

## **V - Human infrastructure can alter the ecosystem services provided by a migratory ungulate**

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Wild ungulates, through their movement over the landscape, provide key ecosystem functions.

Environmental processes such as soil productivity, seed dispersal and carbon sequestration are significantly affected by the presence of large herbivores. However, with the loss of migratory routes due to expanding human infrastructure networks and climate change, landscapes that depend on the movement of these species may experience changes in ecosystem functionality. Nutrient translocation and deposition, which is an important service provided by large herbivores, is of particular interest in alpine agricultural landscapes.

Human activities generally have a negative impact on the quality, quantity, and dynamics of soil nutrient in the landscape, particularly nitrogen. Wild ungulates, with their movement and space use, can offset some of these human impacts by restoring concentrations over the landscape. In this project, we aim to map the nitrogen (N) flow derived by large migrating ungulates in a fragmented Alpine ecosystem. To this end, we developed an Agent-Based Model to quantify animal-vector subsidies balance, based on observed movement of 15 GPS-tracked red deer over two years, and parameterized with population parameters from local monitoring, and species-specific information from literature. Preliminary stoichiometric nutrient budget maps indicate that human infrastructure networks and land use are shaping the movement of red deer, resulting in hotspots of nitrogen intake and uptake. Barrier to movements, caused by anthropogenic land use, has the potential to alter ecosystem services provided by free-ranging animals, particularly important in an ever-changing Alpine environment.