

Mapping reindeer calving grounds across the Russian Arctic

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Background

Aims

- Drivers of local and global biodiversity loss are increasingly broad in scale and conservation planning therefore needs to move towards range-wide assessments
- This can be challenging for migratory species, which are wide-ranging, yet use only a small portion of their range at a given point in time
- Identifying and protecting those parts of the range of these species that are most critical for their survival is important
- Our aims were to
 - map potential calving ground habitat of wild tundra reindeer (*Rangifer tarandus*) populations throughout Russia, and
 - assess possible threats to calving grounds from oil and gas development and climate change



Reindeer in Russia

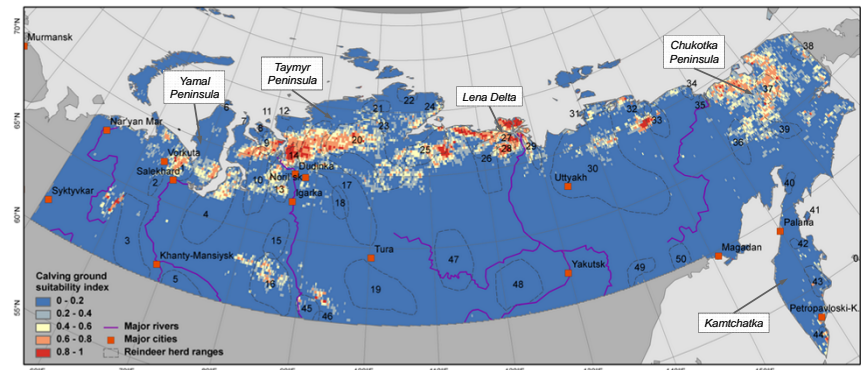
- Russia contains the majority of the global reindeer range, yet information on Russian reindeer populations is scarce, especially regarding seasonal habitat use
- Most reindeer populations have been declining recently due to overhunting as well as habitat destruction and habitat fragmentation

Approach

- We used occurrence data (range maps) from all known reindeer calving grounds
- We include some semi-domestic herds where wild reindeer populations were extirpated historically (e.g., Western Siberia, Chukotka)
- Our predictor variables were related to resource availability in spring, resource availability in summer, predator avoidance, anthropogenic disturbance (e.g., road density), and landscape composition
- We made full use of MODIS Aqua and Terra time series (2001 – 2008) to quantify snow cover dynamics and vegetation productivity
- To assess calving grounds characteristics and to predict their distribution across the entire Russian Arctic, we used ensemble of species distribution models (Maxent + BRTs)

Mapping reindeer calving grounds

- The availability and quality of calving grounds are critical for recruitment and calf survival, and thus for reindeer population persistence
- We find widespread suitable calving habitat throughout the Russian Arctic, with distinct clusters on Yamal, Taymyr, the Lena Delta, in Chukotka and in Kamchatka
- Predictors based on MODIS time series show that Reindeer track the 'green wave' of vegetation green-up and snow melt
- We detect potential calving grounds for wild reindeer populations where calving grounds were not known
- Our models fail to identify calving habitat of the smaller, non-tundra reindeer populations
- Variables describing resource availability in spring and predator avoidance were most important in our models

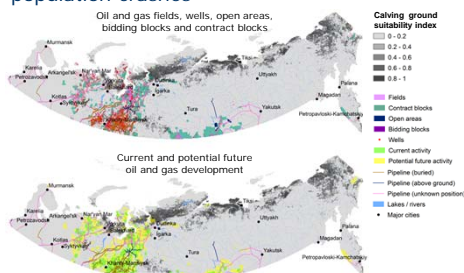


Reindeer calving ground suitability across the Russian Arctic (1 = high) and ranges of known reindeer populations.

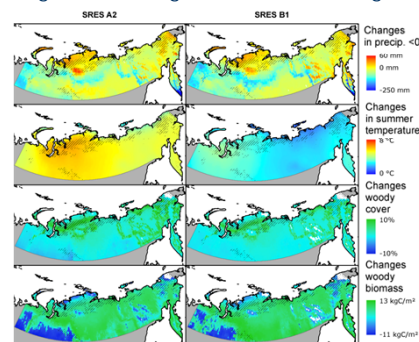
Wild reindeer population ranges are: 1. Shchuchya River, 2. Shuryshkarsky Lake, 3. Konda and Sosva Rivers, 4. Nadym - Pur Rivers, 5. Yuga River, 6. Belyi Island, 7. Yavay Peninsula, 8. Mamontova Peninsula, 9. Gydan Peninsula, 10. Pur - Tar Rivers, 11. Sibirykova Island, 12. Chizhagyn Shore, 13. Western Taymyr, 14. Agapa River, 15. Turukhan River, 16. Tar River headwaters, 17. Pura River, 18. Putorany Mountains, 19. Middle Siberian, 20. Dadypka River, 21. Nizhnyaya Taymyra River, 22. Faddey River, 23. Taymyr Lake, 24. Mariya Pronchishcheva Bog, 25. Popigay River, 26. Lena and Olenek Rivers, 27. Bulun River, 28. Kystyk Uplands, 29. Lena River Delta, 30. Yana and Indigirka Rivers, 31. Novosibirskiy River, 32. Indigirka River, 33. Sudrinskaya, 34. Galgavam River, 35. Kolyma River, 36. Omolon River, 37. Eigytygyn Lake, 38. Amguema River, 39. Mine River, 40. Parapotsky Lowlands, 41. Karaginsky Island, 42. Clovka-Uka River, 43. Kronotsko-Zhupanovskaya, 44. Southern Kamchatka, 45. Entsey River, 46. Angara River, 47. Western Yakutian, 48. Lena and Viluy River, 49. Yudoma River, 50. Kava River

Potential threats to calving grounds

- **Oil and gas development** affects calving grounds already heavily in the Barents Sea region and in southwestern Siberia
- Pressure from fossil fuel extraction will likely increase further in the future
- Pipelines are a main factor fragmenting reindeers' ranges and may explain past population crashes



- **Potential climate change impact** was assessed using averaged outputs from three climate models (ECHAM5, HadCM3 and NCAR-CCSM3) for two scenarios (SRES A2 and B1)
- Vegetation change was modeled using LPJmL



- We find potentially strong climate change impacts, including shrub encroachment (e.g., higher predation), warming (e.g., more insect harassment), and higher risk of freeze-over rains (e.g., can lead to population collapse)
- Climate change will affect calving grounds most strongly on the Taymyr, Chukotka, and Kamchatka peninsulas

Summary

- This first assessment of calving grounds of Russia's wild reindeer populations highlights the spatial heterogeneity and considerable impact of current and potential threats
- Conservation planning should aim to design conservation networks that would allow reindeer to freely move in time and space

Reference: Kuemmerle, T., Baskin, L.M., Leitao, P., Prishchepov, A.V., Thonicke, K., and Radeloff, V.C. (2014): Distribution of reindeer calving grounds in Russia and potential threats from oil and gas development and climate change. *Diversity and Distributions*, 20, 416-429.

Acknowledgements

We gratefully acknowledge funding by:



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