- Determine the socioeconomic, demographic, and biophysical drivers of deforestation at the farm and household level (colonization area and buffer of the Cuyabeno Reserve)
- Explore regional patterns of LULC trajectories in the Northern Ecuadorian Amazon

The Northern Ecuadorian Amazon (NEA)

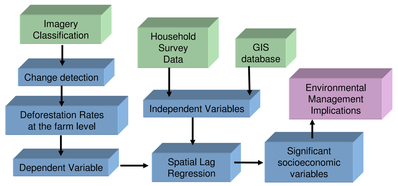


- One of the most conflictive places of the Amazon Basin, in terms of the clashes between development and conservation.
- Hotspot of biodiversity.
- Hotspot of cultural diversity
- Source of huge reserves of oil, the main source of revenue for Ecuador.
- In the last three decades, population growth has been the double than the national average.

Deforestation at the farm level



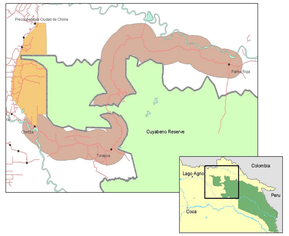
Methods: Statistical Modeling

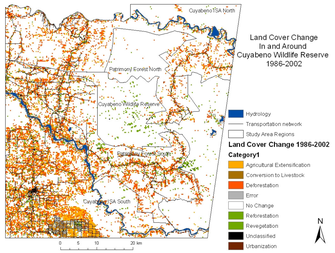


Drivers of Deforestation Rates - Results at the farm level

Variable	1986-1996 Model 1(Lag) Coefficient	Std.Error	1996-2002 Model 1 (Lag) Coefficient	Std.Error	
ρ	0.1222	(0.1252)	0.3345	(0.0861)	***
CONSTANT	0.2388	(0.0562)***	0.1219	(0.0721)	*
WALK	0.0013	(0.0039)	0.0012	(0.0098)	
ROAD	0.0002	(0.0005)	-0.0027	(0.0010)	***
AREA	-0.0016	(0.0007)**	-0.0007	(0.0006)	
FLAT	0.0177	(0.0120)	0.0820	(0.0226)	***
NCROPS	0.0050	(0.0034)	0.0050	(0.0049)	
YRSET	0.0017	(0.0012)	-0.0006	(0.0017)	
LABORH	-0.0008	(0.0003)**	0.0046	(0.0013)	***
LOAN	-0.0096	(0.0134)	0.0002	(0.0057)	
ACCESS	0.0032	(0.0233)	0.0390	(0.0271)	
TITLE	0.0155	(0.0132)	-0.0438	(0.0210)	**
LABORO	0.0021	(0.0117)	-0.0163	(0.0204)	
GOOD	0.0136	(0.0114)	-0.0057	(0.0209)	
ASSETS	-0.0025	(0.0028)	-0.0029	(0.0049)	
EDUC	-0.0180	(0.0080)**	0.0204	(0.0094)	**
AGE	-0.0004	(0.0005)	-0.0003	(0.0009)	
POWER	0.0290	(0.0172)*	0.0193	(0.0188)	
HHSIZE	0.0027	(0.0011)**	0.0000	(0.0011)	
n	144		121		
Log likelihood	198.60		124.26		

Cuyabeno Reserve Case





Poisson Regression

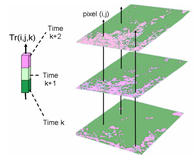
Dependent variable: Ha deforested last year

Variable	Value	SE	Value	SE	Value	SE	
(Intercept)	-1.0882	(0.1967) **	-1.3237	(0.3012) **	-1.6435	(0.4390)	**
UPACHILD			0.1584	(0.0378) **	0.1550	(0.0380)	**
UPAADULTS			0.0190	(0.0438)	-0.0054	(0.0463)	
VIA01	0.3945	(0.2112) *			0.2877	(0.2153)	
VIA03	0.9201	(1.0042)			-0.7303	(1.0093)	
JORNTOTAL					0.0019	(0.0011)	*
ELECTRICIT					-0.1314	(0.2226)	
YREDUC			0.0260	(0.0062)	-0.0122	(0.0231)	
AGE					0.0000	(0.0069)	
AREA					0.0057	(0.0028)	*

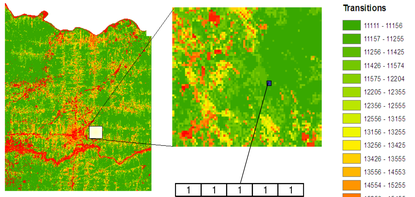
LULC Trajectories

LAND COVER LAND USE TRAJECTORIES

The composition of land trajectories, or pixel history, is defined as the land use type assigned to certain area across the time series. Then the LULC composition characterize the changing of steady nature of a place (i, j) for (k + n) snapshots in time.



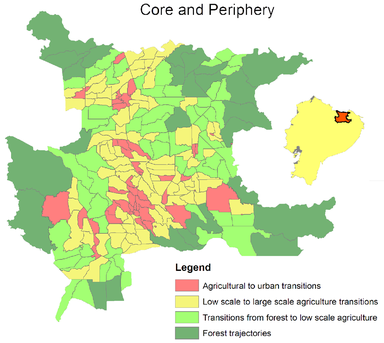
Forest patch example



1	1	1	1	1

Key	1975	1986	1996	1999	2002
Primary Forest	1	1	1	1	1
Secondary Forest	-	2	2	2	2
Large Scale Agriculture	-	3	3	3	3
Small Scale Agriculture	-	4	4	4	4
Pasture	-	5	5	5	5
Urban/Bare Soil	-	6	6	6	6
Non Forest	9	-	-	-	-
No data	0	-	-	-	-

Land Use Land Cover Transitions
Core and Periphery



Conclusions

- There is a continuous but slower process of deforestation
- Demographic factors and initial endowments were important to explain deforestation in the earlier period (1986-1996) but accessibility and legal restrictions were more important in the second period (1996-2002)
- En the case of the Cuyabeno, demographic characteristics (children within the farm) and labor markets were are central to explain deforestation.
- LULC trajectories show a pattern of core and periphery that are related to larger processes of development.

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