ESA Living Planet Symposium 2019, 13.-17. May 2019, Milan, Italy
Session: EO for Terrestrial Biodiversity – Oral presentation

Multi-scale modeling of stopover selection and habitat use by migratory geese

Benjamin Leutner[1], Andrea Kölzsch[2], Martin Wegmann[3], Kamran Safi[2], Martin Wikelski[2], Stefan Dech[1]

[1]German Aerospace Center (DLR), German Remote Sensing Data Center (DFD), Oberpfaffenhofen, Germany
[2]Max Planck Institute for Ornithology, Radolfzell, Germany
[2]Department of Remote Sensing, University of Würzburg, Würzburg, Germany

Many migratory species are facing increasing environmental and anthropogenic pressures. Important migration pathways and resting sites are gradually lost due to habitat degradation and transformation leading to reduced survival and poor reproductive success. Observations of dramatic declines in population size across taxa in conjunction with the unique challenges faced by migratory species, such as non-stationary habitat requirements, have prompted the parties of the UN Convention on the Conservation of Migratory Species (CMS) to pledge to identify, monitor, restore and conserve habitats needed for successful migration. Remote sensing approaches are among the most promising tools to pursue such identification and monitoring of spatially and temporally dynamic habitats. Yet, matching the spatial and temporal scales of available remote sensing imagery and animal habitat use remains challenging.

We examined habitat use of one large avian herbivore: the greater white-fronted goose (Anser a. albifrons) which migrates annually from central Europe to its breeding grounds in the Russian arctic and back. During spring migration the animals need to maximize their energy uptake by carefully timing their migration with vegetation growth at suitable stopover foraging sites. In recent years notable changes in their migration routes and timing have been observed, the reasons for which remain unclear. We tracked well over 150 individuals by means of high-resolution GPS transmitters and accelerometers in order to identify suitable stopover sites and characterize their behavior and space-use within.

We aimed to address two main questions: a) Which landscape elements are important habitat factors inside the stopover sites (local scale)? and b) Can suitable stopover sites be predicted based on the knowledge acquired at the local scale (continental scale)?
Habitat factors were derived based on 20 m resolution optical (Sentinel 2 and Landsat 8) and SAR (Sentinel 1) time series. Annual summary statistics of Sentinel 1 time-series were used as proxy variables of land-use intensity and for gap-filling monthly composites of Sentinel 2 and Landsat 8. Vegetation indices from the optical time-series were used as proxies for the biophysical habitat state during the time of stopover visits.

Habitat preferences and resource use of the geese was modeled by means of behaviorally informed step selection functions both on the local scale (a) and on the larger continental scale (b). Results indicate that white-fronted geese generally select for young vegetation on intensively managed agricultural fields, but there are large differences between stopovers and individuals. Building on these results, we identified the composition of habitat factors in typical stopover sites which served as the basis for continental scale modeling of stopover site selection. Further, we aim to reveal how the birds select for suitable stopover sites in relation to available alternatives. Building on these results, spatially and temporally targeted conservation schemes come into reach through the combination of remote sensing based mapping of temporal trajectories of habitat change with the now available models on stopover site selection.