

Effects of post-Soviet land-use change on large mammals' habitat in European Russia

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Background

Land use impacts on wildlife

- Large mammals often conflict with people and land use (e.g., livestock and cropping)
- Large mammals are also particularly sensitive to land-use change, because they require large and well-connected habitats

Post-Soviet land-use change

- Breakdown of the Soviet Union in 1991 triggered widespread land-use change
- 40% of 1988's agricultural land abandoned
- Abandoned fields reverted into grasslands and early successional forests
- Distinct temporal pattern of forest disturbance

Russian protected areas

- 103 strictly protected scientific state nature reserves (zapovedniks)

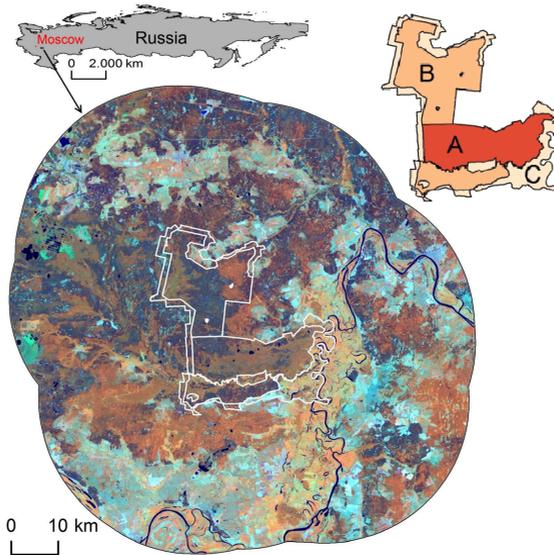


Fig. 1: Study area with Oksky State Nature Reserve (A = core zone, B = transition zones, and C = buffer zone) and its 30-km surroundings (Landsat TM in 453 false colors, 31st May 2007) in Russia

Biodiversity data

- Data from long-term biodiversity monitoring, annually published in the Chronicles of Nature (Летописи природы)
- Winter track counts (WTC, Зимние маршрутные учёты) provide species' occurrence data

Our objectives were

- 1) to explore the habitat selection of wild boar (*Sus scrofa*), moose (*Alces alces*), and wolf (*Canis lupus*)
- 2) to assess changes in habitat availability of these species within Oksky State Nature Reserve (OSNR) and its immediate surroundings from 1987 to 2007, and
- 3) to test the use of prey habitat for analyzing predator habitats

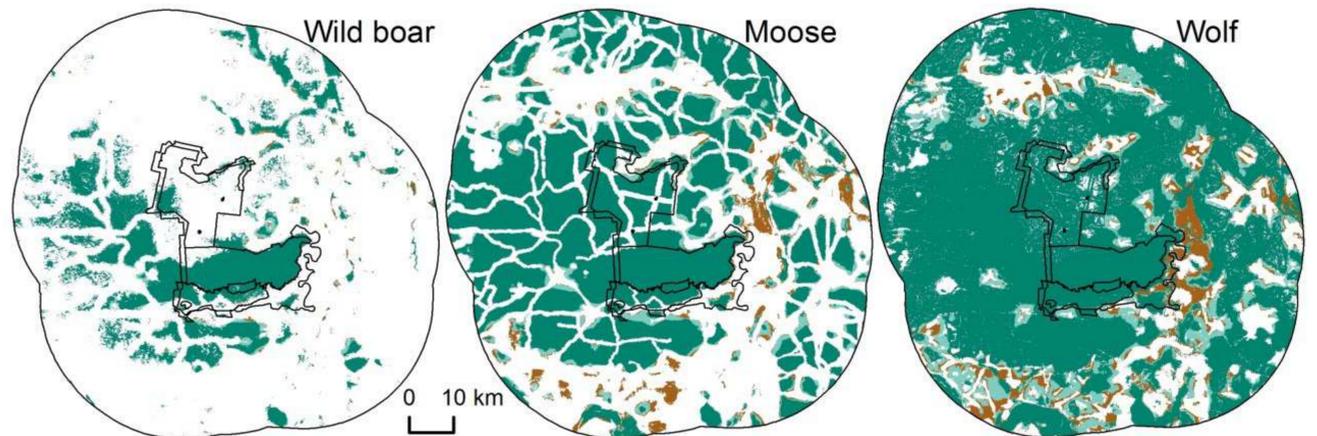
Predicting large mammals' habitat

Data

- WTC from core zone of OSNR (Fig. 1) for wild boar (1978-2007), moose (1992-2008), and wolf (1994-2008)
- Environmental (e.g., land cover, distance to edge and core forest, elevation, and prey habitat) and human-impact data (distance to roads)

Time-calibrated habitat modeling

- Long-term habitat modeling with a single model for the entire time period (1994, 1997, 2002, and 2007)
- Applying maximum entropy modeling (Maxent; Phillips et al. 2006)
- Input: 80-200 species' occurrence points, and 5,000 random background points (core zone)
- Predicting to years of model calibration and 1987, and to the larger landscape



Best-performing models

- Area under the curve (AUC) values based on 10-fold cross-validation: 0.77 wild boar, 0.73 moose, and 0.68 wolf

Legend for Fig. 2:
 ■ Suitable habitat since 1987
 ■ Suitable habitat since 1997
 ■ Suitable habitat since 2007
 □ Study area
 □ Unpredicted habitat

Fig. 2: Maps of changes in predicted suitable habitat maps for wild boar, moose, and wolf in the study area from 1987 to 2007

Changes in large mammals' habitat

Habitat selection

- Predicted habitat characteristics for all three species were well in line with other studies:
- Wild boar: forest cover and low distance to forest edge important (shelter, forage)
- Moose: forest cover important (shelter, forage), areas away from roads preferred
- Wolf: habitat determined by those of ungulates

Changes in habitat availability 1987-2007

- Within study area: wild boar +12% suitable habitat, moose +23%, and wolf +20% (Fig. 3)
- Substantial gain inside and outside of Oksky State Nature Reserve (Fig. 2 & 3)
- Core zone with highest share of suitable habitat and buffer zone with largest increase across time

Prey habitat as predictor for predator habitat

- Prey habitat variables were important for wolf model and resulted in:
 - Less unpredicted habitat area, and
 - A larger share of suitable wolf habitat in all zones of interest

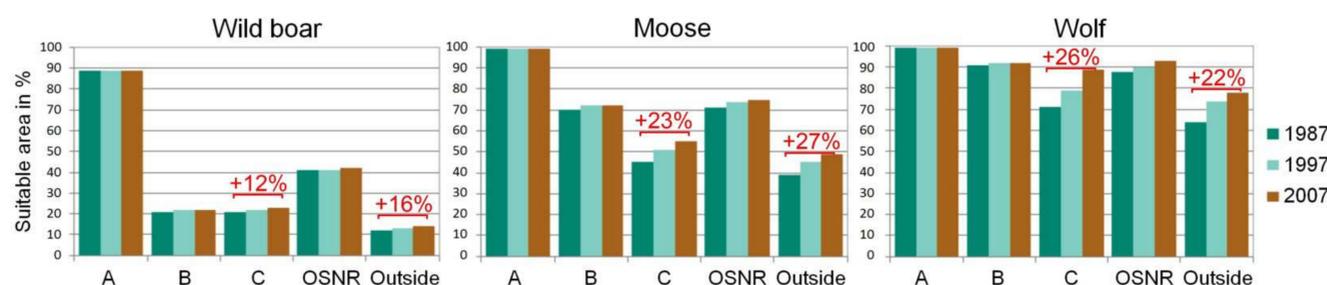


Fig. 3: Share of predicted suitable habitat within Oksky State Nature Reserve (OSNR), its protection zones (A = core zone, B = transition zones, and C = buffer zone), and 30-km surroundings (outside), and highlighted (in Red) percentages of relative area changes 1987-2007

Summary

- Long-term data on large mammals allow to assess the effects of land-use change on wildlife habitat
- Substantial habitat expansion due to post-Soviet rewilding trend in European Russia
- The surroundings of protected areas are very important for large mammals

Reference: Phillips et al. 2006. Maximum entropy modeling of species geographic distributions. *Ecological Modelling* 190, 231-259.
 Citation: Sieber, A., et al. in preparation. Post-Soviet land-use change effects on large mammals' habitat in European Russia.

Acknowledgements

We gratefully acknowledge funding by:



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