eHabitat – A web service for habitat similarity modeling with uncertainty propagation

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We are developing eHabitat, a Web Processing Service (WPS) that can model current and future habitat similarity for point observations, polygons defining an existing or hypothetical protected area, or sets of polygons defining the estimated ranges for one or more species. A range of Web Clients makes it easy to use the WPS with predefined data for predictions of the current or future climatic niche. The WPS is also able to document propagating uncertainties of the input data to the estimated similarity maps, if such information is available. The presentation will focus on the architecture of the service and the clients, on how uncertainties are handled by the model and on the presentation of uncertain results.

The idea behind eHabitat is that one can classify the similarity between a reference geometry (point locations or polygons) and the surroundings based on one or more species distribution models (SDMs) and a set of ecological indicators. The ecological indicators are typically raster bioclimatic data (DEMs, climate data, vegetation maps ...) describing important features for the species or habitats of interest. All these data sets have uncertainties, which can usually be described by treating the value of each pixel as a mean with a standard deviation. As the standard deviation will also be pixel based, it can be given as rasters. If standard deviations of the rasters are not available in the input data, this can also be guesstimated by the service to allow end-users to generate uncertainty scenarios.

Rasters of standard deviations are used for simulating a set of spatially correlated maps of the input data, which are then used in the SDM. Additionally, the service can do bootstrapping samples from the input data, which is one of the classic methods for assessing uncertainty of SDMs. The two methods can also be combined, a convenient solution considering that simulation is a computationally much slower process than bootstrapping.

Uncertainties in the results produced by eHabitat can be visualized in different ways, as maps, as difference maps in the case of different SDMs, or as the uncertainty of summary statistics such as the habitat replaceability index (HRI) defined as the relative size of the area with a similarity to the training data above a certain threshold.