

FINNISH PROTECTED AREA NETWORK IN A CHANGING CLIMATE

INTRODUCTION

Climate change impacts many aspects of nature challenging the ability of protected area (PA) network to preserve species populations, ecosystems and ecosystem services. These impacts may be aggravated by land use of intervening landscapes hindering species movements to new suitable areas. The Protected Area Network in a Changing Climate project (SUMI, 2017–2019) produces new knowledge for climate-wise conservation planning. Based on research in four work packages (WPs), the project provides a multi-faceted assessment of the Finnish PA network's functionality in the face of climate change.

WORK PACKAGE 1

VULNERABILITY OF SPECIES TO CLIMATE CHANGE

WP1 focuses on the impacts of climate change on species and aims at answering the following questions by producing novel empirical analyses and a comprehensive literature survey:

- Will climate change drive species (of conservation concern) out of PAs?
- Will species be able to colonize new areas?
- What characteristics make species particularly vulnerable to climate change?

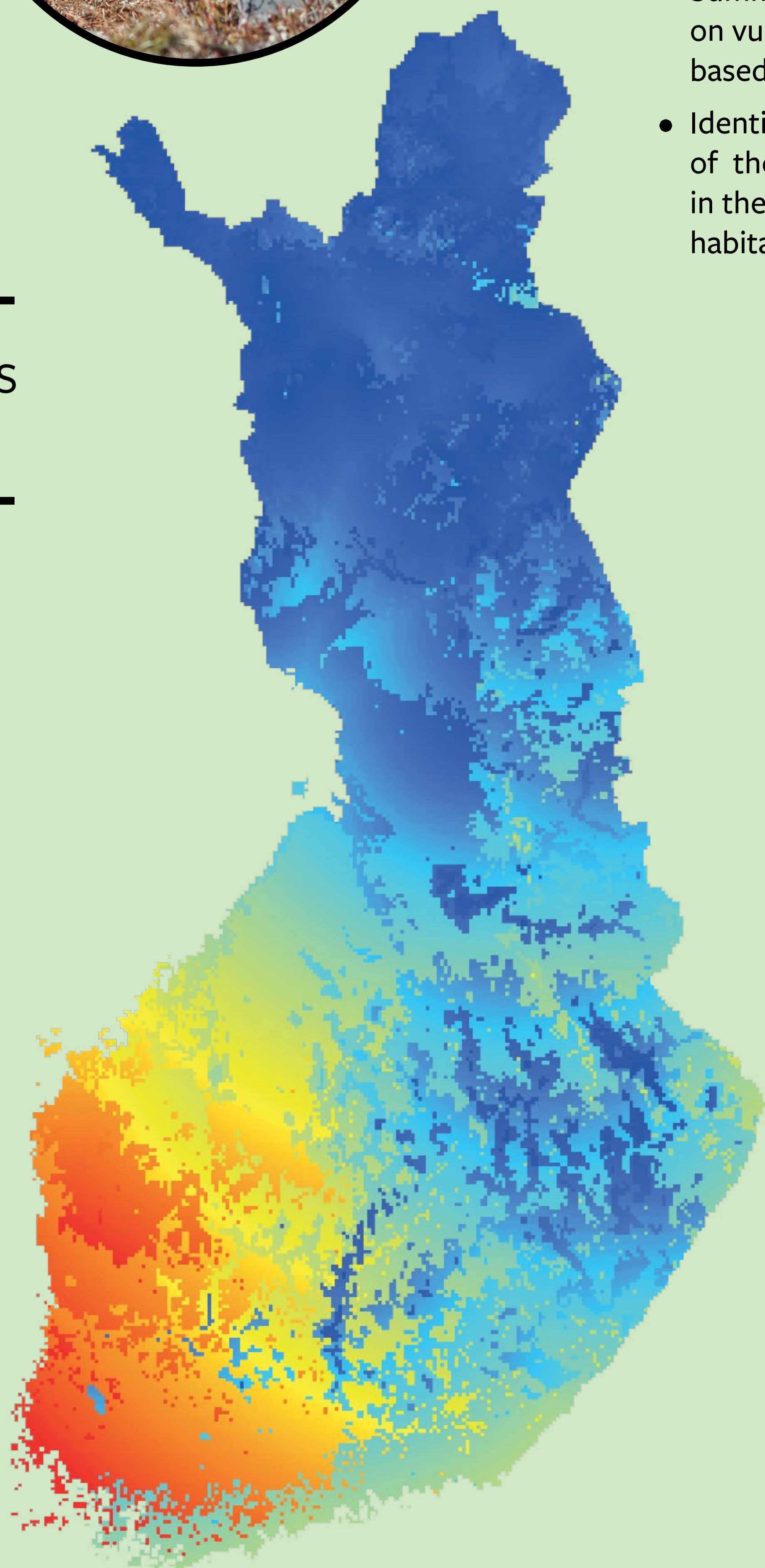
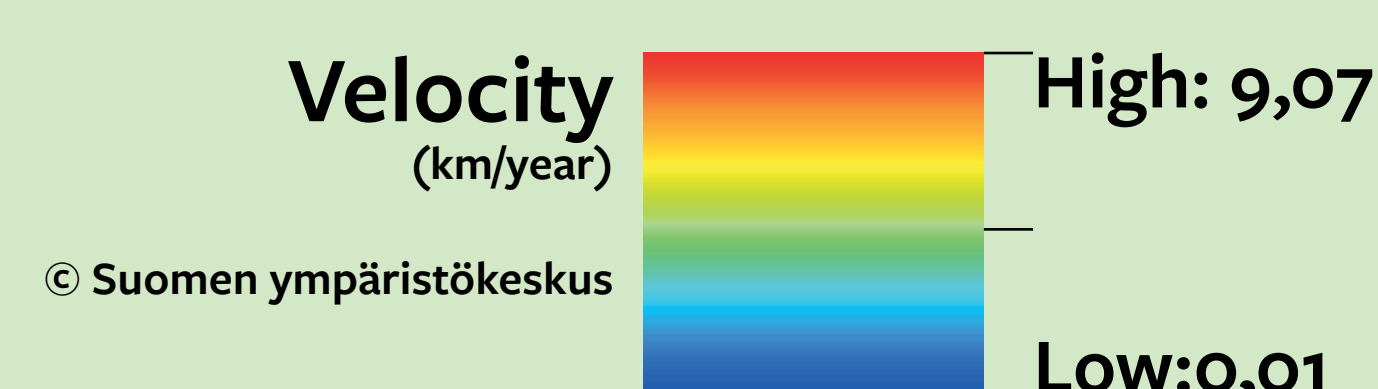
WORK PACKAGE 3

BIOGEOLOGICAL CHARACTERISTICS AND BUFFERING CAPACITY OF PAS

WP3 investigates the role of climatic and biogeophysical conditions of PAs, and the ecological quality of landscapes surrounding PAs by:

- Assessing the fine-resolution velocity of climate change across Finland and within individual PAs, following Carroll et al. (2015)
- Examining buffering capacity of topographic and climatic variability in PAs to support the persistence of species populations and communities
- Linking climate change –induced risks in PAs to harmful impacts of land use in their surroundings to discover risk hot-spots

The rate ('velocity') of climate change in mainland Finland, indicating how fast mean July temperature changes in different locations between observed (1981–2010) and projected (2040–2069; RCP 4.5) climates. Colors from blue to red indicate increasing velocity.



CONCLUSIONS

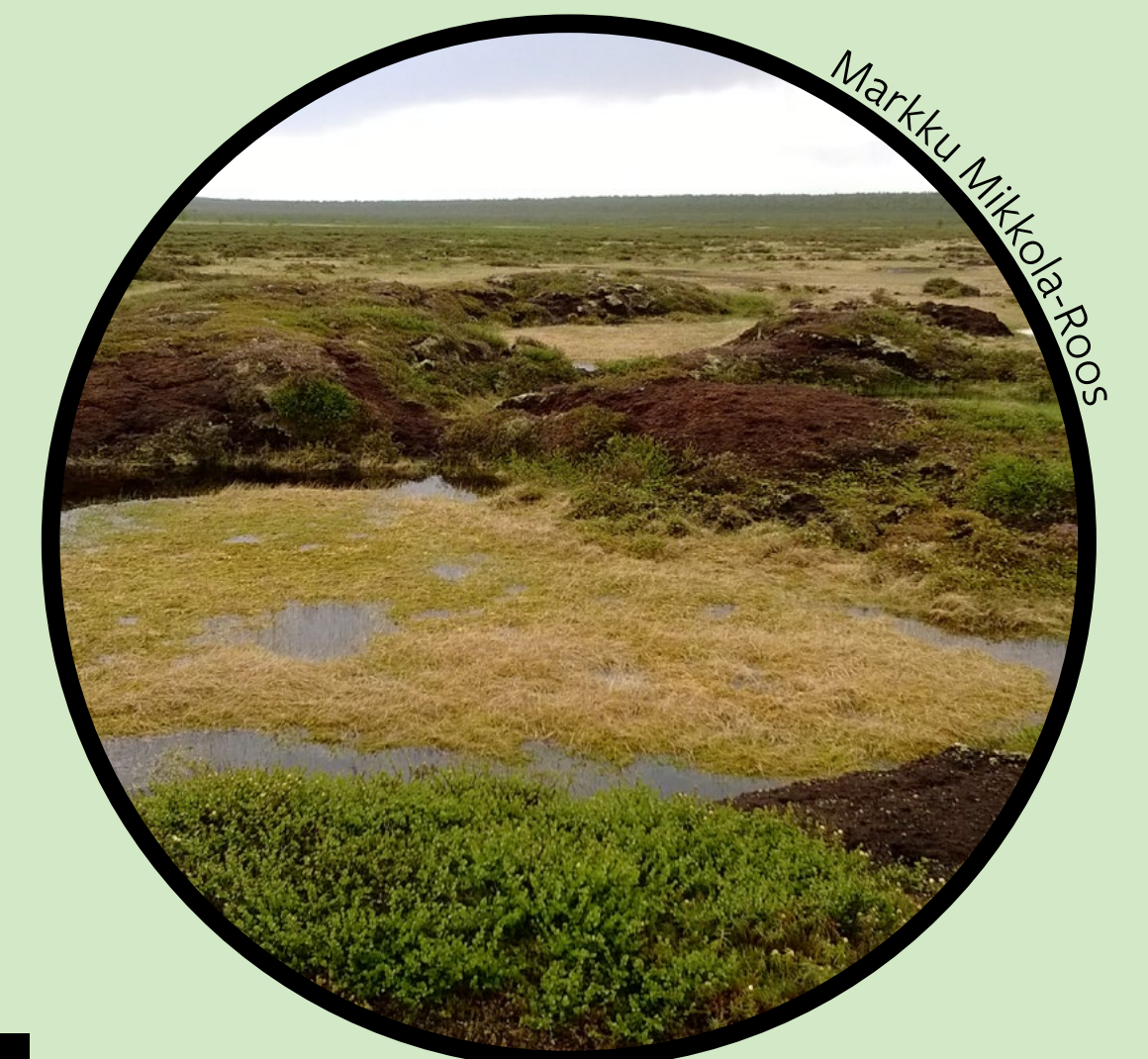
Velocity of climate change varies substantially both geographically and between climatic variables. According to all three future climate scenarios (RCP 2.6., RCP 4.5., RCP 8.5.), many habitats and species in Finland will be affected. First changes are already emerging; for example, the mean weighted density of the Finnish bird species shifted 28.5 km (1.8 km/year) northwards in the PA network between 1981–1999 and 2000–2017. Alarmingly, at the same time the total bird population density declined by 10% in the PAs (Virkkala et al. 2018). Our results call for urgent attention to more comprehensive climate-wise conservation planning, including restoration actions within PAs and adjusting land uses in their surroundings to better support species movements.

WORK PACKAGE 2

VULNERABILITY OF ECOSYSTEMS TO CLIMATE CHANGE

WP2 assesses the vulnerability of ecosystems to climate change and consequent implications for conservation by:

- Summarizing the state of knowledge on vulnerability drivers for ecosystems based on a literature review
- Identifying and analyzing the status of the most vulnerable ecosystems in the PA network, with a focus on habitats in the EU Habitats Directive



WORK PACKAGE 4

CARBON SEQUESTRATION AND STORAGE IN PAS

Following Akujärvi et al. (2016), WP4 investigates the role of PAs in carbon sequestration and storage, both in the aboveground biomass and underground soil. WP4 aims to:

- Produce spatially-detailed estimates of carbon budgets in forests on mineral soils, based on forest site type and main tree species
- Link carbon data with biodiversity metrics to discover 'win-win' PAs which harbor both biodiversity values and important ecosystem services for climate change mitigation and adaptation



References

Akujärvi, A., Liski, J. & Lehtonen, A. 2016. Ecosystem services of boreal forests – Carbon budget mapping at high resolution. *Journal of Environmental Management* 181:498–514. doi:10.1016/j.jenvman.2016.06.066

Carroll, C., J. J. Lawler, D. R. Roberts, and A. Hamann. 2015. Biotic and Climatic Velocity Identify Contrasting Areas of Vulnerability to Climate Change. *Plos One* 10:e0140486.

Virkkala, R., Rajasärkkä, A., Heikkinen, R.K., Kuusela, S., Leikola, N. & Pöyry, J. 2018. Birds in boreal protected areas shift northwards in the warming climate but show different rates of population decline. Submitted manuscript.