Case Study Area

Belarus

Forests in Belarus (2)

- Temperatures in the 2001-2010 period were 1.0-2.0°C higher than the long-term averages
- Bark beetle invasions => more than 14% of old-growth spruce forests were clear-cut in 2001-2005
- Fire period is getting longer => large areas of forests and peat bogs were damaged in 2003 and 2004
- Forest area damaged by storms is constantly increasing

Bark-Beetle Invasion in Bielaviežskaja Pušča

Strict protection zone

UNESCO World Heritage Site

Remnants of a Spruce Forest in Mahilioŭ Area

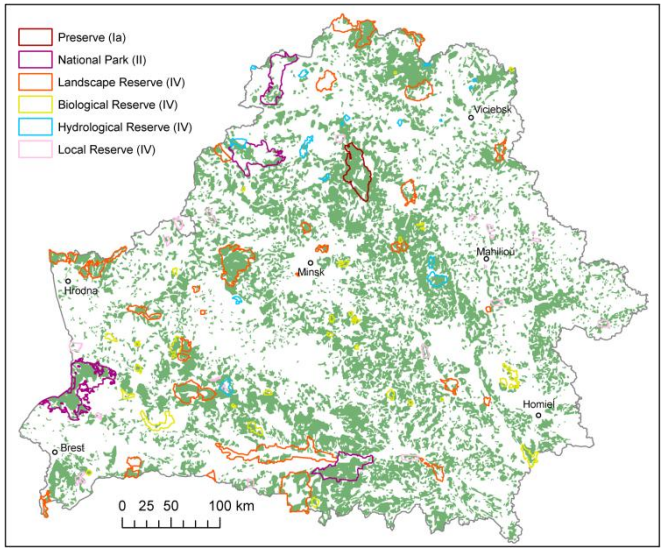

40.5 meter Christmas
tree in Bielaviežskaja
Pušča National Park

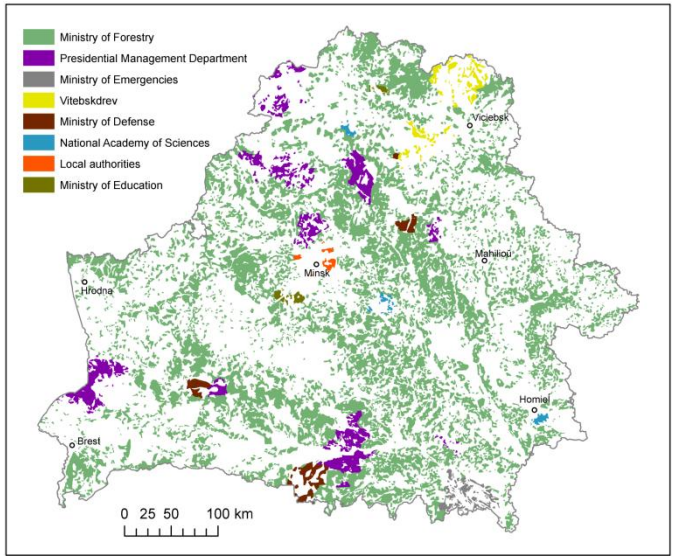
Old-growth forests are shrinking

Plantations are expanding

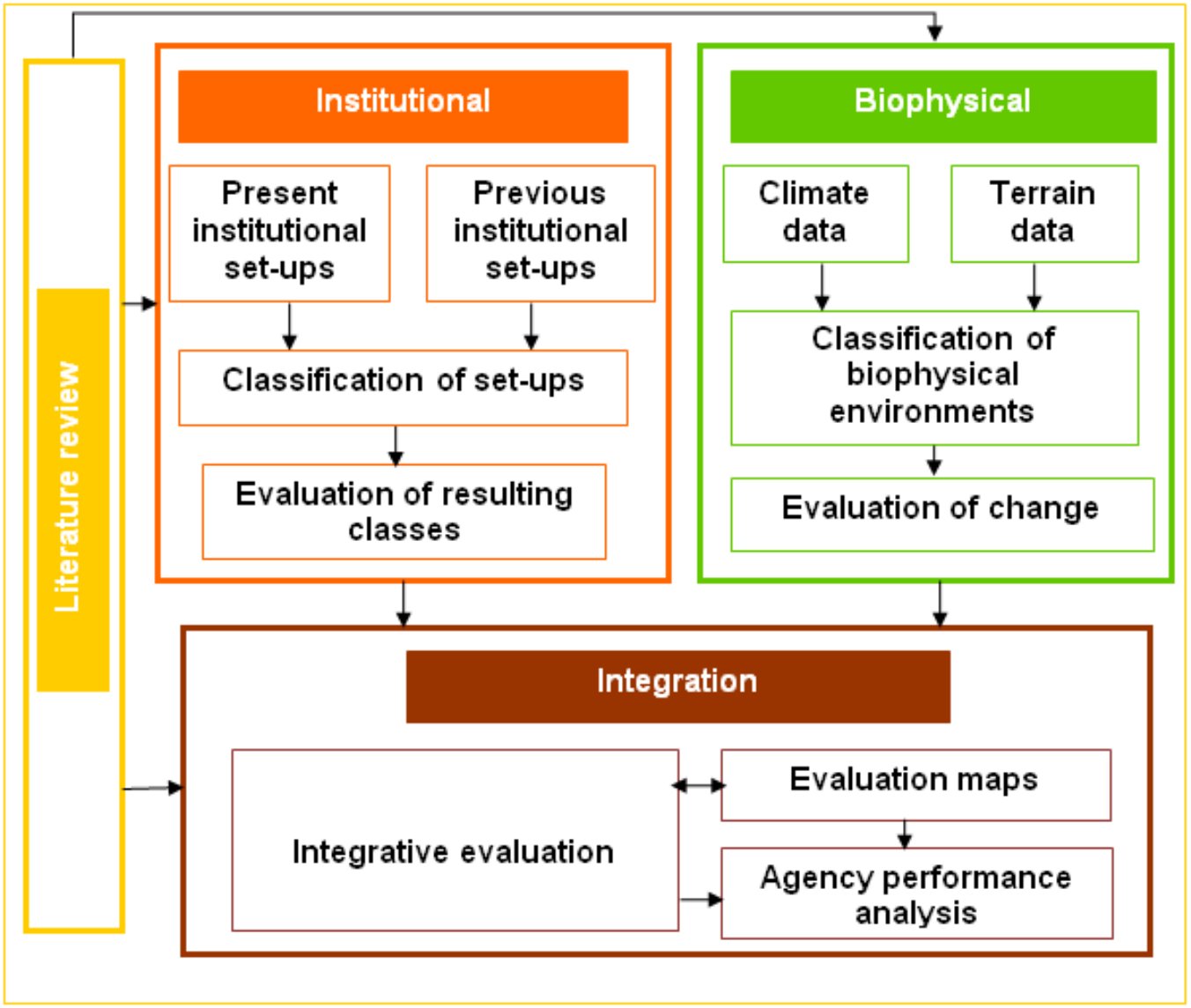
Environmental Governance in Belarus

- Highly hierarchical governance
- 99.63% of lands and 100% of forests are in the state ownership
- All the forests are managed by 8 agencies
- The number of agencies responsible for environmental control and monitoring is also limited
- There are only 4 categories of specially protected areas
- All levels of governance are present

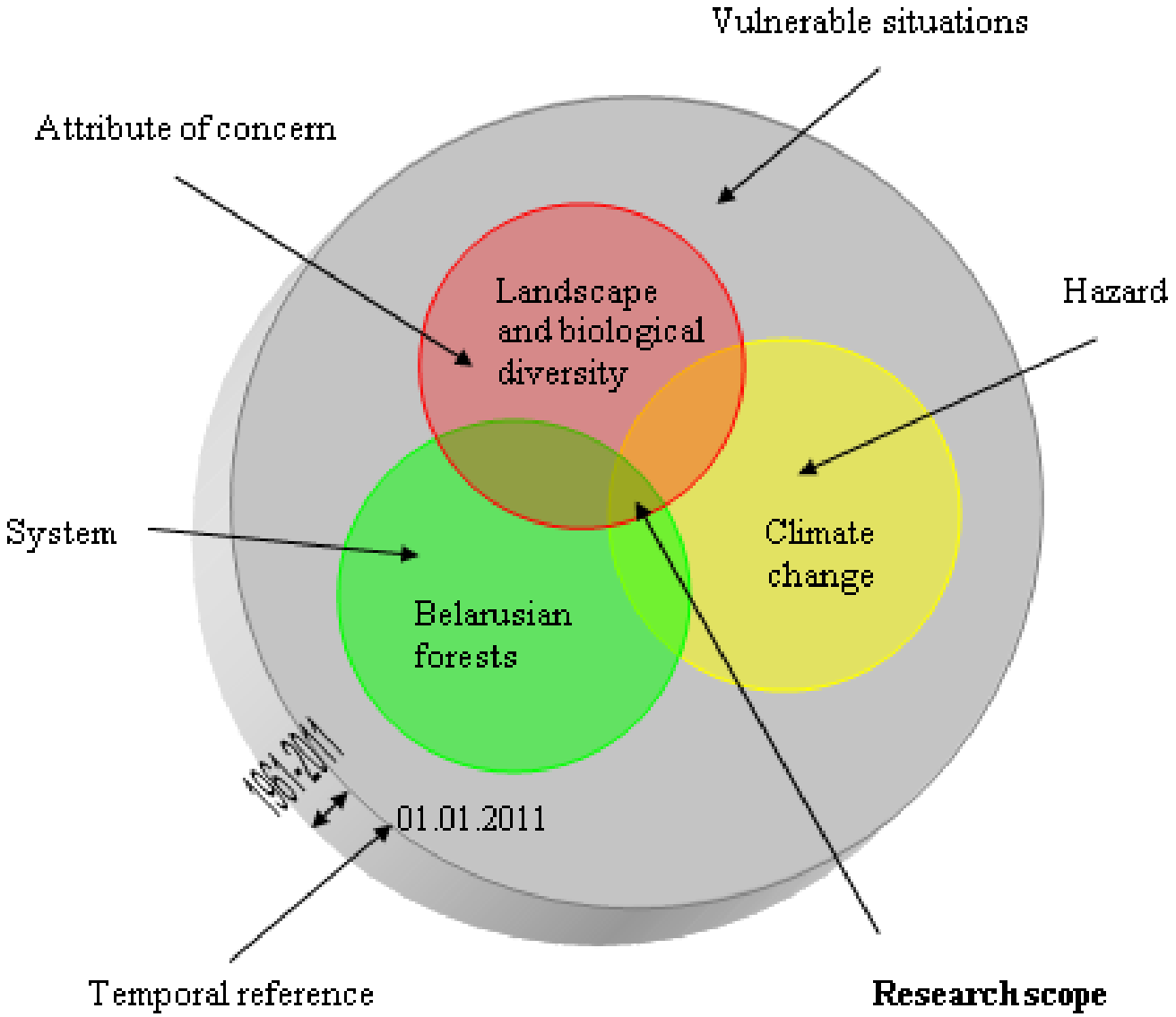




Methodological framework: Key components



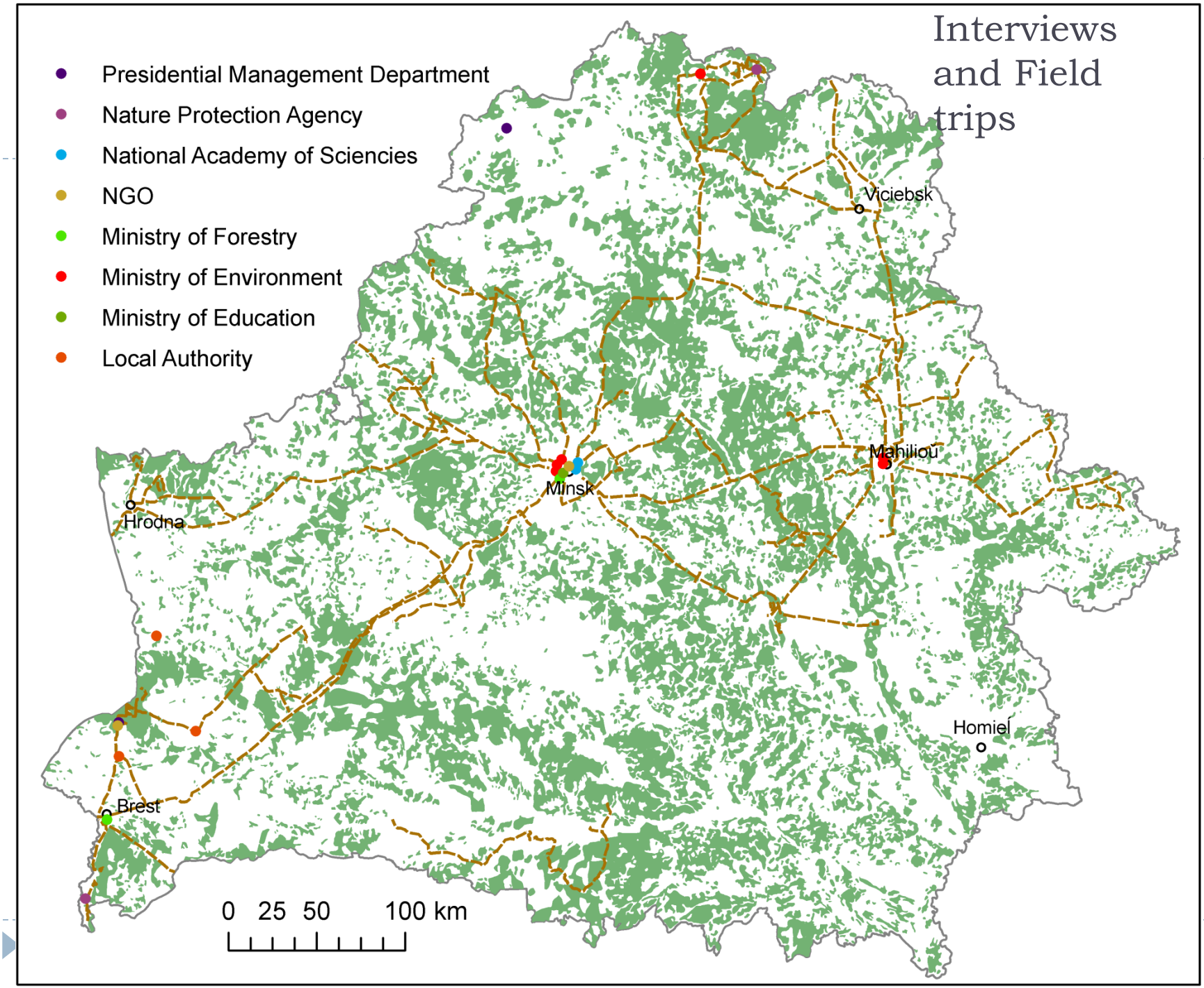
Research scope



Data collection

- Primary Data
  - In-depth and semi-structured interviews
  - Participant observation
- Secondary Data
  - Archival research and document review
  - Geological, vegetation, forest, and landscape maps
  - Meteorological data (105 weather stations)
  - Datasets: CRU CL 2.0, CRU TS 1.2, and TYN SC 1.0
  - GCM and RCM outputs

Interviews and Field trips



Methodology: concepts

- Institutional perspective on governance of natural resources:
  - "*…the establishment, reaffirmation or change of institutions to resolve conflicts over environmental resources*" (Paavola, 2007:94)
- Institutions are referred to as:
  - "*working rules that are used to determine who is eligible to make decisions in some arena, what actions are allowed or constrained, what aggregation rules will be used, what procedures must be followed, what information must or must not be provided, and what payoffs will be assigned to individuals depending on their actions*" (Ostrom, 1990)
- Institutional design principles (Ostrom, 1990):

Methodology: basic definitions

- Governance / institutional set-up:
  - a finite number of identifiable institutions operating within a specific area (park, nature reserve, forest stand, watershed, lake, etc) and within a specific context of power relations (including the presence of multiple levels of governance), access to resources, accountability and legitimacy
  - "*governance regimes… encompass the whole range of customs, norms and rules that shape a particular object (e.g. the levels of biodiversity that are in fact realized)*" (Paavola et al. 2009:149)

- Governance / institutional domain:
  - a typical combination of a management/conservation mandate(s) and management/coordinating bodies in charge

Methodology: analytical framework

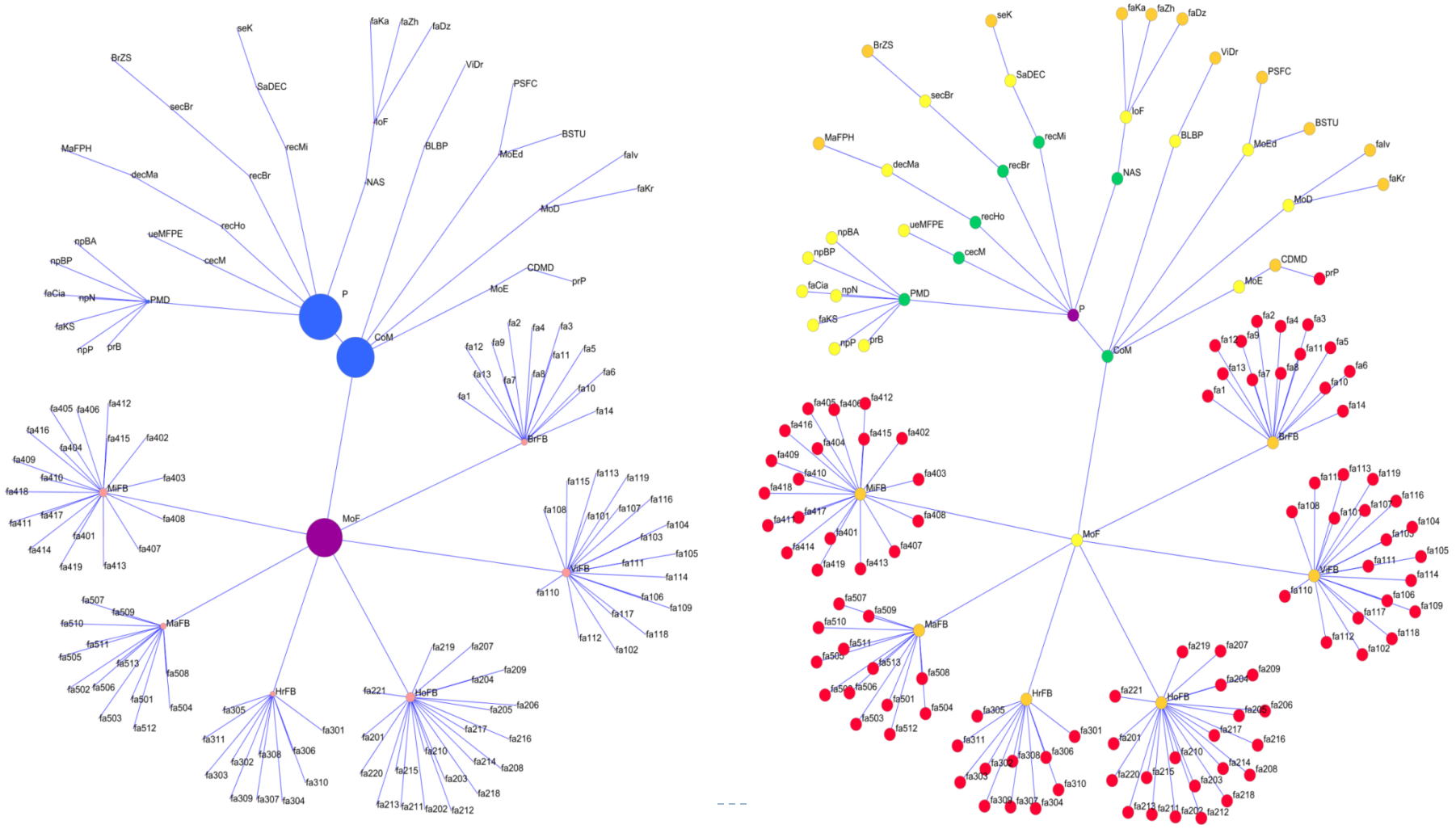
- Analytical problems of Earth System Governance research plan (Biermann *et al.* 2009):
  - (i) the overall ***architecture*** of ESG, (ii) ***agency*** beyond the state and of the state, (iii) the ***adaptiveness*** of governance mechanisms and processes, (iv) their ***accountability*** *and* ***legitimacy***, and (v) modes of ***allocation*** *and* ***access*** in ESG

- Key issues of multi-level environmental governance (after Paavola et al. 2009):
  - Scale,
  - Fit (spatial, temporal, functional)
  - Interplay

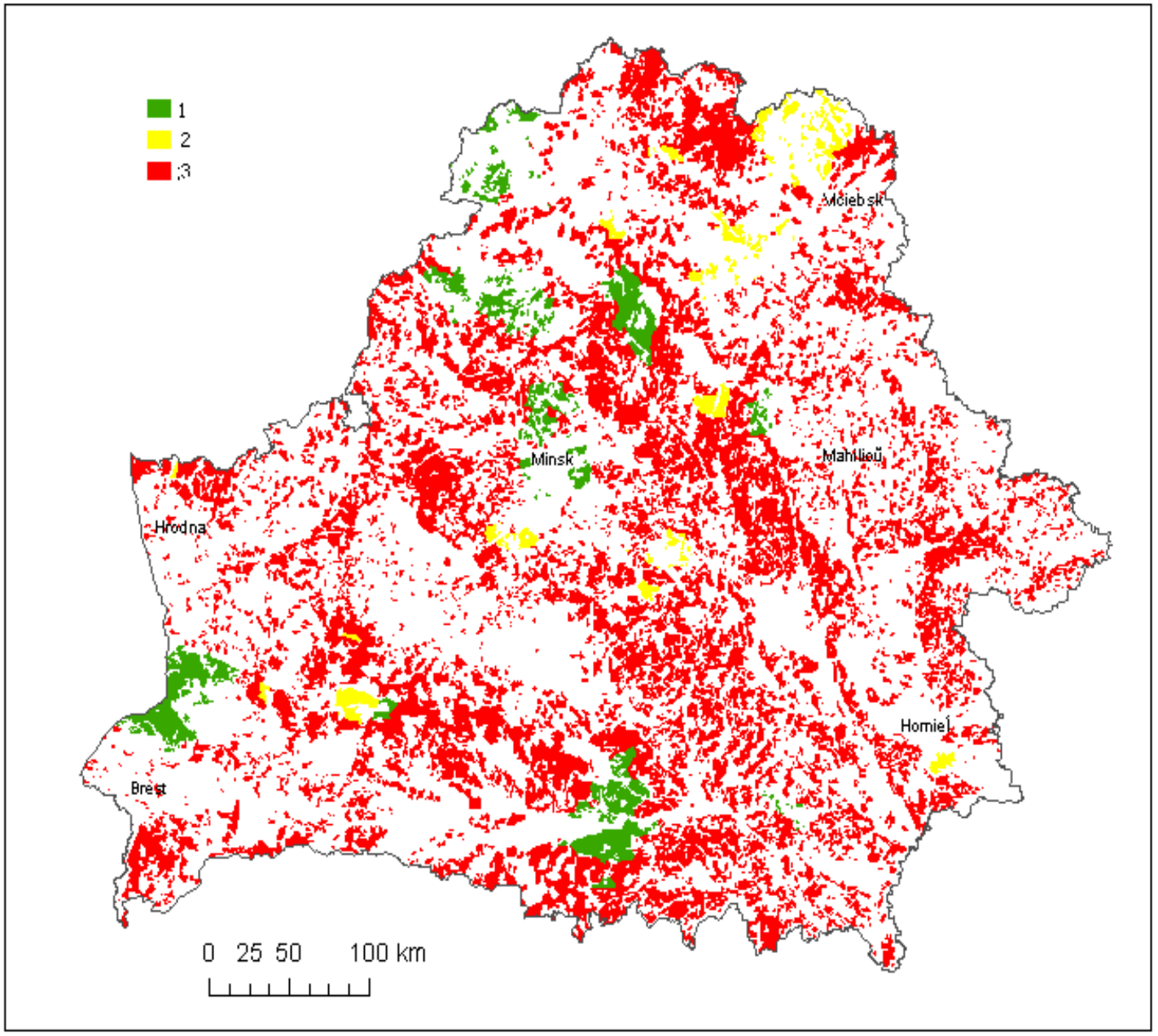
Evaluation of institutional characteristics

- Review of the institutional arrangements involved in landscape and biodiversity governance
- Identifying agencies responsible for forest management in Belarus (NetDraw, Cytoscape)
- Mapping the forests in respect to institutional regimes associated with forest management agencies (ArcGIS 10)
- Evaluation of governance design within each institutional domain and assessing "legacy effects"

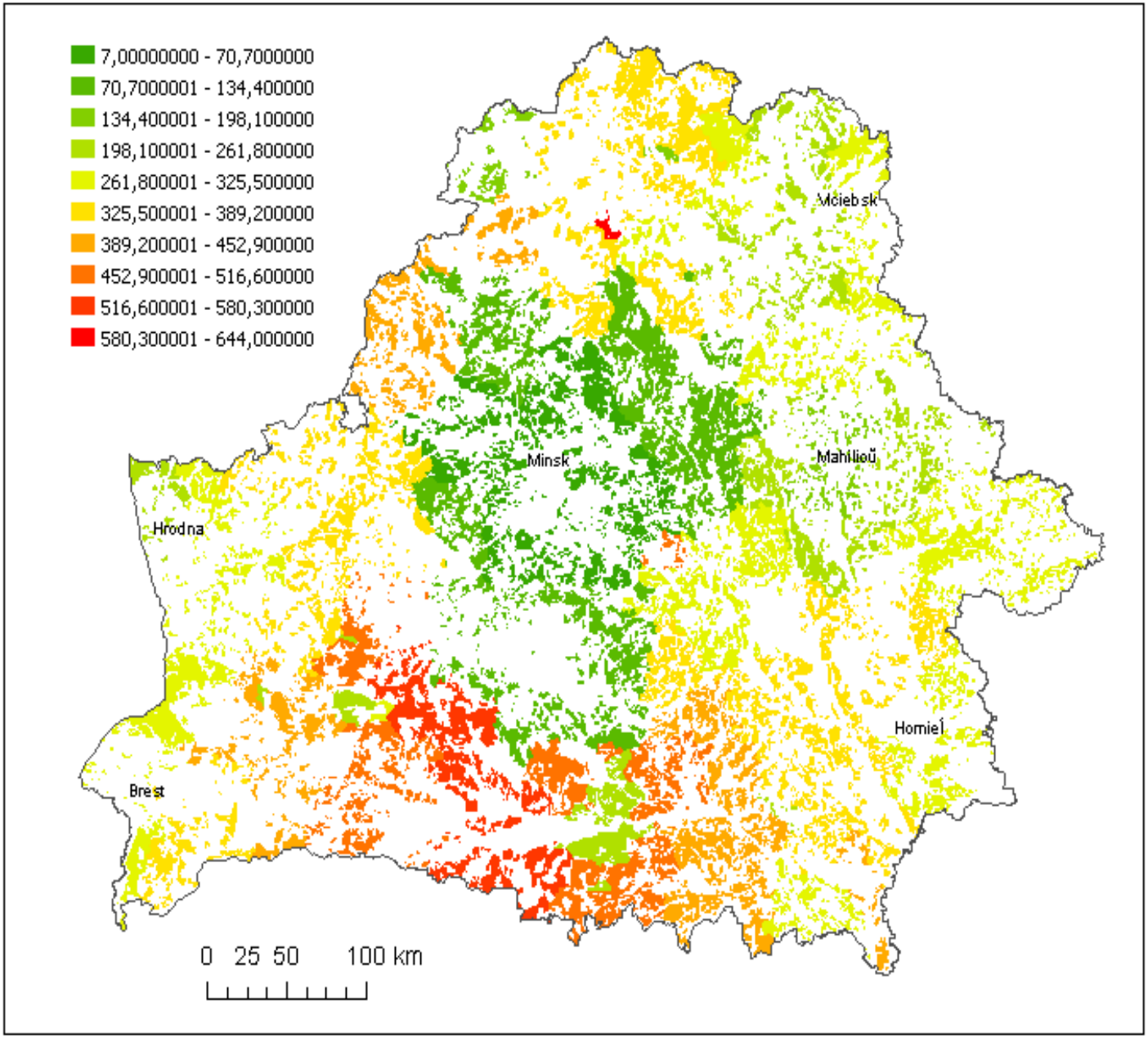
Network diagram of the forestry agencies



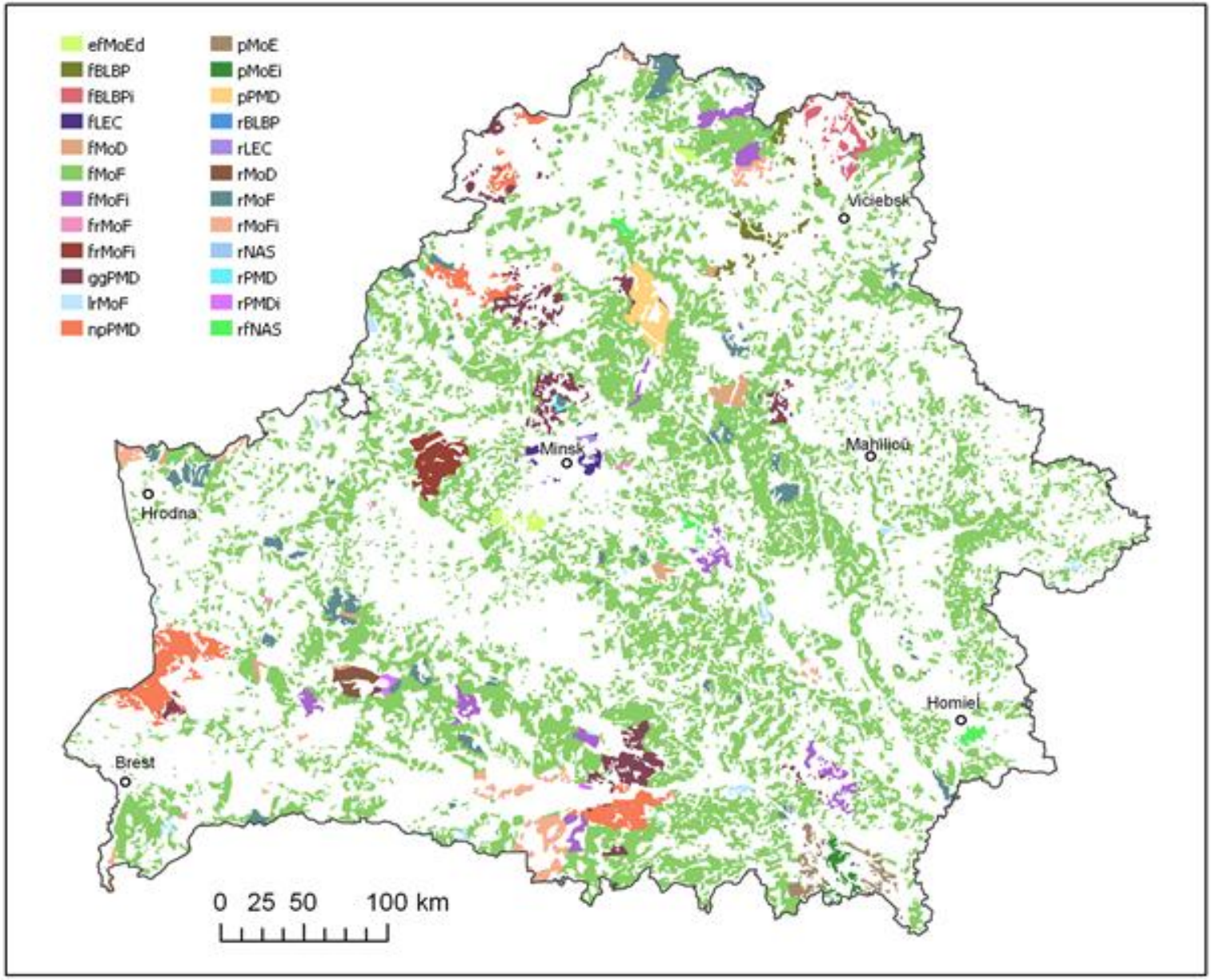
Topologic distance to the center of the governance system



Metric distance to the center of the governance system



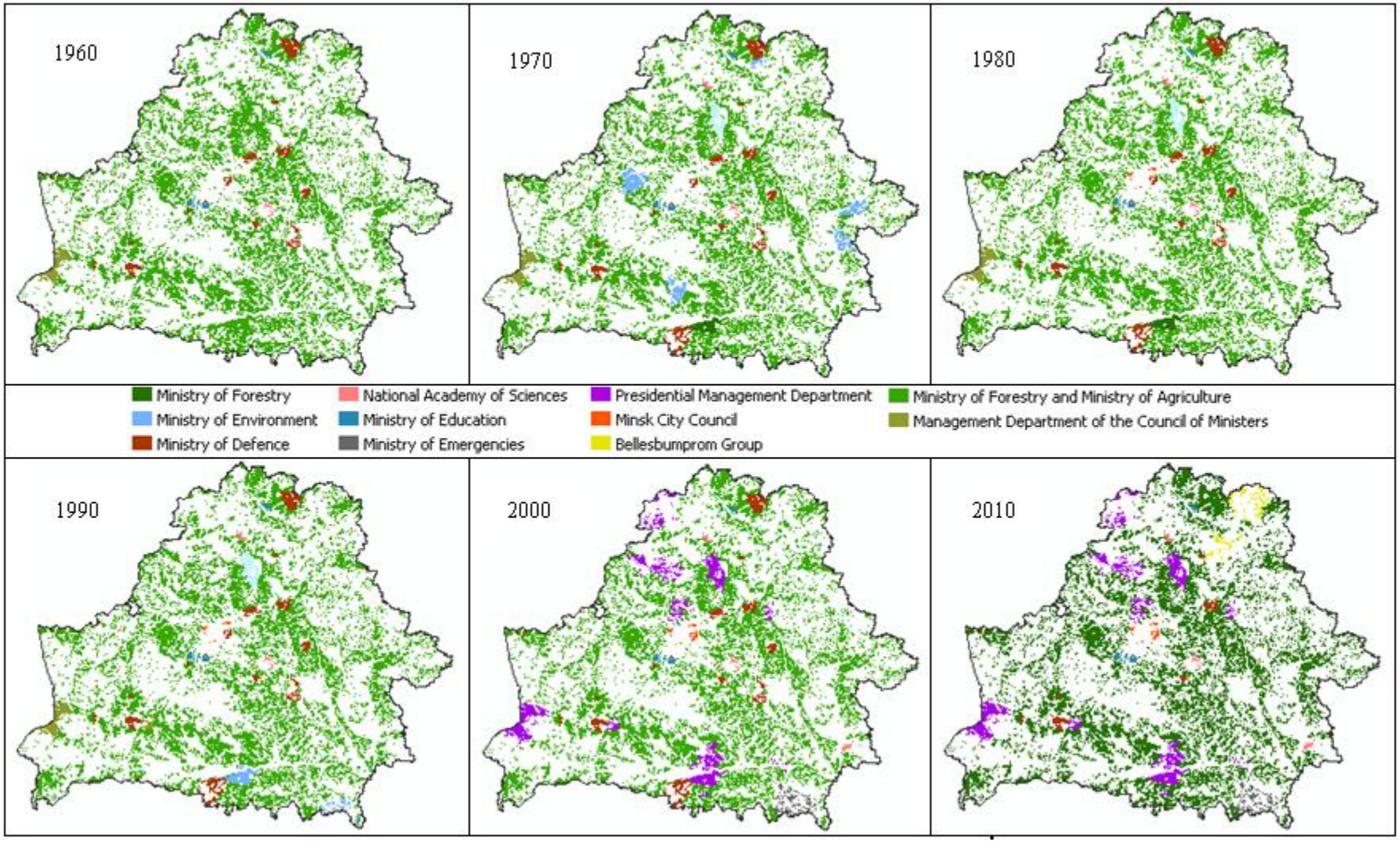
Diversity of institutional set-ups



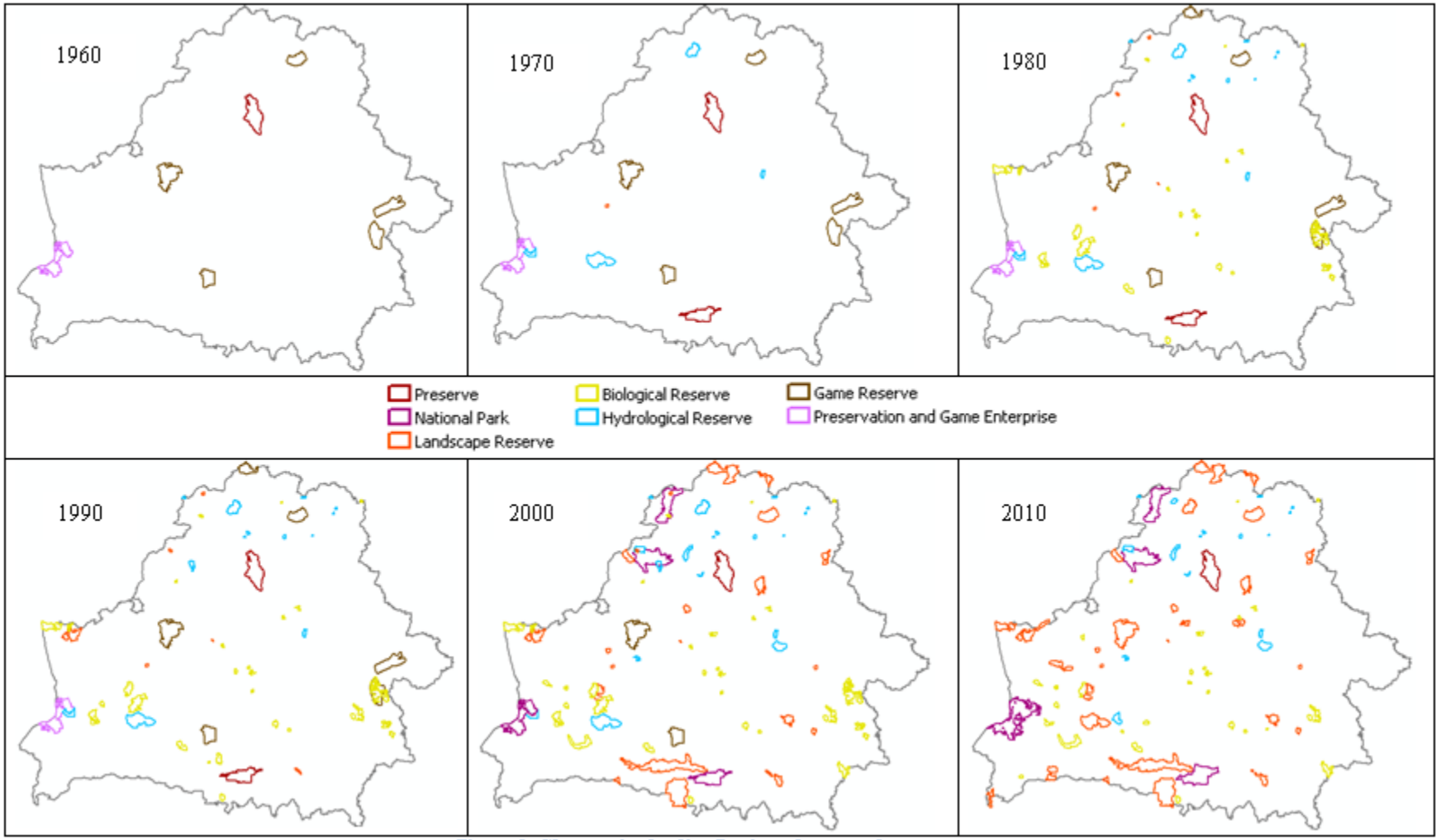
Evaluation scores

№	Classes of institutional domains	Architecture	Agency	Adaptiveness	Accountability / Legitimacy	Allocation / Access	**Total**
1	pPMD	1	1	0	0	1	**3**
2	pMoEm	0	1	-1	0	0	**0**
3	npPMDi	1	1	-1	0	1	**2**
4	npPMD	1	0	-1	0	1	**1**
5	rMoFi	1	1	1	1	1	**5**
6	rMoF	0	0	1	1	0	**2**
7	rPMD	-1	0	-1	0	0	**-2**
8	rMoDi	-1	-1	-1	0	0	**-3**
9	rLEC	0	0	0	1	0	**1**
10	lrMoF	1	0	1	1	1	**4**
11	fMoFi	0	1	1	0	0	**2**
12	fMoF	0	0	1	0	0	**1**
13	fLEC	0	-1	0	1	0	**0**
14	efMoEd	1	1	1	0	1	**4**
15	mfMoD	-1	-1	-1	-1	-1	**-5**
16	ggPMD	-1	0	0	-1	0	**-2**
17	rbNAS	1	1	1	1	0	**4**
18	fVDi	0	0	0	0	0	**0**
19	fVD	-1	0	0	0	0	**-1**

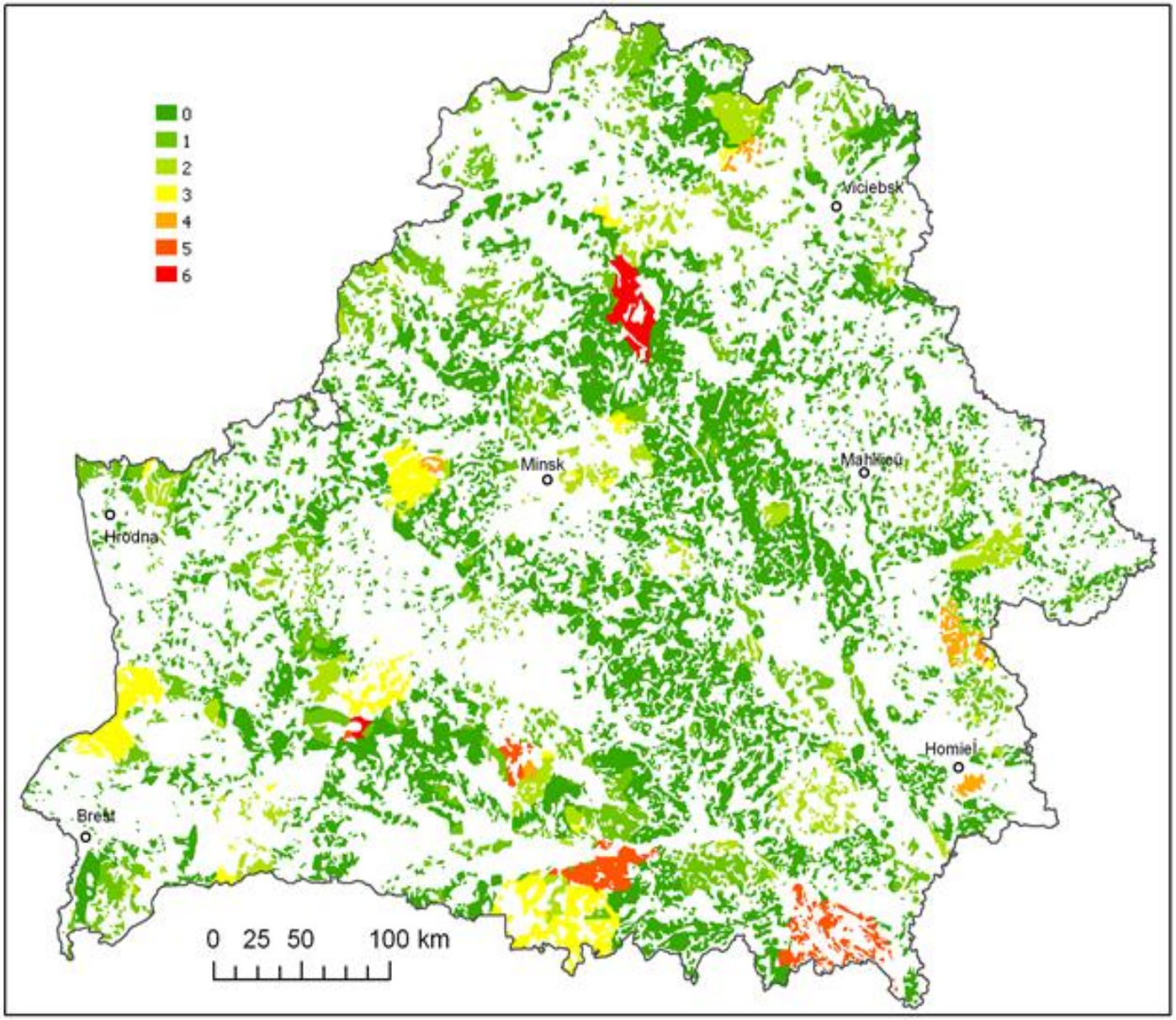
Change in the distribution of the jurisdictions of forestry agencies



Changes in the distribution of protected areas



Number of changes in the institutional set-up



Biophysical characteristics

- Inventory of abiotic variables relevant for plant distribution and productivity
- Classification of biophysical environments
- Evaluation of the biophysical environments under climate change:
  - Creating rankings of the environments
  - Quantification of biophysical vulnerability based on the ranking scores of environments shifting through forest patches

Climatic variables:

- number of growing degree days baseline 5 and 10 C,

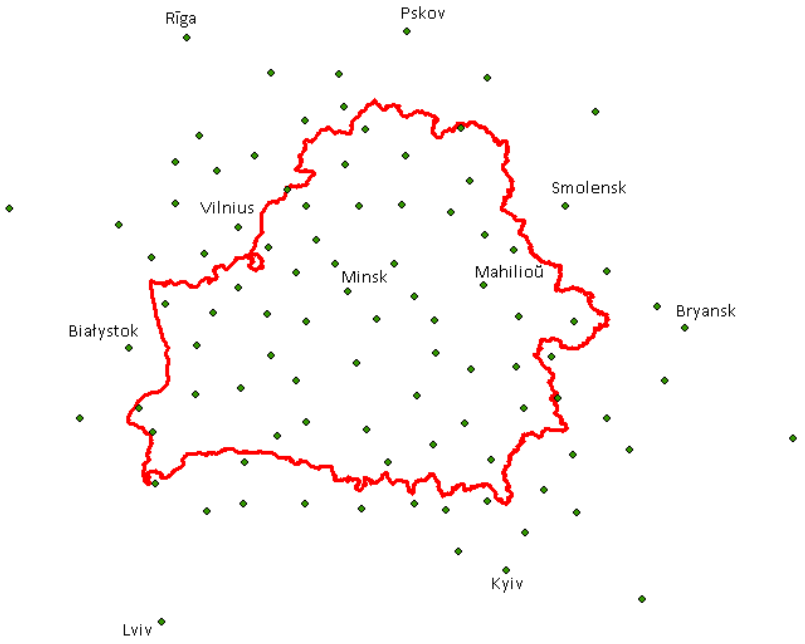
- annual hydrothermal coefficient (HTC after Seljaninov),

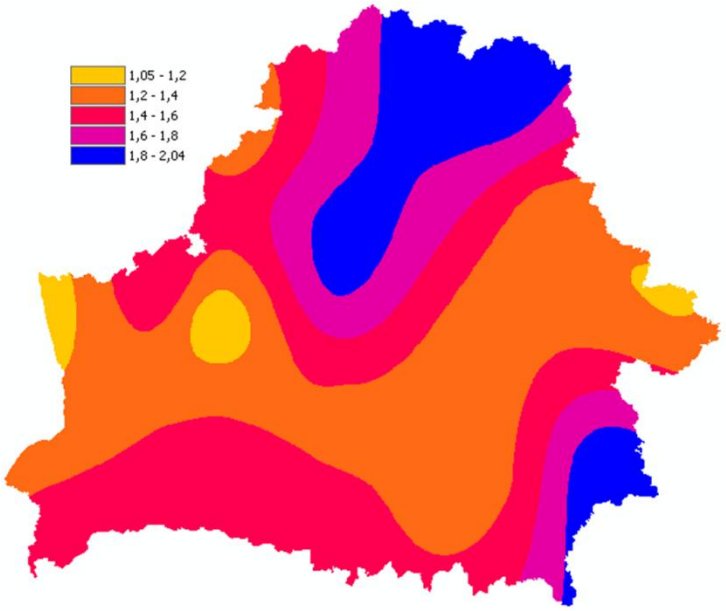
- growing season lengths (days),

- annual averages of mean daily temperature,

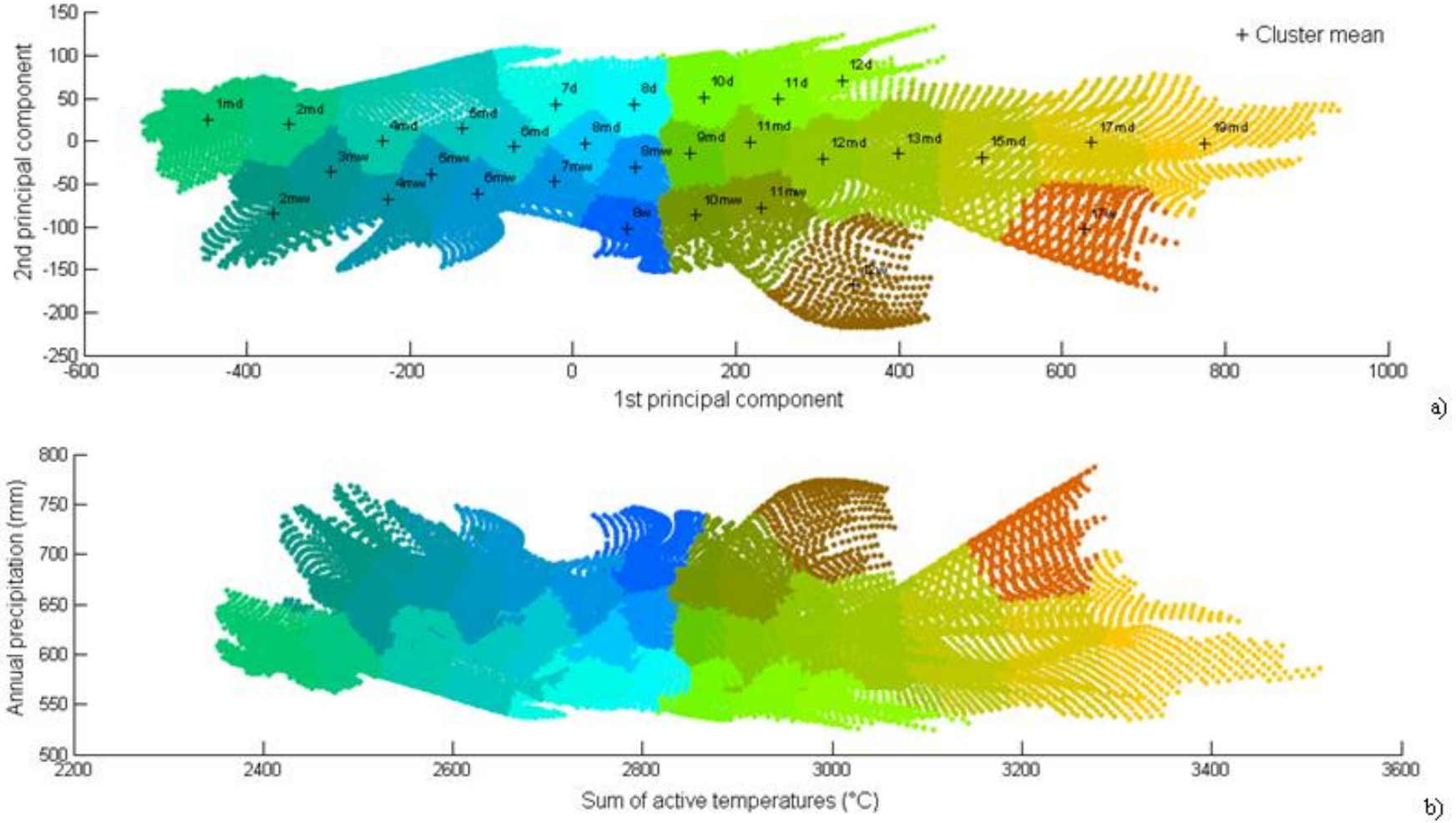
- annual sums of mean daily precipitation,

- growing season precipitation

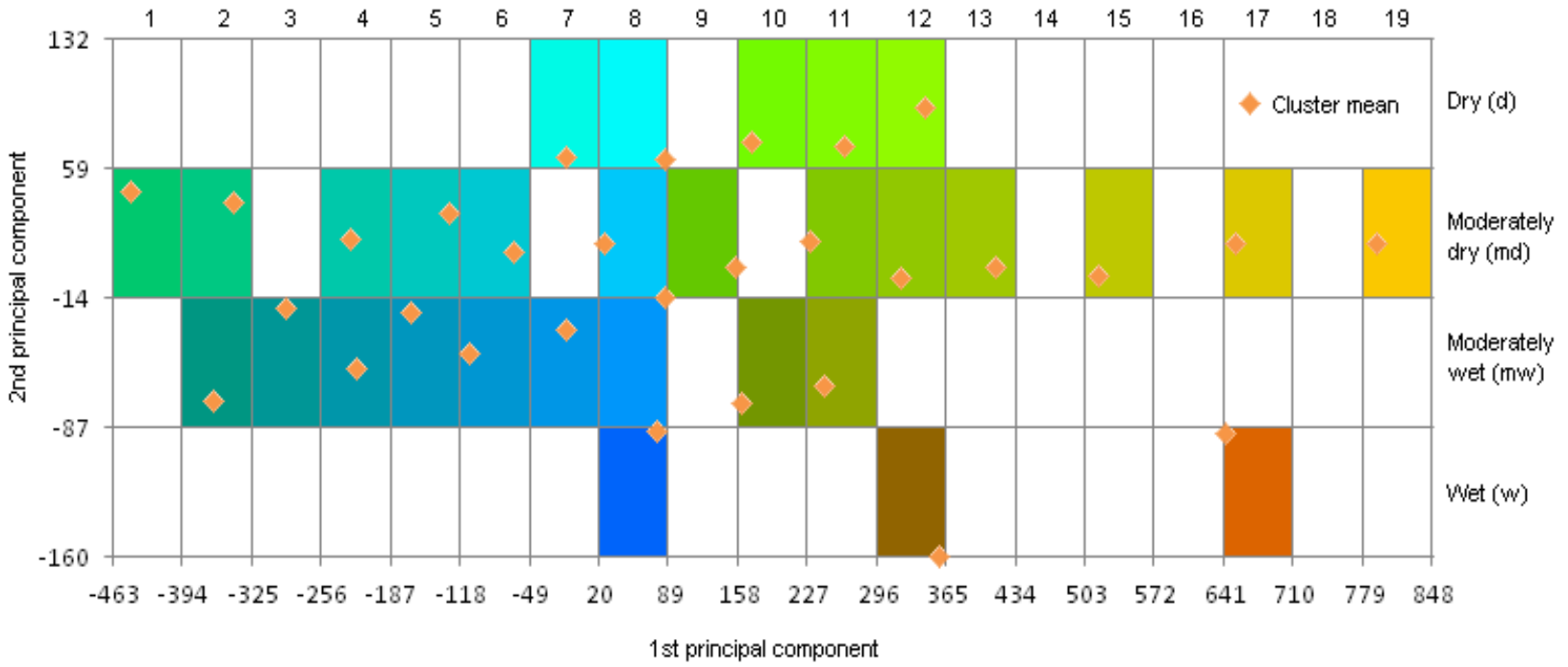


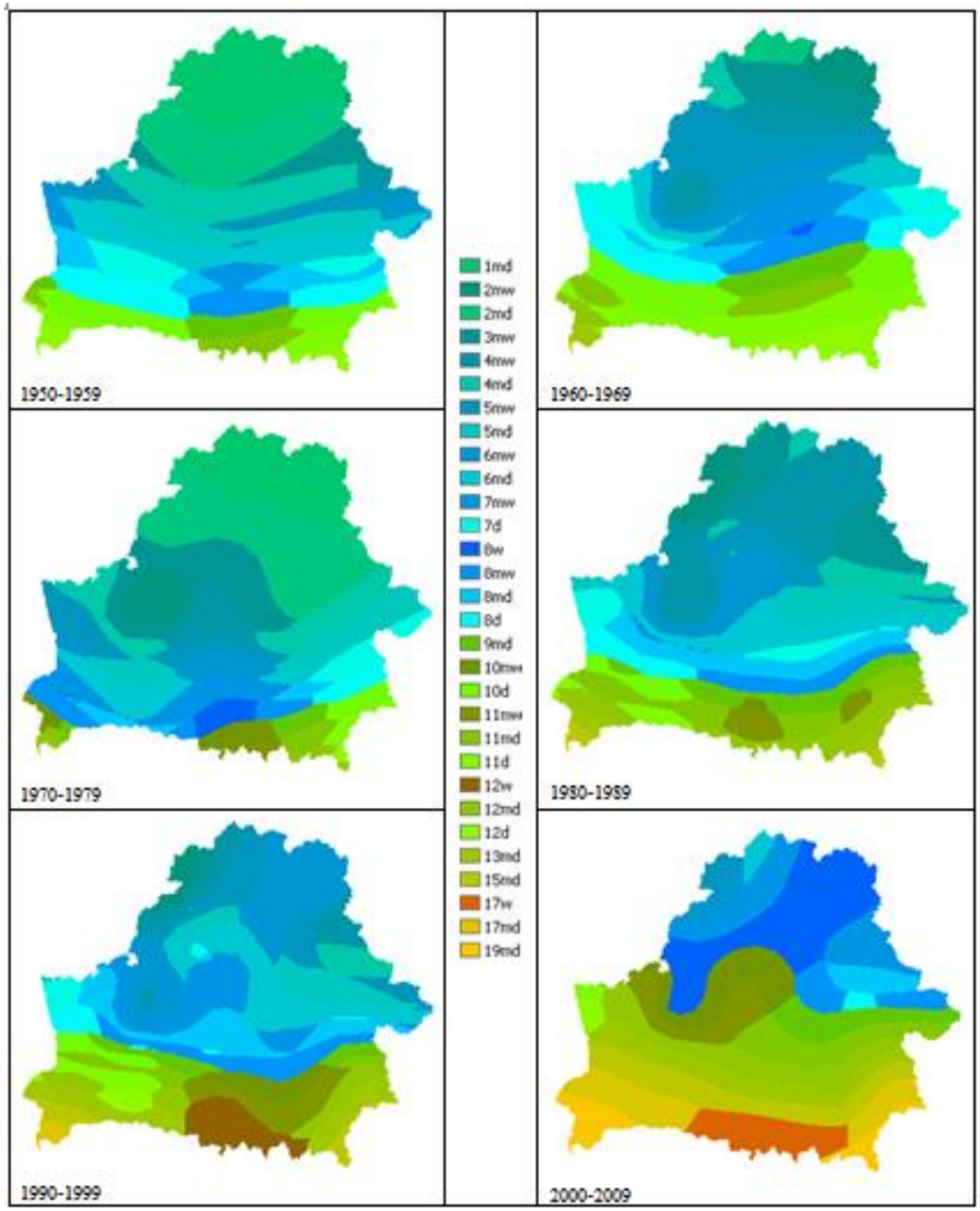


Scatter-plots for principal components (a) and climatic variables (b)

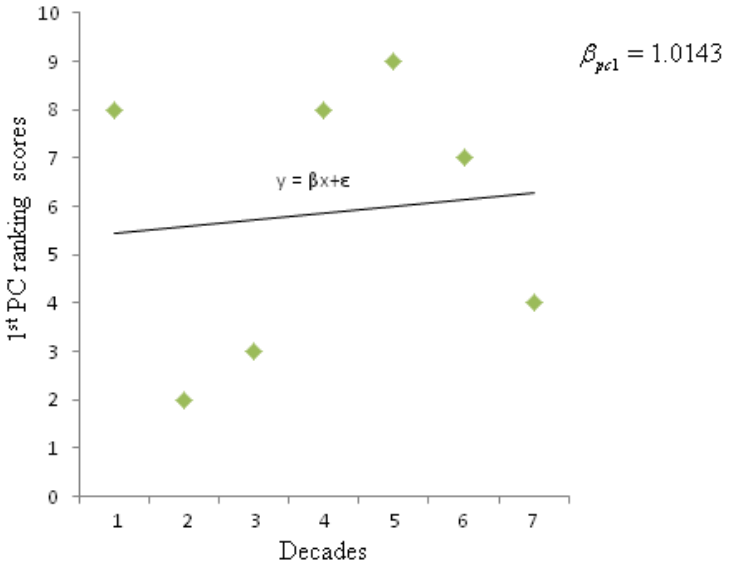


Naming of the Biophysical classes



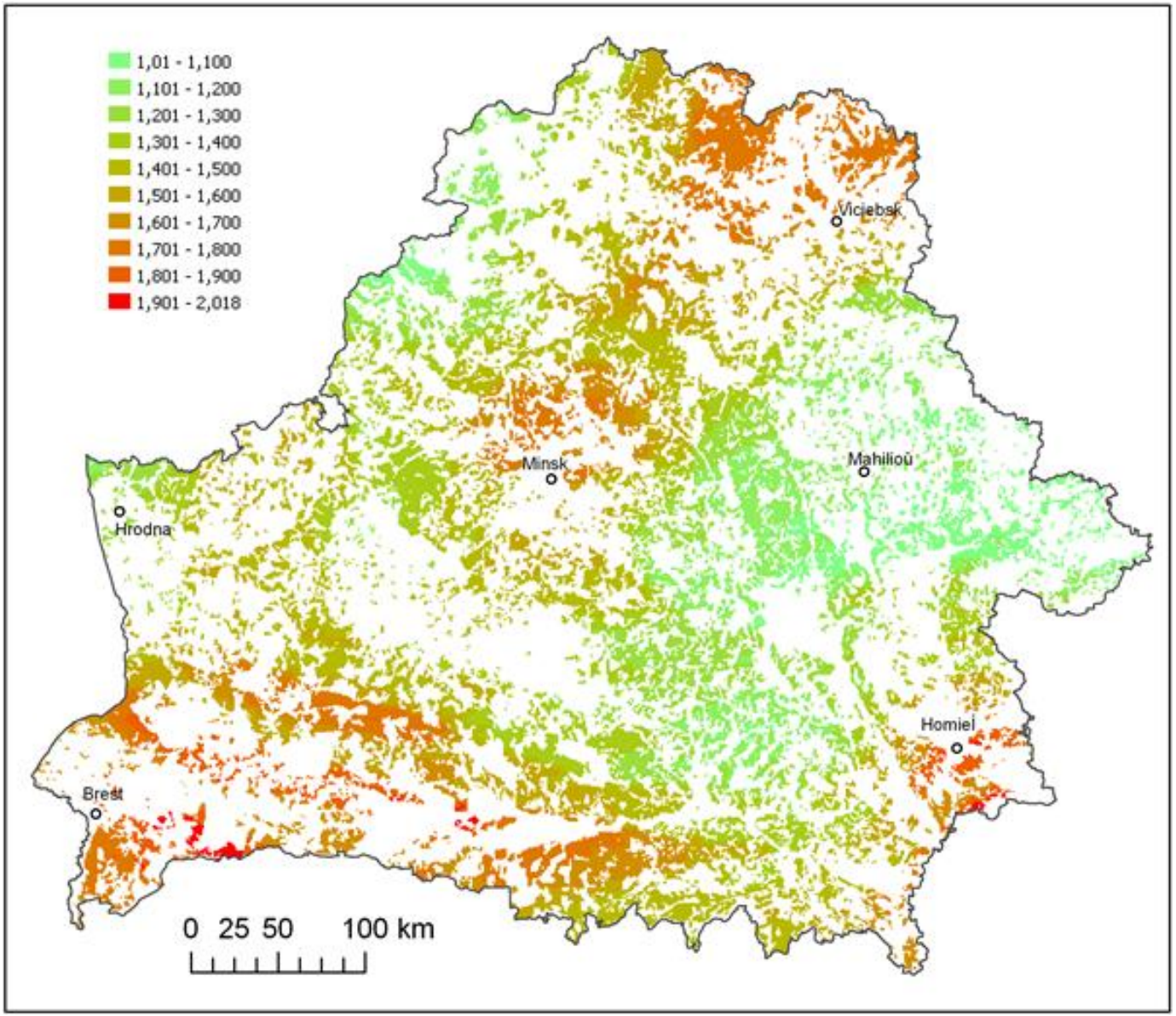


Biophysical shifts



$$V_b = \sqrt{1+\beta_{pc1}^2+\beta_{pc2}^2}$$

Evaluation of biophysical characteristics (index)

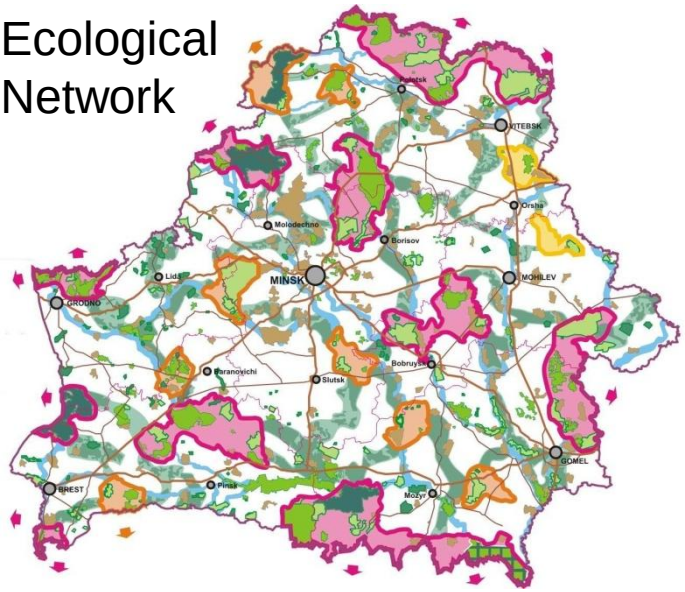


Integration of institutional and biophysical characteristics

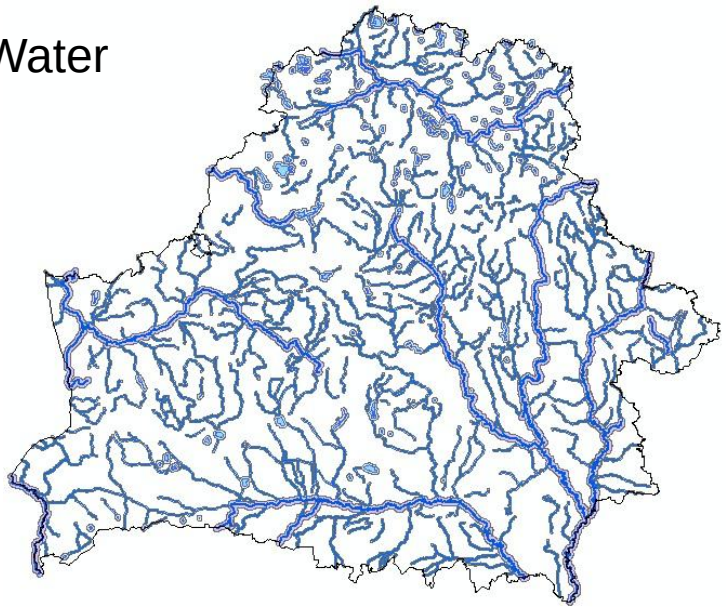
- An integrative evaluation based on
  - Spatial Misfits (Appropriateness of scale, Clearness of boundaries)
  - Functional Misfits (Appropriateness of institutional set-up, Barriers to active adaptation)
  - Temporal Misfits (Incremental change, Abrupt change)
- Evaluation of governance performance of each institutional set-up
  - Pest invasions
  - Forest fires
  - Total loss

Integration: Buffer Analysis

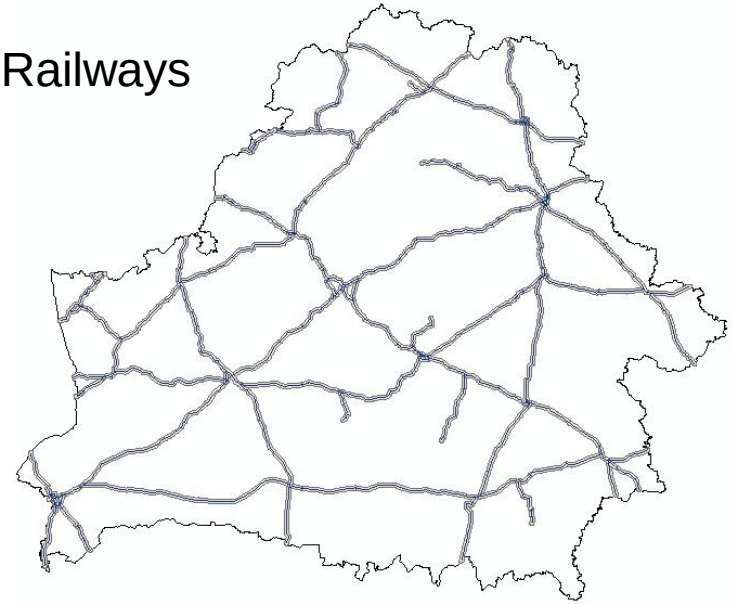
Ecological Network



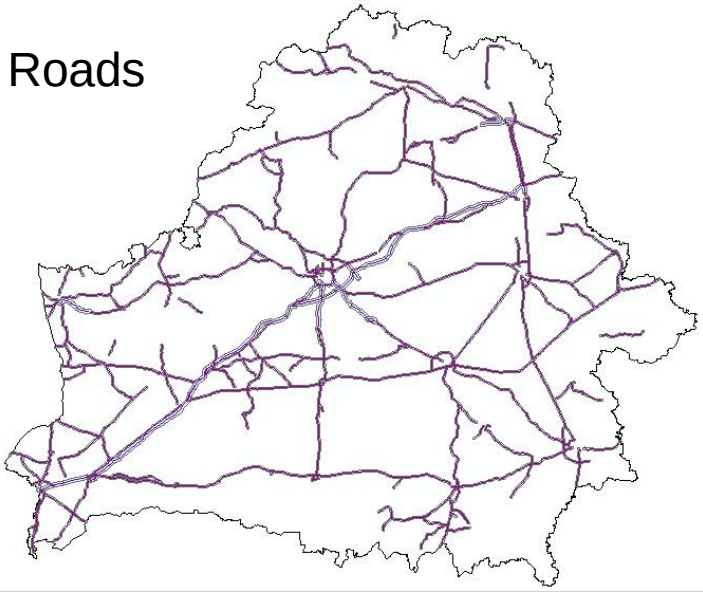
Water



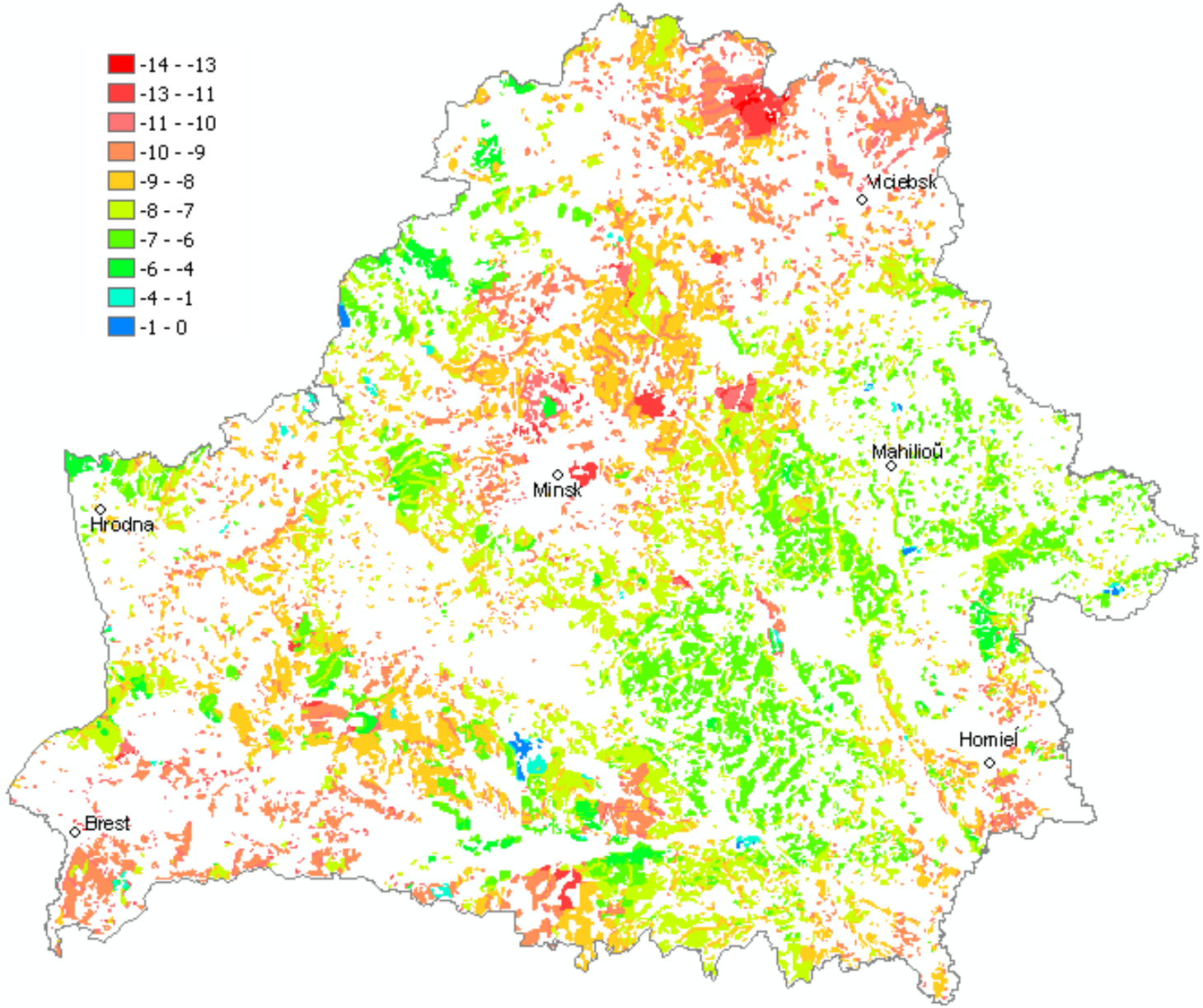
Railways



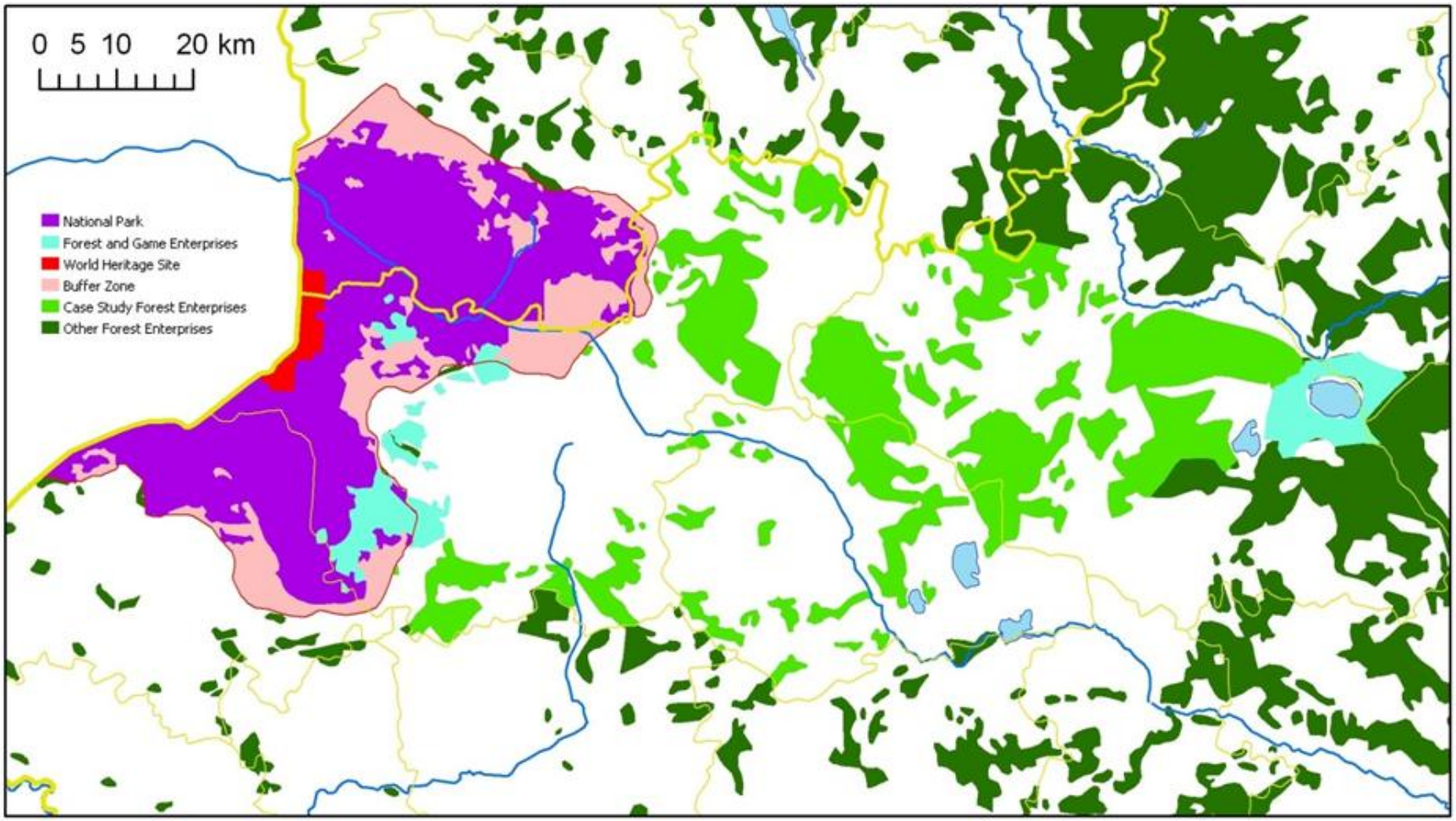
Roads



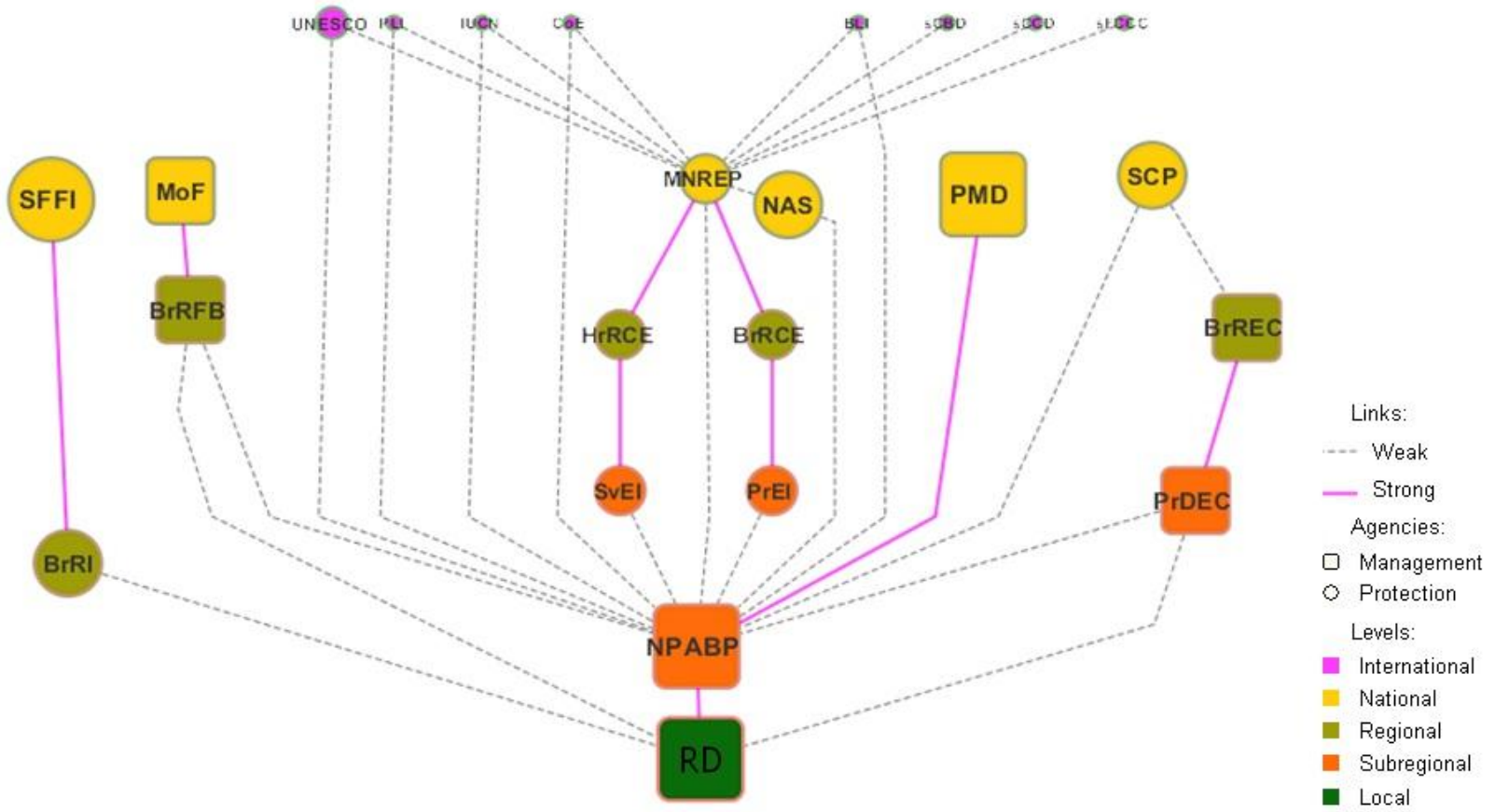
Integration: Cumulative misfit



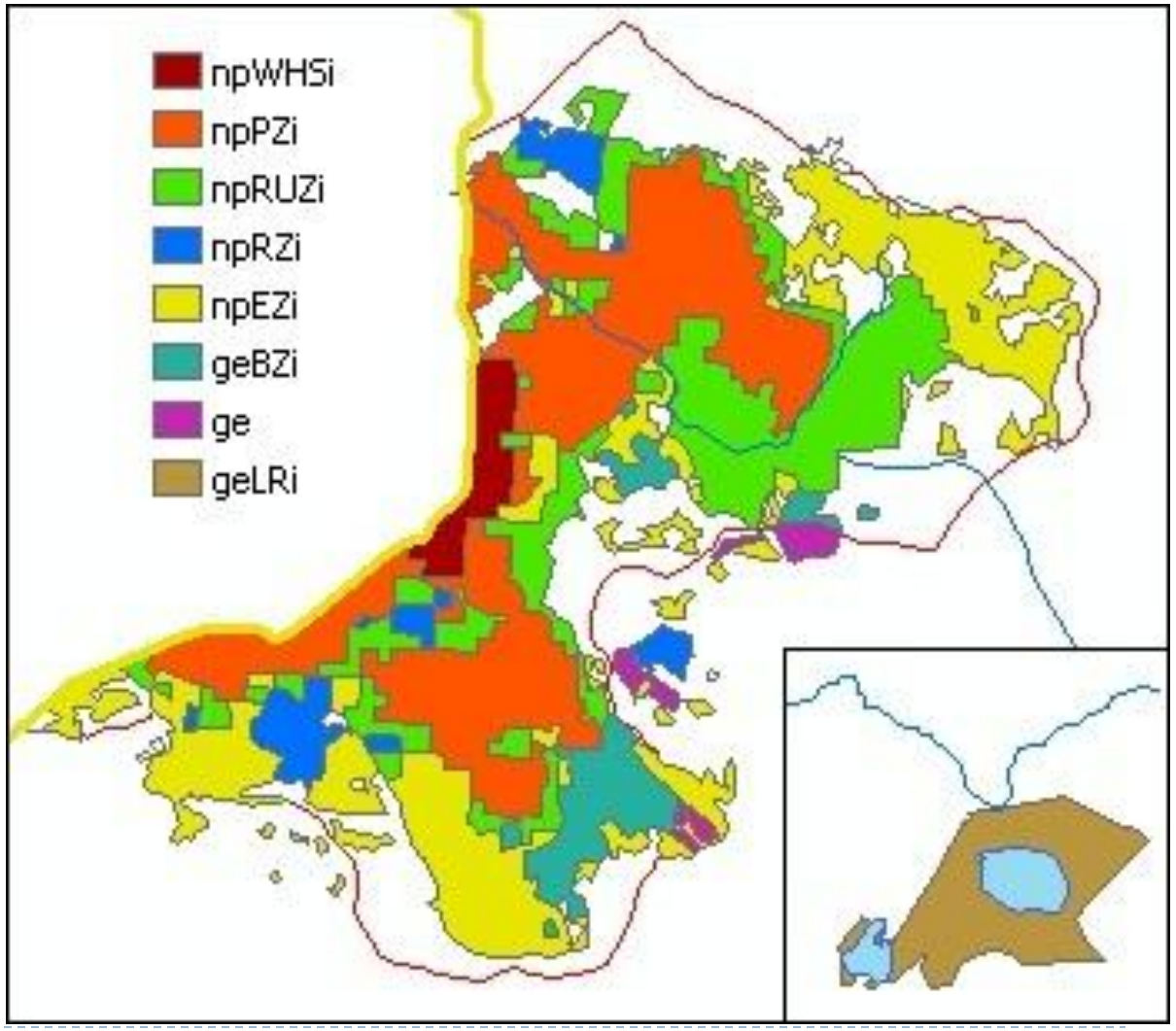
The region of Bielaviežskaja Pušča



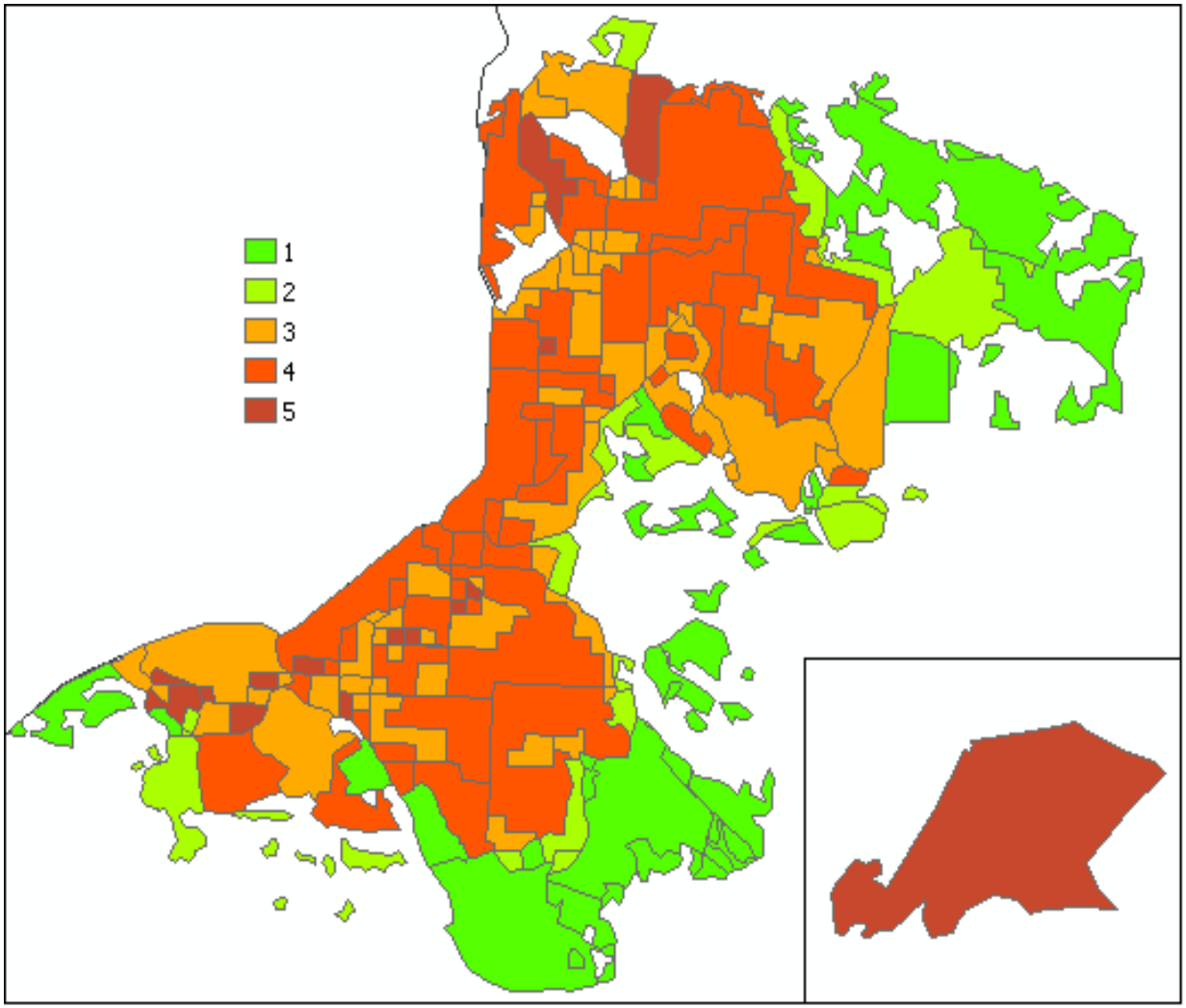
The region of Bielaviežskaja Pušča: Actor network



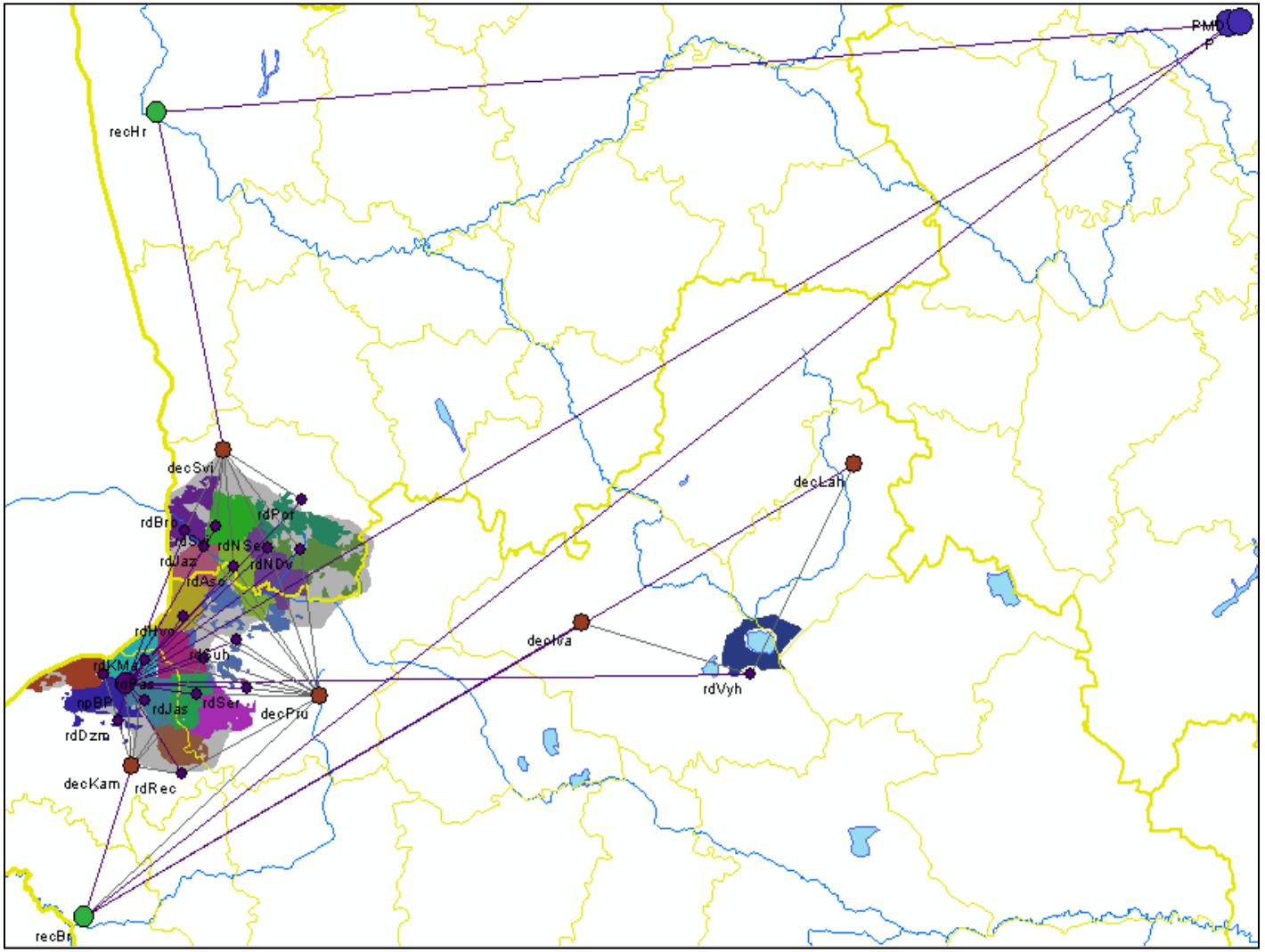
Governance domains set-ups in the BPR in 2012



Change: Governance domains set-ups in the BPR in 2012



Network: Governance domains set-ups in the BPR in 2012



Area: Governance domains set-ups in the BPR in 2012