Land Cover and Land Use Change in Temperate Europe

Introduction

People

???

Environment
Introduction

People

Land use

Environment
Introduction

People

Land use

Environment
Introduction

Individuals

Communities

Regional

National

Global

People

Land use

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Land use

Environment
1. How much do broad-scale drivers affect land use?
Introduction

People

Land use

Environment
Introduction

Land use

People

Environment
2. How does disturbance affect land use?
Introduction

People  Land use  Environment
Introduction

Bruegel, Pierre 1562
Introduction

Wenzel, Peter 1810
3. What happens to the environment when land use subsides?
1. Broad-scale drivers?
2. Disturbance?
3. Rewilding?
Eastern Europe provides a perfect ‘natural experiment’
Introduction

1. Nations diverged
2. Socioeconomic upheaval
3. Land abandonment
1. Broad-scale drivers?
2. Disturbance?
3. Rewilding?
Introduction

1. Broad-scale drivers?
2. Disturbance?
3. Rewilding?
1. Broad-scale drivers

- People
- Land use
- Environment
1. Broad-scale drivers
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2007
1. Broad-scale drivers

Unprofitable organizations
Abandoned fields (1990-2000)

Percent

Belarus-Grodno
Belarus-Mogilev
Russia-Smolensk
Russia-Kaluga
Russia-Vladimir
1. Broad-scale drivers
1. Broad-scale drivers

- Land use
- People
- Environment

- Unchanged area
- Masked area
- Fallow land
- Afforestation

Farmland abandonment

<table>
<thead>
<tr>
<th>Country</th>
<th>Fallow land</th>
<th>Afforestation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poland</td>
<td>15%</td>
<td>10%</td>
</tr>
<tr>
<td>Slovakia</td>
<td>16%</td>
<td>9%</td>
</tr>
<tr>
<td>Ukraine</td>
<td>18%</td>
<td>8%</td>
</tr>
</tbody>
</table>
1. Broad-scale drivers

- Global
- National
- Regional
- Communities
- Individuals

Drivers:
- People
- Land use
- Environment
2. Disturbance

1. Broad-scale drivers
2. Disturbance?
3. Rewilding?
2. Disturbance
2. Disturbance
2. Disturbance

Legend
- digitized settlements
- Unclassified
- other
- permanent agriculture
- permanent grassland
- post-Chernobyl abandonment
- post-socialist abandonment
- recent re-cultivation
2. Disturbance

Post-Chernobyl Abandonment

% abandonment in respective zone
2. Disturbance

Post-Socialist Abandonment

% abandonment in respective zone

- overall
- 30km zone
- >40 Ci/km²
- 15-40 Ci/km²
- 5-15 Ci/km²

Ukraine
Belarus

- post-socialist abandonment
- recent re-cultivation
2. Disturbance

Landsat change detection 1990-2000
2. Disturbance

Overall 0.8% forest loss, 22,000 ha illegal logging
2. Disturbance

Autonomous Republic of Adjara, southwestern Georgia, 2.6% change

Legend
- Red: Deforestation/ Degradation
- Yellow: Forest Regrowth
- Green: Forest
- Non-forest

Kilometers

0  2.5  5  10  15
2. Disturbance

Typical illegal logging:
- No clear cut
- Close to village
- Close to roads
2. Disturbance

The Carbon “book-keeping model” (Houghton 1980s)

- Tracks changes in carbon stocks from year to year
- Uses harvest and clearing estimates; estimates decomposition of wood products

I. Forest harvest and regrowth: C released and accumulated

II. Forest loss, Carbon release

III. Reforestation C accumulated
2. Disturbance
2. Disturbance

• Georgian forests are a carbon sink (~0.3 Tg/yr.)
• Georgia will remain sink until 2040
• Sink strength ~30% of Georgia's carbon emissions
2. Disturbance

1990

2000
2. Disturbance
2. Disturbance

- 1990 – 2000: 2.4% forest lost
- 2000 – 2005: 3.1% forest lost
- Average change size 7.9 ha
- Harvesting concentrated, and mostly on private land
2. Disturbance

- Romania is a carbon sink, probably until 2070
- Sink strength ~10% of Romania's carbon emissions
2. Disturbance

[Diagram showing the transition from natural ecosystems to intensive agriculture with stages of land use development.]
3. Rewilding

1. Broad-scale drivers
2. Disturbance
3. Rewilding?
3. Rewilding
3. Rewilding

![Graph showing population changes from 1963 to 2005. The x-axis represents years from 1963 to 2005, and the y-axis represents population in thousands of heads. The graph shows a peak in the early 1980s followed by a decline.]

- **Livestock population**
3. Rewilding
3. Rewilding

![Graph showing population and burned areas over time.](image-url)
3. Rewilding

Population dynamics in 1976-2001

Thousands of animals

Year


0 100 200 300 400 500 600 700 800
3. Rewilding
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MODIS/ TERRA Landcover 1km
- barren or sparsely vegetated
- closed shrublands
- cropland/natural vegetation mos
- croplands
- deciduous broadleaf forest
- deciduous needleleaf forest
- evergreen needleleaf forest
- evergreen broadleaf forest
- grasslands
- mixed forests
- open shrublands
- permanent snow and ice
- permanent wetlands
- savannas
- urban and built-up
- water
- woody savannas
3. Rewilding

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Correlation Coefficient
- MODIS Forest
- Core forest
- Edge Forest
- Forest fragments
3. Rewilding

[Image of a map with different landcover types and a graph showing correlation coefficients for different variables such as Road Density, MODIS Urban, Settlements, Population 1991, Population 2001, and Travel cost.]
3. Rewilding
Conclusions

• Nations mattered, stark cross-border differences
• Disturbance triggered both abandonment and logging
• Carbon sinks, bears thrived, but saiga declined
1. How much do broad-scale drivers affect land use?
1. Broad-scale drivers

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2. How does disturbance affect land use?
2. Disturbance

[Diagram showing land use transition stages: pre-settlement, frontier clearings, subsistence, intensifying, intensive agriculture, protected/recreational lands, urban areas, natural ecosystems, proportion of landscape]
3. What happens to the environment when land use subsides?
3. Rewilding
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radeloff@wisc.edu