Linking Past to Present in European Russia’s Temperate Forests

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Research setting

- Temperate forests of European Russia are changing rapidly
- Socioeconomic changes, greater population density, access to markets
- However, temperate forests are less studied despite their higher productivity
- Our goal is to monitor patterns of change using satellite records and explain these patterns using socioeconomic and biophysical drivers
Research setting
Approach

- Monitor forest cover at 5-year increments between 1985 and 2010
- Propose socioeconomic and biophysical drivers of forest change across different time periods
- Assess the spatial resolution issues that are at the heart of forest monitoring in the temperate zone
Forest monitoring
Forest monitoring

Baumann et al (in prep)
Value of winter snow imagery

<table>
<thead>
<tr>
<th></th>
<th>winter</th>
<th>spring</th>
<th>summer</th>
<th>fall</th>
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<tr>
<td>forest</td>
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<td>92</td>
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<td>Non-forest</td>
<td>94</td>
<td>90</td>
<td>91</td>
<td>93</td>
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</tbody>
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May 2002

July 2002

Aug 2002

Feb 2003
Forest monitoring

- 1985-1995 period seems to be the “shock” period with various forest change patterns

- 2000-2010 period shows consistent forest recovery

- Early period possibly characterized by lack of regulation but also other

- Later period characterized by forest regrowth on abandoned lands
Forest monitoring
Drivers of forest harvest

- Despite the large institutional changes in the forestry sector, there are no quantitative analysis of drivers of forest disturbance in European Russia.
- Knowing these drivers may help understand the spatial and temporal patterns of forest change.
- Combine remote sensing with economic theory of timber supply to statistically estimate the drivers of forest harvest.
- Focus on difference between regions and districts.
Drivers of forest harvest
Drivers of forest harvest

Using forest change data from GreenPeace and Popotov et al (2010)

Wendland et al (in review)
Drivers of forest harvest (district)

- Drivers of forest harvest are consistent with classical economic theory of timber supply
- Forest area (more forest area = more harvest)
- Conifer proportion (more valuable timber = more harvest)
- Slope (more access = more harvest)
- Road density (more harvest = more harvest)
- Market location (more access = more harvest)
Drivers of forest harvest (regional)

Map of magnitude and significance of regional effects on forest disturbance

- differences within the forestry sector (Soviet legacies)
- divergences in regional institutional and political conditions
- rate of return from other economic sectors within regions
The effects of governance

- governance has a nonmonotonic effect on logging rates

- regions that currently rank at low levels of governance, a marginal improvement in governance would increase logging rates

- regions that currently rank at high levels of governance, a marginal improvement in governance would decrease logging rates

- the nonmonotonic effect of governance on timber harvest differs from the governance effects on deforestation
Spatial resolution effects

- Given the size of timber harvest plots and their distribution across the landscape, a question arises as to the impact of spatial resolution on forest harvest monitoring.

- Test MODIS-like sensor effects on our ability to identify and map forest harvest.

- Test across regions with different harvest rates and with other spatial resolutions.
Spatial resolution effects

Forest change [2000-2005]
Spatial resolution effects

![Graph showing percent of forest change within 250 and 500 m pixels for 250 meter and 500 meter resolutions.](image)
Spatial resolution effects

![Graph showing spatial resolution effects](image)

- **Inverse distance metric**
- **Percent of forest change within 250 m pixels**
- **Legends:**
  - Band 1
  - Band 2
  - Band 3
  - Band 4
  - Band 5
  - Band 6
  - Band 7
Spatial resolution effects

If using coarse resolution data, we need to pay attention to weak signals and thresholds.

There is continued need for Landsat style observations to monitor forests in the temperate zone.
Main findings

- Following a period of decline (the shock period), the forests of European Russia are expanding (recovery period) but there are major differences.
- Classical economic theory explains both district and regional-level differences in harvest rates.
- Governance has a non-linear effect on harvest rates — this nonmonotonic effect of governance on timber harvest differs from the governance effects on deforestation.
- Spatial resolution matters more in regions with smaller harvest plots.