Movement, Migration and Ecological Plasticity in Deer Species: facts and Consequences in a Changing European Landscape

Francesca CAGNACCI[1], Wibke PETERS[2], Mark HEBBLEWHITE[3]

[1]Department of Biodiversity and Molecular Ecology – Research and Innovation Centre, Fondazione Edmund Mach, San Michele all' Adige, TN 38010, Italy
[2] Abteilung Biodiversität, Naturschutz, Jagd, Bayerische Landesanstalt für Wald und Forstwirtschaft (LWF), Germany
[3]Wildlife Biology Program, Department of Ecosystem and Conservation Sciences, University of Montana, USA
& the EURODEER consortium: euroungulates.org

[*]Corresponding author: francesca.cagnacci@fmach.it

Migration is an important component of ungulate behavioural tactics that is tightly linked both to population distribution and to the function ungulates exert in ecosystems. The migration rate of several species has been observed to decrease, and climate change and anthropic pressure have been indicated as potential driving causes [1].
The loss of migratory behaviour in ungulates could have paramount consequences on the ecosystems that encompass their seasonal ranges, on the one side, and affect population dynamics on the other. This talk has two main goals: first, to re-establish the link between deer migratory behaviour and emerging movement patterns, reviewing the contributions to the newly established 'migratoriness' concept [2,3,4]; then, to assess the determinants of migration by looking at multi-population movement datasets of deer species in temperate climates, specifically the European roe deer Capreolus capreolus [5] and red deer Cervus elaphus.
The analysis of movement trajectories of deer species through different methods allowed us to identify inconsistencies in the classification of migratory behaviour at individual level that we attributed to individual plasticity. We thus acknowledged the emergence of movement patterns other than residence and stereotyped migration through the concept of 'migratoriness', measured through several newly proposed metrics.
By analysing movement data from the Eurodeer consortium (individual trajectories of roe and red deer from more than 10 populations for this study), we assessed the effects of intrinsic factors (sex) and extrinsic conditions (e.g. topography, seasonality, canopy closure, plant productivity/NDVI, snow layer) on seasonal distribution of individuals and parameters describing migration plasticity. Although variation in plant phenology affected migration probability in both species, we found a stronger disconnect between plant productivity and migration for roe deer than for red deer, especially in spring. In a fine-scale analysis at the local scale, we also observed a strong relation between the snow layer (i.e., snow depth) and the winter distribution of roe deer, in presence of supplemental feeding. Our results suggest that climatic and landscape changes may affect future deer species migrations and seasonal distribution of populations.
We conclude with considerations on how these changes may feedback on deer habitat productivity, biodiversity, and ecosystem services, and if they should be considered as a form of reversible adaptive behavior.

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Figure 1. Distribution of roe and red deer populations available in the Eurodeer consortium on which this study is based upon.

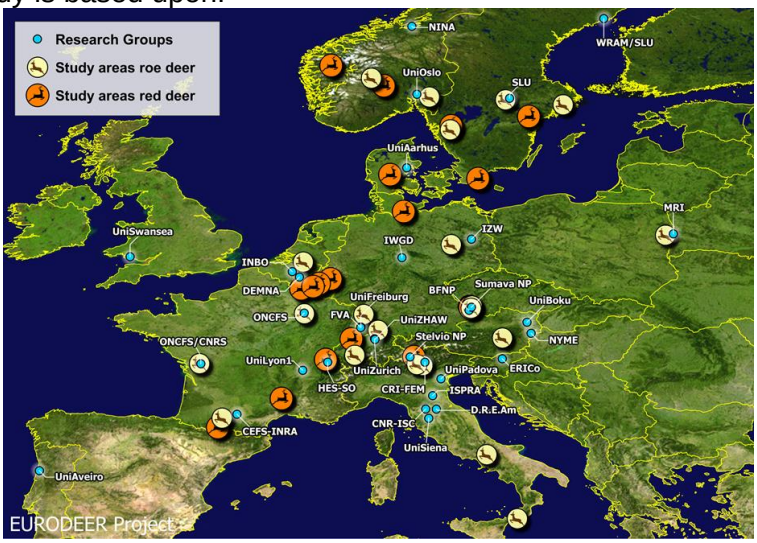

Figure 2. Daily probability of migration in different European ecotypes in roe deer (top panels) and red deer (bottom panels), for spring (left panels) and autumn (right panels) migration. The total migration probability across the population analyzed is also indicated.