Drivers of deforestation and forest degradation in Vietnam: An integrated causal analysis at the national level

Poster · February 2017

DOI: 10.13140/RG.2.2.21339.57123

3 authors, including:

Quy Van Khuc

Colorado State University

4 PUBLICATIONS **1** CITATION

SEE PROFILE

Mark Paschke

Colorado State University

136 PUBLICATIONS **1,984** CITATIONS

SEE PROFILE

Drivers of deforestation and forest degradation in Vietnam: An integrated causal analysis at the national level

Quy Van Khuc[1], Mark W. Paschke[1], Bao Quang Tran[2]

[1] Department of Forest and Rangeland Stewardship, Colorado State University, Fort Collins, CO 80523, The United States
[2] Department of Forest Resources and Environment, Vietnam National University of Forestry, Hanoi, Vietnam

ABSTRACT

Vietnam is one of the few countries in the world to be severely affected by climate change. Recently a major program for reducing carbon emission from deforestation and forest degradation (REDD+) has been introduced to help Vietnam mitigate and adapt to climate change. REDD+ aims to reduce carbon emissions by preserving forest carbon stocks, manage forests sustainably, and improve forest carbon stocks through forest restoration. Current policies in Vietnam provide a sound platform for REDD+ to develop, and REDD+ can potentially greatly contribute to reduction of deforestation and forest degradation (DFD). However, these policies and the REDD+ program are still hindered due to our limited understanding of the extent of deforestation, forest degradation and their underlying causes. This study employs GIS tools and spatial econometrics methods to quantify the extent as well as the causes of deforestation and forest degradation in Vietnam. Results showed that around 2.42 million hectares of forests were lost and degraded between 2000 and 2010. The North central, Northeast, Central Highland areas, and Northwest were places where deforestation and forest degradation was taking place the most. There were several underlying indicators of deforestation and forest degradation including elevation, initial forest cover, population growth, agricultural sector's GDP per capita, and poverty. Results illustrated several important policy implications for forest restoration and the REDD+ program in Vietnam. Of which, increasing peoples' income, reducing poverty rate and controlling population growth are of the top priority policy solutions that Vietnam should focus on.

1. INTRODUCTION

Climate change threatens the quality of life and existence for human beings and nature. Adaptation and mitigation of the effects of climate change through forests is widely admitted as a highly effective approach to combating climate change thanks to forests' carbon dioxide absorption capacity.

Vietnam is severely affected by climate change. Taking part in the Reducing Emission and Deforestation and Degradation (REDD+) project is within Vietnam's goal of helping effectively mitigate climate change through forests.

Current policies in Vietnam have provided a sound platform for REDD+ to develop, and REDD+ can potentially contribute significantly to initiatives battling deforestation and forest degradation. However, these policies and the REDD+ program are still hindered by significant limitations, including low participation of poor households and the private sector.

Better understanding of deforestation and forest degradation (DFD) and their drivers is essential for informing policies designed to control deforestation, promote forest restoration, and improve the livelihood of forest communities in Vietnam.

2. OBJECTIVES

- To quantify the extent of deforestation (DF) and forest degradation (FD) in Vietnam between 2000 and 2010.
- To determine the drivers of forest loss and forest degradation between 2000 and 2010.
- To suggest the coming policies on controlling deforestation and forest degradation in Vietnam.

3. METHODS

3.1. Model selection method

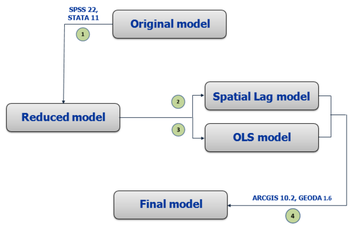


Fig. 3.1. Model selection procedures

- Step 1: raw data was checked before coding and entering into an Excel file.
- Step 2: examine the reliability and validity of the Ordinary Least Square (OLS) regression model and spatial lag (SL) model thru testing the suitability of model, normality of error, collinearity, and heteroscedasticity.
- Step 3: we selected spatial lag model to estimate the drivers of forest loss and forest degradation in Vietnam.

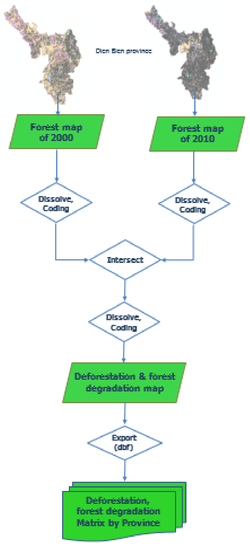


Fig. 3.2. Forest data analysis procedures

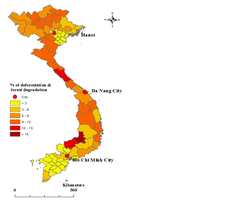
3.2. Spatial Lag Model

- The formula: $y = \rho Wy + X\beta + \varepsilon$
- N: the number of observations (N = 46);
- K the number of independent variables: (1) poverty rate in 2000 (%), (2) poverty change (1, 0), (3) population change (%), (4) GDP of agricultural sector per capita (thousand Vietnam Dong), (5) forest cover in 2000 (%), (6) natural logarithm of elevation;
- y: N × 1 vector of the dependent variable: deforestation (%), forest degradation (%), deforestation & forest degradation (%);
- W: an N × N spatial weights matrix, ρ the spatial lag coefficient, X an N × K matrix of independent variables;
- β: a K × 1 vector of coefficients for independent variables, ε an N × 1 vector of the disturbance term.

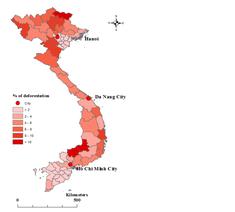
3.3. Data sources

- Forest data: Ministry of Agricultural and Rural development (MARD); Ministry of Natural Resources and Environment (MONRE).
- Social-economics data: General Statistics Office (GSO) of Vietnam
- Biophysical data: Ministry of Natural Resources and Environment (MONRE); Individuals.

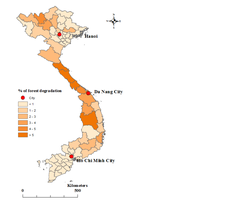
4. RESULTS



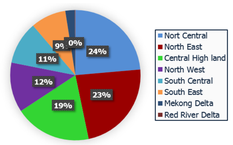
① DFD: 2.4 million ha ~ 7.35% of total natural area (TNA) & 20.13% of total forest area (TFA).



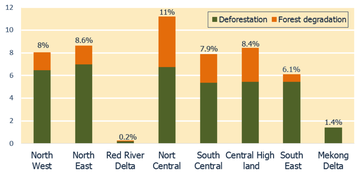
② DF: 1.5 million ha ~ 5.36% of TNA & 14.7% of and TFA. Taking place the most in Nghe An: 129,600 ha.



③ FD: 653,000 ha of forests; Taking place the most in Gia Lai: 129,600 ha.

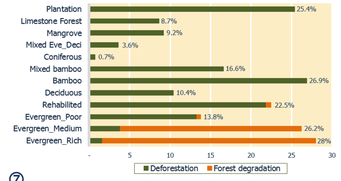


④ DFD by regions: North Central 571,000 ha vs Red River Delta 3,000 ha, accounting for 23.6%, 0.23% of total DFD in respectively.

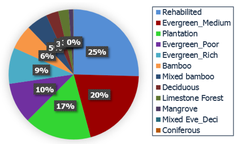


⑤ DFD by regions: North Central vs Red river Delta ~ 11.2% vs 0.2% of TNA. Forest degradation not found in Mekong Delta.

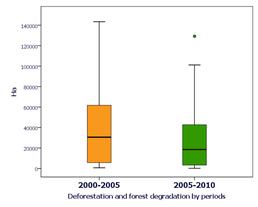
⑥ DFD with biophysical conditions: Pearson's correlations btw DFD & Elevation (r = 0.435, P=0.003); Forest cover (r = 0.830, P=0.000).



⑦ DFD by forest type's contribution: Rich evergreen contributes the most: 217,000 ha ~ 27.9% of its own initial area.

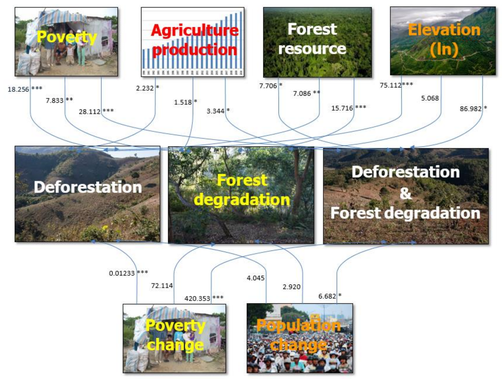


⑧ DFD by forest type's contribution: Rehabilitated forest contributes the most: 615,478 ha vs Coniferous contributes the least: 1,282 thousand ha ~ 25.42% vs 0.05% of total DFD.



⑨ DFD is different btw two periods: 2000-2005 and 2005-2010 (Mean different: 10,500 ha, P= 0.01)

⑩ **Estimated results of Spatial Lag model**



5. CONCLUSIONS

- Deforestation and forest degradation (DFD) took place at high intensity but it tended to decreases btw 2000 & 2010.
- DFD displayed different spatial patterns of forest cover change while the area of DFD was larger in higher elevations.
- DFD occurred mainly in North Central, North East, Central Highland, and North West.
- DFD was mainly shared by rehabilitated forest, evergreen, while it took place at the highest intensity of evergreen forest, bamboo, plantation.
- Several factors caused DFD in Vietnam including poverty, population, agricultural production, forests, elevation. Of which, socio-economic variables are the main drivers of DFD.
- To help control DFD and effectively implement in REDD+ in Vietnam, our recommendations on the coming policy are: (1) to reduce strictly poverty rate and improve people's livelihood, (2) to manage population effectively, (3) to strengthen protection and management of existing forest resources.

6. REFERENCES

1. Anselin, L., Rey, S.J., 2014. Modern spatial econometrics in practice: A guide to GeoDa, GeoDaSpace and PySAL. GeoDa Press LLC, Chicago, U.S.A.
2. Bao, T.Q., 2012. Field survey to identify the driving forces of deforestation and reforestation/regeneration in Dien Bien province. Technical report, Vietnam National University of Forestry, Hanoi, Vietnam.
3. Canadell, J.G., Raupach, M.R., 2008. Managing forests for climate change mitigation. Science 320 (5882), 1456-1457.
4. Hosonuma, N., Herold, M., De Sy, V., De Fries, R.S., Brockhaus, M., Verchot, L., Angelsen, A., Romijn, E., 2012. An assessment of deforestation and forest degradation drivers in developing countries. Environmental Research Letters 7 (4), 044009.
5. JICA, 2012. Potential forests and land related to climate change and forest in Vietnam. Technical report. Japan International Cooperation Agency (JICA Hanoi), Vietnam.
6. Meyfroidt, P., Lambin, E.F., 2008a. The causes of the reforestation in Vietnam. Land use policy 25 (2), 182-197.
7. Pham, T.T., Moeliono, M., Nguyen, T.H., Nguyen, H.T., Vu, T.H., 2012. The context of REDD+ in Vietnam: Drivers, agents and institutions. Center for International Forestry Research (CIFOR), Bogor, Indonesia.
8. Schmidt-Thome, P., Nguyen, T.H., Pham, T.L., Jarva, J., Nuottimäki, K., 2015. Climate change in Vietnam. In: Ha Nguyen, Long Pham, and Philipp Schmidt-Thome (Eds.), Climate Change Adaptation Measures in Vietnam: Development and Implementation, Springer, pp. 7-15.

ACKNOWLEDGEMENTS

I would like to express my thanks to Vietnam Education Foundation (VEF) for support of my current study at Colorado State University (CSU), USA. To MARD, MONRE, GSO of Vietnam for the precious support of data. To Professor John B. Loomis @ CSU & Dr. Patrick Meyfroidt @ FRS-FNRS & Earth and Life Institute, University of Louvain for the special help and excellent comments on improving the quality of research. To graduate students at Restoration Ecology lab @ CSU for their useful revision and suggestion. To my dear family for the unconditional love and care that motivate me complete this research.