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Modelling of Habitat Preferences of water pipits (*Anthus spinoletta spinoletta*) in "Nationalpark Gesäuse" using Remote Sensing and GIS

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Keywords

Modelling of Habitats, Water Pipit (*Anthus spinoletta spinoletta*), Remote Sensing, GIS, Logistic Regression, Landsat 5, NDVI, Nationalpark Gesäuse

Abstract

In spring 2009 a survey was done on a grid patterned cell basis (100x100m), and data on absence and presence of water pipits (*Anthus spinoletta spinoletta*) in “Nationalpark Gesäuse” were collected.

From this data we performed a habitat preference model, using logistic regression in a stepwise forward procedure. 64 habitat variables were calculated mainly using biotop data from Nationalpark Gesäuse, a digital elevetion model (resolution 25X25m), Landsat 5 TM satellite data and data from our bird-survey. We used the satellite data to calculate an index for biomass, the NDVI (Normaliced Differential Vegetation Index).

The Nationalpark Gesäuse was choosen as investigation area because of the presence of very good digital data sources that make it ideal to do such surveys, furthermore the scientific team from Nationalpark Gesäuse provided great help during preparation and performing the studies as well as organising facilities and contacts.

We started the modellbuilding process by calculating univariat models using Nagelkerke R^2 and choosing the most powerful variables to reduce the number of variables. To avoid multicolliniarity, bivariat spearman rang correllations (Rs) were calculated and if Rs was >0,5 only the variable with the more powerful Nagelkerke R^2 was chosen for further calculations.

To avoid spatial autocorrelation, absence-gridcells were only taken for further calculations if they showed a minimum distance of 500 meters to the next precence dataset.

Principal component analysis showed the necessity to calculate two separated models for alpine pasture and alpine meadow, because there are differences in habitat preferences of water pipits breeding in primary habitats to those breeding in secondary, manmade habitats.

A total of 235 out of 804 examined grids showed presence of water pipits. The level of occupancy on the alpine pasture areas reached 16% compared to alpine meadows, where about half of the grids were populated.

In both habitats, snowfields proved to be very important prerequisites of a potential habitat. While on alpine pastures great distances to the next snowfield had a negative effect, on alpine meadows the length of the boundaries of snowfieds where most important and showed a positiv effect. Snowfields and their boundaries showed to be the most importand foraging grounds for water pipits during the time of reproduction.

Different structures of wood and high average levels of the normalized differential vegetation index (average biomass) showed positive influence on habitat suitability, while large rocky areas of the alpine meadows were avoided.

Alpine pastures are more attractive if they show characters of open land with great distance to the next forested habitats.

Furthermore influence of minimal biomass was proven and we could conclude that the water pipit needs areas with sparse vegetation.

LANDSAT 5 TM satellite data was very helpful to characterise the habitat preferences of water pipits by calculating the NDVI, one of the variables that came out very powerfull during the modelling prozess. Those data are easy to get, they are cheap and available all over the world, for different timepoints over several years. There are great options for ecological surveys using GIS and Remote Sensing Data, since there are sensors existing with better resolution than the Landsat 5 TM.

The water pipit can be seen as an umbrella species for alpine open, but vegetated land. There are several species that benefit from habitat management done for waterpipits. Those management tasks could be taking care of alpine pastures, to keep them open and prevent them from growing with woods. Intensive agriculture or grazing should be avoided and some structures like rock or small shrubs should be left or planted. The water pipit is also

an interesting indicator species for climate change effects. It is one of the species that will loose potential habitat if the woods will grow up in higher altitudes. It is therefore easy to measure those effects by monitoring water pipits.

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