

# The Green Belt of Fennoscandia as a tool to assess boreal bird responses to forest management intensity

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## 1. Background

The Green Belt of Fennoscandia is of utmost importance for biodiversity conservation in the North of Europe. Extending from the Baltic Sea to the Arctic Ocean, it is made up of a network of existing and planned protected areas situated to a large extent along the border between Finland and Russia, with the largest ones situated in Russia. By allowing the natural development and dynamics of the vegetation over such vast stretches of land, the protected areas provide unique opportunities to understand the ever-changing nature of the boreal forest and, by comparison with managed landscapes, the ecological implications of forestry in the boreal zone.

## 2. Objective, study area and expected results

Within the framework of the Fennoscandian Green Belt, the aim of this project was to assess boreal bird responses to different levels of forest management and its consequences for forest breeding conservation value. This was done by comparing bird densities and their habitats between Russian protected (Kalevala National Park, 74000 ha) and Finnish protected (20 sites, 22-6343 ha), partly-managed (1 site, 3200 ha) and managed forest landscapes (3 sites), along a cross-border gradient of increasing forest management intensity. In the partly-managed landscape (Ruunaa), both commercial forestry and nature protection were being implemented side-by-side, with commercial forests accounting for 55% of the forest land. All the studied areas belonged to the same forest vegetation zone (mid-boreal).

With its 74,000 ha of pristine wilderness, the Kalevala National Park in Russian Karelia represents one of the largest and last self-functioning natural forest ecosystems in Europe. The conservation value of boreal forest landscapes and the diversity of their bird communities were expected to increase with the level of forest naturalness along the studied gradient, from Finnish managed to Russian Kalevala protected forest landscapes (Figure 1).

Figure 1 – Study area.



## 3. Material and methods

In order to estimate their diversity and abundance, forest birds were counted by using the Finnish line transect census method (Figure 2). The line transect method consisted in a one-visit census, in which birds were counted along a transect with a length of 3-7km. In the line transect method a 50m wide main belt along the walking line and a supplementary belt outside the main belt were separated. Densities of bird species were calculated on the basis of observations on the whole survey belt including both main and supplementary belts. They were adjusted to the different detectabilities and audibilities of the different species by using existing species-specific correction coefficients. Together with bird data, transects were used to estimate the tree dominance (spruce, pine, mixed), the ground vegetation type and the forest height structure of the studied areas (as proportions of the transect length).

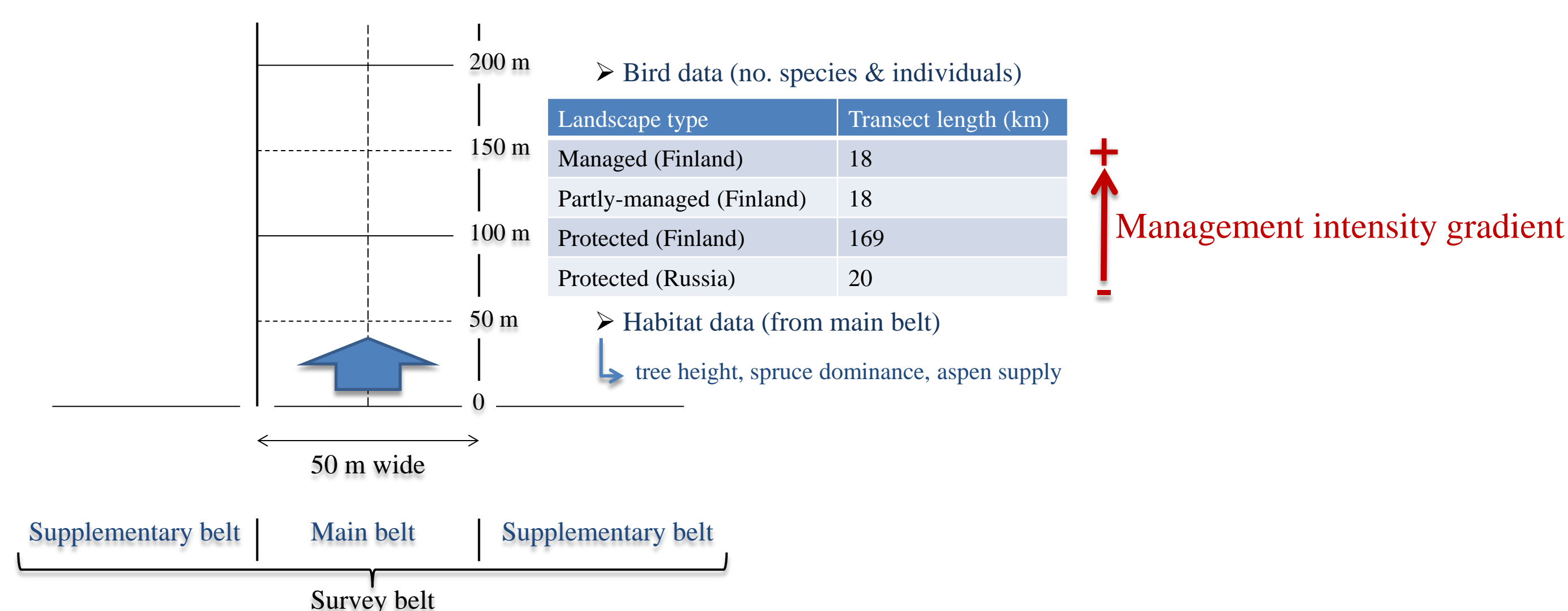


Figure 2 – Finnish line transect census method.

Among forest birds, special attention was paid to species of conservation importance, classified into 9 categories (Figure 3).

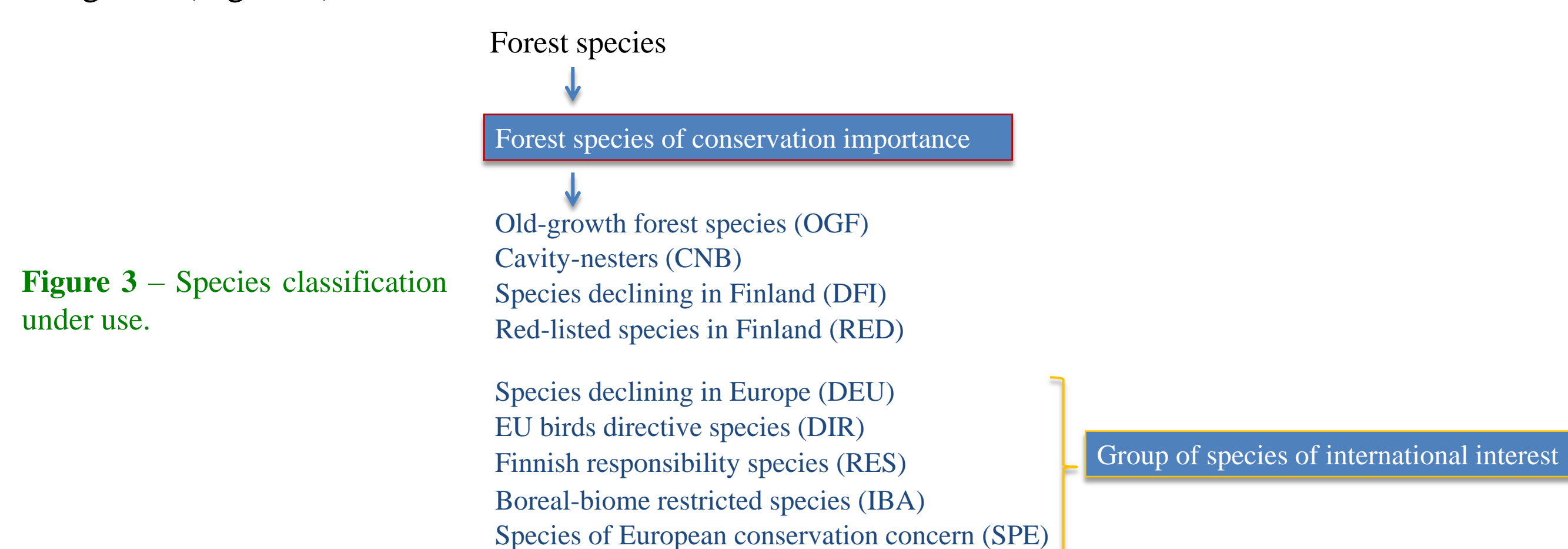


Figure 3 – Species classification under use.

A species conservation value was derived from the number of times the species belonged to one of the 9 categories. The breeding conservation value index of a forest area was then estimated by combining information from species conservation values and local abundances (Figure 4).

FOREST SPECIES TAXONOMY			CLASSIFICATION										
Scientific name	English name	Finnish name	OGF	CNB	DFI	RED	DEU	DIR	RES	IBA	SPE	SCV	
<i>Anser fabalis</i>	Bean goose	Metsähanihi	0	0	1	1	0	0	0	1	0	0	3
<i>Bucephala clangula</i>	Goldeneye	Telkkä	1	1	0	0	0	0	1	0	0	0	3
<i>Accipiter gentilis</i>	Goshawk	Kanahaukka	1	0	1	0	0	0	0	0	0	0	2
<i>Bonasia bonasia</i>	Hazel grouse	Pyy	0	0	0	0	1	1	0	0	0	0	2
<i>Lagopus lagopus</i>	Willow grouse	Riekkö	0	0	1	1	1	0	0	0	0	0	3
<i>Tetrao urogallus</i>	Capercaillie	Metso	1	0	1	1	1	1	0	0	0	0	6
<i>Cuculus canorus</i>	Cuckoo	Käiki	0	0	0	0	1	0	0	0	0	0	1
<i>Glaucidium passerinum</i>	Eurasian pygmy-owl	Varpuspöllö	1	1	0	0	0	1	1	0	0	0	4
<i>Strix uralensis</i>	Ural owl	Viirupöllö	1	1	0	0	0	1	0	0	0	0	3
<i>Jynx torquilla</i>	Eurasian wren	Kienpiika	0	1	1	1	1	0	0	0	0	1	5
<i>Dryocopus martius</i>	Black woodpecker	Palokirki	1	1	0	0	0	1	0	0	0	0	3
<i>Dendrocopos major</i>	Great spotted woodpecker	Käpytikka	1	1	0	0	0	0	0	0	0	0	2
<i>Picoides tridactylus</i>	Three-toed woodpecker	Pohjantikka	1	1	1	0	1	1	1	0	0	1	7
<i>Anthus trivialis</i>	Tree pipit	Metsäkivirven	0	0	1	0	1	0	0	0	0	0	2

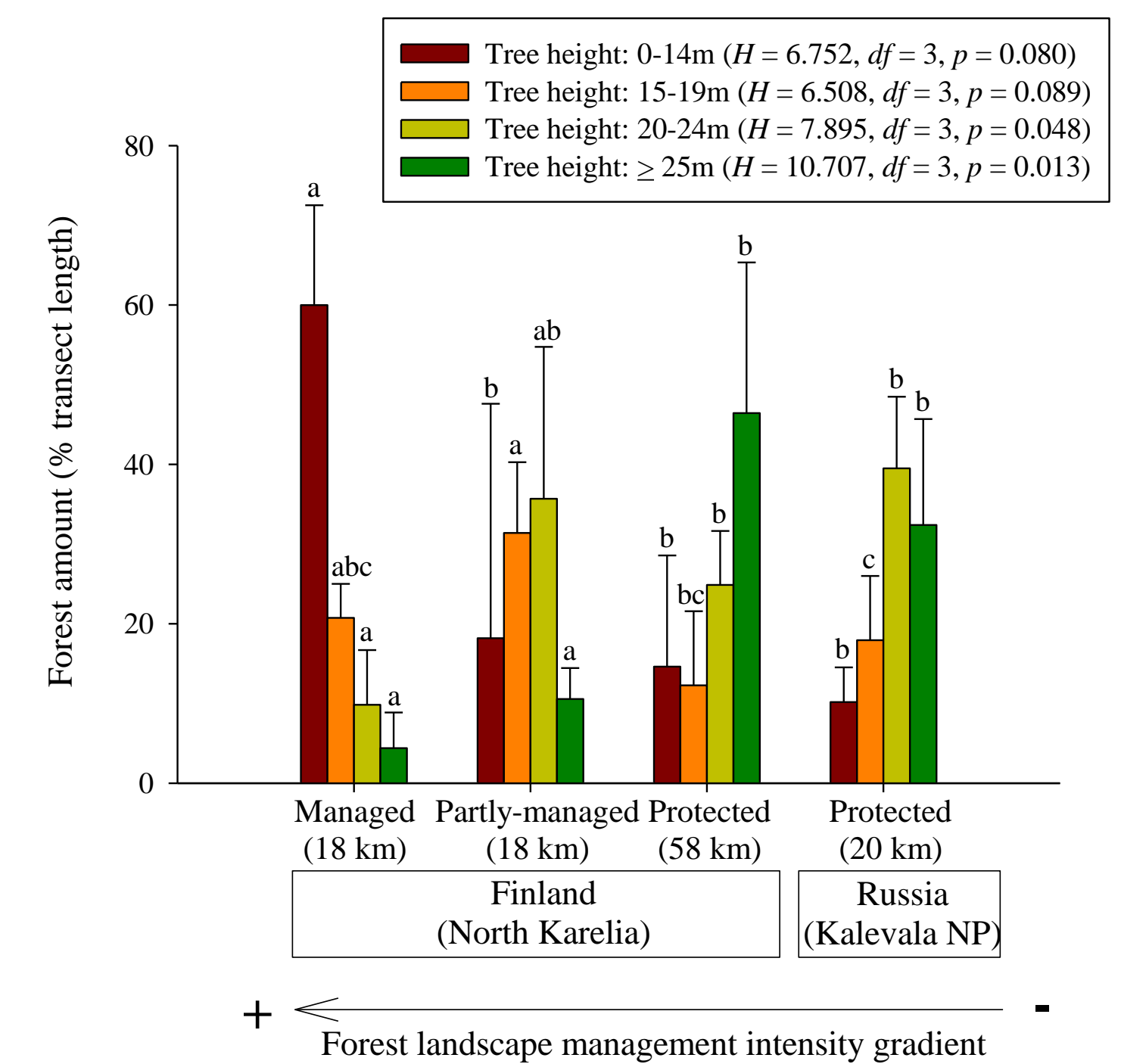
Figure 4 – Method for estimating forest conservation value for breeding birds.

$$\text{Forest Breeding Conservation Value} = \sum_{\text{tot}} (\text{SCV} \times \text{Density})$$

## 4. Results I: forest structure

An increase in the level of forest landscape management intensity from Russia to Finland produced clearly visible and profound effects on the boreal forest, with a gradual shift in height/age structure from old-growth towards younger stages of development (Figure 5).

Figure 5 – Height class distribution of forest landscapes along the studied gradient of management intensity. Small letters are used for pairwise statistical comparisons (with different letters referring to significant differences).



## 5. Results II: species richness and diversity

Rarefied down to a common abundance level, the sampled bird communities from Finnish and Russian protected forest landscapes contained significantly more species than those from managed and partly managed landscapes in Finland (Figure 6a). Accordingly, forest bird communities were found increasingly diverse with a reduction in the level of forest management intensity (Figure 6b).

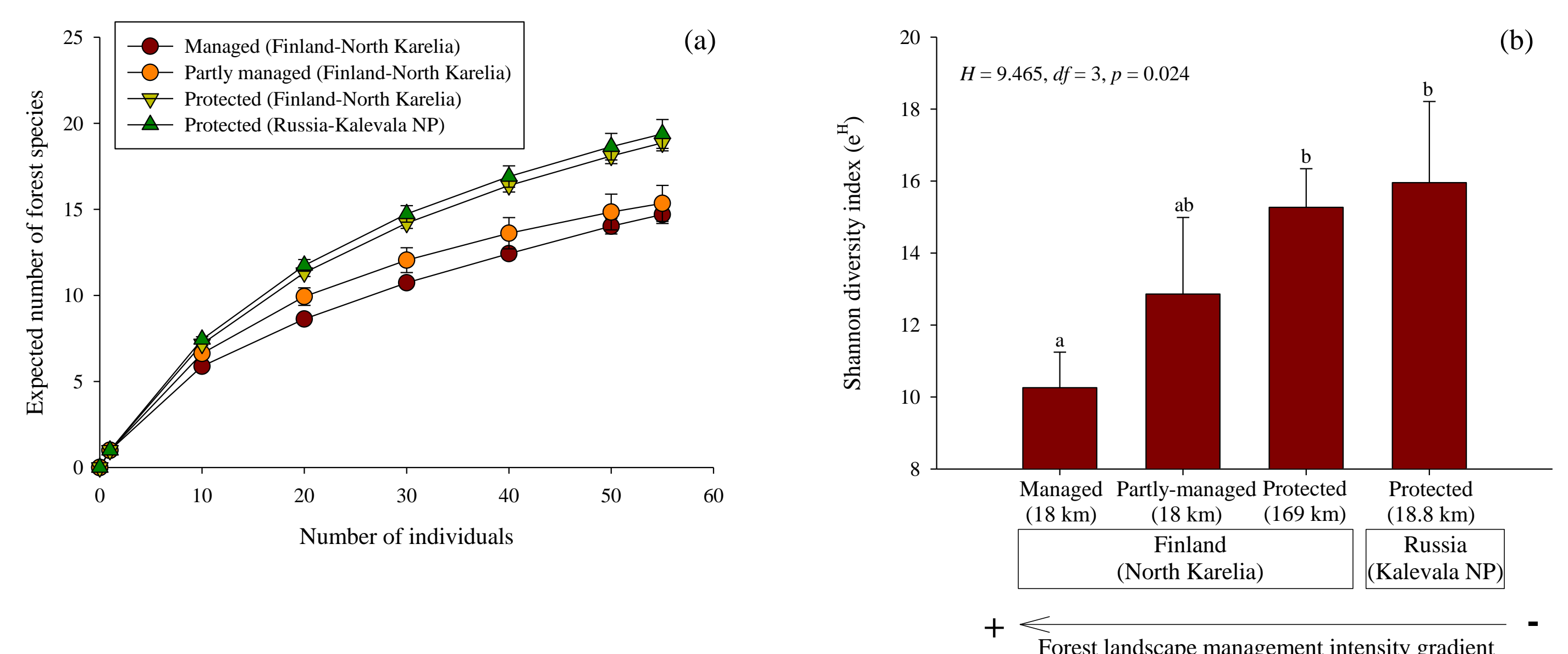


Figure 6 – Individual-based rarefaction curves and diversity estimate for forest bird communities in studied forest landscapes.

## 6. Results III: species densities and composition

Total forest bird density did not differ significantly between forest landscape categories, even if mean values were higher on protected land (Figure 7a). Among species however, those of conservation importance and to a lesser extent the species of international interest reached their lowest abundance in Finnish managed forest landscapes. Overall, their breeding densities increased steadily with the level of landscape protection, reaching their highest values without significant differences in Finnish and Russian protected areas. Yet, the large Russian protected area harboured a significantly higher abundance of boreal-biome restricted forest species and of species currently declining and being threatened in Finland than the other forest landscapes (Figure 7b).

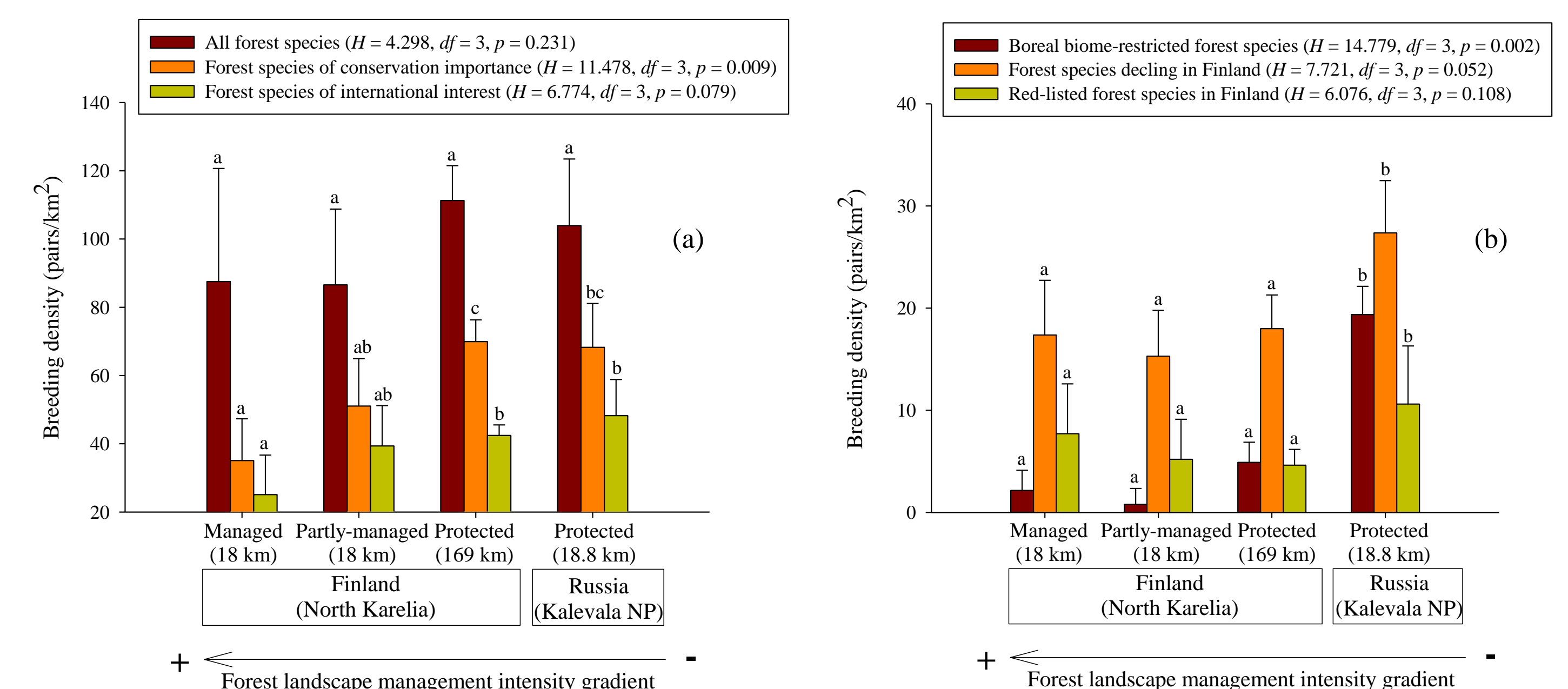


Figure 7 – Variation in the breeding density of forest birds along the studied gradient of landscape management intensity.

## 7. Conclusions

By including forest landscapes with contrasting management histories, from young managed to old-growth natural-like, the Green Belt of Fennoscandia allows the assessment of species and community responses to forest management.

Investigations on forest birds showed the negative impact of forest management intensity on species diversity, abundance and composition in parallel to dramatic changes in the forest structure.

Supporting the original prediction, the conservation value of the studied boreal forest landscapes for breeding birds diminished with an increase in management intensity (Figure 8).

This first transboundary assessment provides additional evidence for the significance of particularly large forest protection areas such as the Kalevala National Park to sustain boreal forest birds.

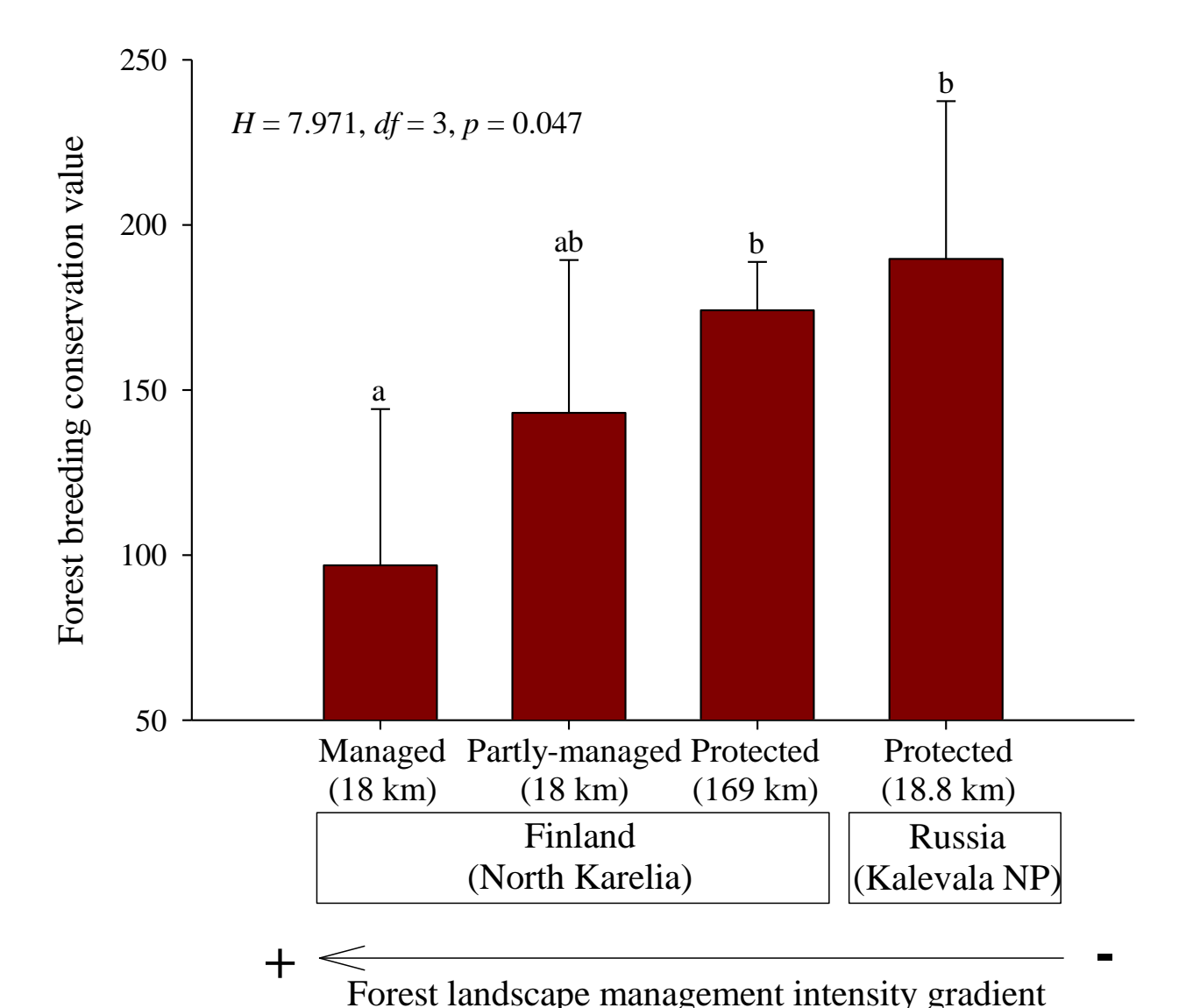


Figure 8 – Variation in forest breeding conservation value along the studied gradient of landscape management intensity.