Modelling invasive alien species distributions: The need for high-resolution climate information

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A Belgian research project, called 'TrIAS' (Tracking Invasive Alien Species), aims to identify emerging Invasive Alien Species (IAS) over Europe and Belgium and to inform policy makers using a data-driven workflow, enabled by tracking the progression of IAS.

To estimate the future probability of establishment of specific plant or animal IAS throughout Europe, high-resolution climate data for present and future climate conditions for Europe are needed as input for climate-driven species distribution models. However, two important issues must be resolved to obtain such a product. More specifically, the available climate data features (i) a rather coarse resolution and (ii) substantial systematic errors.

Therefore a three-step statistical downscaling approach has been developed in order to provide minimally-biased, high-resolution (1 km) risk maps of IAS for Europe and Belgium. In the first step, the ERA-Interim-driven EURO-CORDEX Regional Climate Model (RCM) ensemble at a spatial resolution of 12.5 km (Kotlarski et al., 2014) is re-gridded to the 1-km CHELSA reference grid (Karger et al., 2017). Secondly, the differences or systematic biases between the RCMs and the CHELSA data are calculated. Finally, a bias correction is applied on the 1-km-interpolated EURO-CORDEX RCM ensemble that follow the current and future climate conditions (so-called historical and RCP experiments), in order to account for the possible biases present in the climate models. This statistical downscaling approach is applied on a set of climatological variables relevant for species distribution modelling.

We present the workflow of the statistical downscaling approach, the resulting 1-km climate products based on the EURO-CORDEX ensemble and examples of high-resolution risk maps of IAS under current and future climate scenarios. The resulting maps will be used for expert risk assessment in Belgium and Europe, using a standardized assessment protocol to assess the risks of IAS to biodiversity, human, plant, and animal health.