



Drivers of forest cover change in Eastern Europe and European Russia, 1985–2012



Jennifer Alix-Garcia^{a,*}, Catalina Munteanu^b, Na Zhao^a, Peter V. Potapov^c,
Alexander V. Prishchepov^{d,e}, Volker C. Radeloff^b, Alexander Krylov^c, Eugenia Bragina^b

^a Department of Agricultural and Applied Economics, University of Wisconsin–Madison, United States

^b SILVIS Lab, Department of Forestry and Wildlife Ecology, University of Wisconsin–Madison, United States

^c Department of Geographical Sciences, University of Maryland, United States

^d Department of Geosciences and Natural Resource Management, University of Copenhagen, Øster Voldgade 10, DK-1350 København K, Denmark

^e Leibniz Institute of Agricultural Development in Transition Economies (IAMO), Theodor-Lieser-Str. 2, 06120 Halle (Saale), Germany

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ABSTRACT

The relative importance of geography, history, and policy in driving forest cover change at broad scales remains poorly understood. We examine variation in forest cover dynamics over the period 1985–2012 across 19 countries in Eastern Europe and European Russia in order to shed light on the role of these in driving forest cover change after the collapse of socialism. Using a combination of cross-section and panel regression methods, we find that privatization of forest lands increased forest cover loss due to logging, as did increases in agricultural land between 1850 and 1900. Land quality has no power to explain variation in forest loss between countries, nor does trade and price liberalization policy. None of our covariates explain forest regrowth on non-forested land over the period. We conclude that history and land privatization drove important cross-country variation in forest dynamics in the region, but that the majority of forest cover change over the period results from shocks, both political and economic, shared by all countries in the sample. This highlights the importance of broad-scale shocks as drivers of forest change, relative to geographic and policy variability across individual countries.

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1. Introduction

The collapse of socialism is perhaps the most substantial natural experiment in social change that has occurred in modern history. It was sudden, resulted in major structural changes, and country-level policy responses were strikingly varied. The collapse also triggered widespread land use changes, including land abandonment, disparate forest cover changes, and the rapid expansion of urban areas resulting from large rural-to-urban migration (Foley et al., 2005; Hostert et al., 2011). However, while the overall shock was shared by all countries in the region, the inherent political, socioeconomic, and institutional differences have created divergent transition paths across countries with subsequent variation in land use change (Lerman et al., 2004a; Prishchepov et al., 2012; Griffiths et al., 2013). Our goal here is to compare the importance of geography, history, and policy in explaining differences in the intensity of forest use and regrowth over the tumultuous post-socialist period. We examine forest loss and gain

across Eastern Europe from 1985 to 2012 to understand how policy differences among countries affect these trends. Our specific questions – related to these three subsets of determinants – are:

- 1 Does trade liberalization explain forest loss or gain? Theory suggests that if countries start off with equally distorted economies, liberalization should lead to greater efficiency in resource use, so that countries with bigger changes in liberalization policies should expect to see larger reallocation of resources, increasing forest loss from logging in locations with comparative advantage of forest production, and decreasing it where comparative advantage is not present.
- 2 Do key historical events have a persistent effect on land use change today? For forest harvesting, but also for agricultural activities, land use in the distant past may strongly influence current behavior. Given rotational cycles, forest management decisions made around the turn of the 20th century may still be visible in forest loss from logging patterns 100 years later.
- 3 Does geography “trump” policy and history? Geographic features, including environmental variability such as inherent land productivity, should strongly determine the location of productive activity related to forestry and agriculture. For example,

* Corresponding author.

E-mail address: jennifer.alix-garcia@wisc.edu (J. Alix-Garcia).

countries with more suitable land for agriculture should have less agricultural land abandonment.

Our paper contributes to the broad literature on land use change in transitioning economies. Prior work on post-socialist land use change in the region has generally employed two approaches: papers examining subsets of countries, often focusing on cross-border variation, and those assessing within-country variation. The within-country studies provide important insights into the location of land use change within a relatively uniform institutional environment. Albania, for example, engaged in large scale agricultural land privatization. A combination of village-level survey data and satellite images revealed that drivers of land use change varied significantly during the different stages of transition. Initially, land fragmentation served as a risk diversification strategy for rural households and therefore slowed down abandonment rates (Sikor et al., 2009), so abandonment occurred in remote, less-populated areas. In later stages, land fragmentation lead to greater abandonment (Müller and Munroe, 2008), and variation in land abandonment was strongly correlated with out-migration (Sikor et al., 2009). In Romania, topographical characteristics played a more dominant role in predicting cropland abandonment, and rural population and migration were weaker predictors (Müller et al., 2009). It is difficult, however, to draw broad conclusions regarding the importance of policy variation by examining only within-country variation.

There are a number of studies comparing rates of land use change among subsets of the countries in the region. These studies are useful for understanding how differences in institutional environments across similar ecological zones can affect land use. The complexity of the process is emphasized in narratives detailing land use change across long periods that highlight the importance of both path dependency as well as unexpected change (Jepsen et al., 2015). The region has provided a rich environment for cross-border analysis (Kuemmerle et al., 2008; Hostert et al., 2011; Alix-Garcia et al., 2012; Griffiths et al., 2013). One analysis across the boundary triangle of Poland, Ukraine, and Slovakia revealed the influences of different biophysical factors, land ownership, and other institutional drivers (Kuemmerle et al., 2008). High abandonment rates in Poland and Slovakia were explained by decreasing rural population and the land privatization process (Palang et al., 2006), whereas in Ukraine weak institutions and decreasing government support for agriculture were key explanatory variables (Wegren, 2003; Lerman et al., 2004b). Another approach exploited matching and regression analysis to create comparable control groups based on the same baseline characteristics, and found that biophysical factors were the main forces driving divergent abandonment rates in Poland and Slovakia (Alix-Garcia et al., 2012). A meta-analysis of case studies within the region indicated an important role for socio-economic factors in driving land use change across the Carpathians (Munteanu et al., 2014). However, most of the within-region work is limited to two or three countries. Only one study examined five former Eastern Bloc countries based on a selected set of satellite imagery after the early 1990s (Prishchepov et al., 2012). To eliminate potential confounding factors, which could affect agricultural productivity (such as elevation and slope), that study focused on one area within relatively homogenous agro-ecological conditions but large variation in institutional changes. They attributed higher land abandonment rates in Latvia (42%), Russia (31%), and Lithuania (28%), to delayed institutional change in land privatization and the decline in government support for agriculture.

The advantage of using within-country variation or small sub-samples of countries is that fewer factors can potentially confound inference on drivers of land use change. However, within-country variation does not capture the large differences in transition approaches across countries, nor does it allow us to infer the

relative importance of policies versus other drivers of land use change at a broad scale. We are aware that cross-country regression analysis, which we will use in this paper, is fraught with problems of inference due to the joint determination of policy and outcome variables (Temple, 1999; Durlauf et al., 2005; Easterly, 2005). However, while these issues are clearly a challenge to our study, we believe that the exercise is justified for three reasons. The first reason is that we use first differences and fixed effects regressions to help eliminate time-invariant unobservables. Second, the endogeneity of policy to land use change is likely less severe than it is for economic growth, since land use outcomes occur over a longer time scale. Finally, we do not interpret our estimates as causal, but seek to understand whether the variation in land use change rates across countries can be explained by variation in a small subset of potential key variables according to the literature, and we carefully examine the correlation among these variables.

2. Methods

2.1. Study area and background

Our study region covers approximately 7.5 million square kilometers and includes 19 Eastern European countries, which we group according to the commonly used categorization of CIS (Commonwealth of Independent States) and CEE (Central and Eastern European countries) (Mathijs and Swinnen, 1998; Lerman et al., 2004a; Rozelle and Swinnen, 2004). The CIS countries are Russia, Belarus, Ukraine, and Moldova,¹ and the CEE countries are Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Macedonia, Montenegro, Poland, Romania, Serbia, Slovakia and Slovenia. The study region spans a wide variety of biomes, ranging from Mediterranean in the South, over temperate grass and scrublands at mid-latitudes, to temperate and boreal forests and finally tundra in the northernmost reaches (Olson et al., 2001). The region also includes lowland areas highly suitable for agriculture, such as most of Ukraine, Poland, Belarus, and Hungary, as well as a variety of forest ecosystems spread across the three major mountain systems – the Urals, the Caucasus and the Carpathians. The countries with the highest percentage of forest cover are Slovenia (62.4% of the land area), Latvia (54.3%) and Estonia (51.8%) and the countries with lowest forest cover are Hungary (22.6%), Ukraine (16.8%) and Moldova (12%) (WDI, 2012).

The collapse of the Soviet Union constitutes the most recent geo-political and socio-economic transition in a region well-versed in transition.² In the 19th century, the study region was divided between the Prussian, Habsburg, Ottoman and Russian Empires, with European geo-political borders shifting several times, new countries emerging following the two World Wars, countries changing from monarchies to democracies and totalitarian governments. The collapse of the Soviet Bloc in Eastern Europe and adoption of market economy principles brought about a number of policy changes that had important direct and indirect effects on the agricultural sector. Such policy changes included the removal of state subsidies to output and input prices, which resulted in starkly deteriorating conditions for trade and hence negatively affected agricultural profitability (Rozelle and Swinnen, 2004). Our study focused both on the most recent transition following the collapse of

¹ Note that we include only 4 of the 12 CIS member and associate states. The missing CIS countries are all located either in Central Asia or in the Southern Caucasus, and their environmental and socioeconomic conditions are so different that it be questionable to both group them with the Eastern European CIS countries and compare them to the CEE countries. Given this sample, we cannot extrapolate to all CIS member states.

² Riasnovsky and Steinberg (2010) and Bideleux and Jeffries (2007) note that drastic changes in land use and land cover accompanied these shifts.

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