Modeling bird migration in relation to atmospheric dynamics

supervisors: Judy Shamoun-Baranes and Willem Bouten

CGE has considerable expertise in modelling different aspects of bird movements. Meteorological conditions have a very strong influence on the temporal and spatial distribution of birds and this interaction is strongly emphasised in our research. Nevertheless, many questions, both biological and technical in nature remain to be answered. For students interested in the relationship between bird behaviour and weather there are many research possibilities. For example, the lesser spotted eagle (*Aquila pomarina*) is a bird of prey that migrates great distances utilizing thermal convection and soaring flight. Annual visual surveys in Israel and Georgia have shown that the migratory season of this species is very condensed, with in some years, very strong fluctuations in daily concentrations of migrants. Case studies have suggested that the weather in important geographic funnels, may strongly influence migration intensity. Although many factors may influence thermal convection, perhaps cloud cover may be used as a proxy for flight conditions. The aim of this study is to test if cloud cover classified from satellite images can be used as a meteorological proxy to explain migration intensity.
The avian data that may be available for different research projects includes radar observations, visual observations and GPS tags (see UvA-BiTS). Sources for meteorological data may include remote sensing or mesoscale forecast models depending on the study. Different aspects of migration meteorology may be studied such as the relationship between weather at a point of takeoff and migration intensity at a distant site. Conceptual models of migration incorporating the influence of weather are also strongly suggested.

*Technical skills/methods***:** literature research, statistics, database querying, programming in Matlab or R, introduction to meteorology. For some projects: image analysis, GIS, remote sensing classification techniques.

Modeling spatial distribution, populatoin trends, habitat quality or biodiversity on the basis of the National Database Flora and Fauna

supervisors: Emiel van Loon and Willem Bouten

The Netherlands has a dense observation network for flora and fauna, which is disclosed by the National authority concerning nature via the National Database Flora and Fauna (NDFF). We use data from the NDFF to investigate various aspects of organismal distributions in the Netherlands. There are many research possibilities for students interested in analyzing and/or modelling the spatio-temporal distribution of these data. Following are two examples:

1. Currently the spatio-temproal distribution of a broad range of vascular plants in the Netherlands (period 1990 – 2010) is being modeled. The aim is to evaluate whether mechanisms leading to range contraction or expansion relate to certain plant traits. The models use environmental variables like soil type, water table depth, elevation, nearby land use, distance to sea.
2. The presence, abundance and distribution of an "indicator species" over time can be used to monitor habitat quality. Generally, indicator species are chosen within one taxonomic group. However, through the NDFF, it will be possible to simultaneously study species from a wide taxonomic range. The aim of the study is to identify trends in habitat quality using "indicator species" from different taxonomic groups.

A student may focus on methodological issues (comparing existing methodologies or develop new techniques), evaluate the predictive performance of existing models, or relate model output to conservation efforts in the Netherlands. Different analytical approaches may be chosen, such as dynamic

or static, spatially explitit or lumped, Bayesian or non-Bayesian analyses, involving a dynamic population model or not.

Technical skills/methods: literature research, general and spatial statistics, GIS, programming in R.

Using LiDAR DEMs and DGPS data for analyzing temporal landslide change

supervisors: Harry Seijmonsbergen and Willem Bouten

Landslides are the result of gravity driven processes generally resulting in irregular topography. Digital Elevation Models can be generated by using DGPS stations at fine cell sizes. Such fine resolution DEMs allow comparison to existing height data and may inform about potential landslide change and thus to vulnerability of landscape for slope instability. In western Austria DEMs of various cell sizes are available in instable regions, including multi-temporal Laser Altmetry (LiDAR) data at 1m resolution. Additional information is available from multi-temporal air-photos covering 50 years. This research exists of a) field measurement of a selected landslide area using DGPS equipment, b) preparing a digital terrain model which will be linked to existing 1m resolution LiDAR DEMs and c) analysis of landslide change by using modeling techniques in Matlab and/or GIS software for evaluating the potential use of DGPS for temporal landslide change.

Developing digital geomorphological mapping methods

supervisors: Harry Seijmonsbergen and Willem Bouten

Various classic systems for geomorphological mapping exist. Modern geomorphological mapping combines traditional mapping systems with GIS-based techniques and stores, analyses and presents geomorphological information digitally in geodatabases. Parts of a geomorphological database nowadays are Digital Elevation Models, maps showing land surface parameters and other thematic information. For ArcGIS, such a system is in development for alpine regions. In mid latitude west-European landscapes different landforms and processes occur, which require alternative approaches in digital mapping. In this research a) a digital library of combined symbols and polygons will be developed for digital mapping and implemented in ArcGIS and b) a geodatabase is designed which will be suitable for web-based services using ArcIMS technology. As an alternative, two existing classic systems which are in development for digital mapping – the Swedish and the (Dutch) Austrian legend can be tested and compared in an area such as Luxembourg. It is foreseen to publish the results in the "Journal of Maps" as layered .pdf maps.

Object-based analysis of cirques from LiDAR DEMs for ELA-reconstruction

supervisors: Harry Seijmonsbergen and Niels Anders

Cirques are distinct glacial landforms that occur in alpine regions. Cirques may contain depositional landforms such as morainic ridges, rock glaciers and Protalus Ramparts. These are indicators for the Late Glacial disintegration of larger glacier networks and for Equilibrium Line Altitudes (ELAs) that mark local (de)glaciation stages. Mapping of cirques by using object-based rules for the extraction of glacial landforms will provide tools to objectively classify local deglaciation stages in the Eastern Alps. Collection of data and validation of results will be based on existing detailed geomorphological maps, orthophoto-interpretation in combination with Light Detecting and Ranging (LiDAR) data and optional

fieldwork information. The analysis may cover: a) development of rule sets using eCognition for the delineation and classification of cirques from DEMs by using Land Surface Parameters (LSPs) such as height, insolation, slope angle and aspect b) reconstruction of ELAs and c) presentation of Late-Glacial deglaciation maps showing local stadia. In this project, eCognition software is used to develop the rule sets for recognition and analysis of cirques. The ELAs are reconstructed with the aid of literature techniques such as Balance Ratio (BR), Accumulation Area Ratio (AAR) and/or Maximum Elevation of Lateral Moraines (MELM). The results are stored and visualized in an ArcGIS geodatabase.