Impact of biased sampling effort and spatial uncertainty of locations on models of plant invasion patterns in Croatia

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Introduction

Biological databases are often used in analysing distribution of different taxa but are usually characterised by variable sampling effort and spatial uncertainty of locations. We tested the influence of geographically biased sampling effort and spatial uncertainty of locations, on models of species richness. For this purpose we assessed the pattern of invasive plants in Croatia using Flora Croatica Database. Procedure of testing sensitivity of models consist of tessellating the area into coherent ecological classes (hereinafter Gower classes); ranking quadrants according to sampling effort per class; creating models using varying numbers of quadrants and testing their performances with independent validation points; determining a best fitting model and a threshold of sampling effort, below which data are too unreliable for modelling; simulating spatial uncertainty by adding an adequate random term to each location; and re-running the models by using the simulated locations.

Results

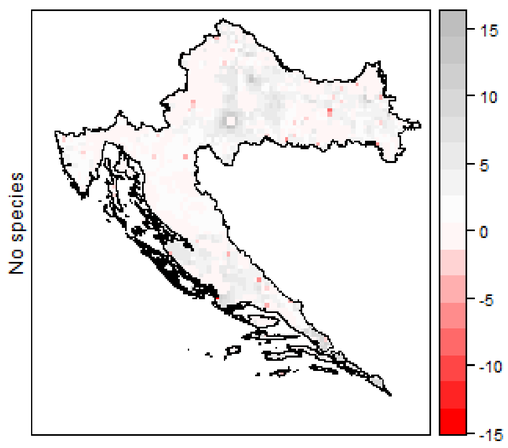

Figure 2. Differences in predictions between final model (D65 plus validation points) and full model D0.

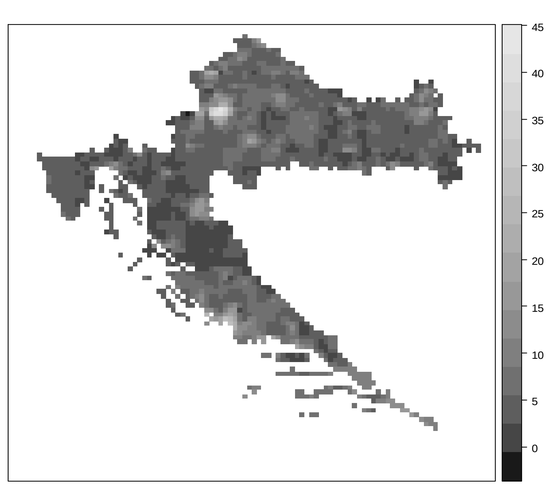

Figure 3. Invasive plant species predictions using model Final model plus precision uncertainty obtained controlling both, geographically biased sampling bias and spatial uncertainty source of error.

Materials and Methods

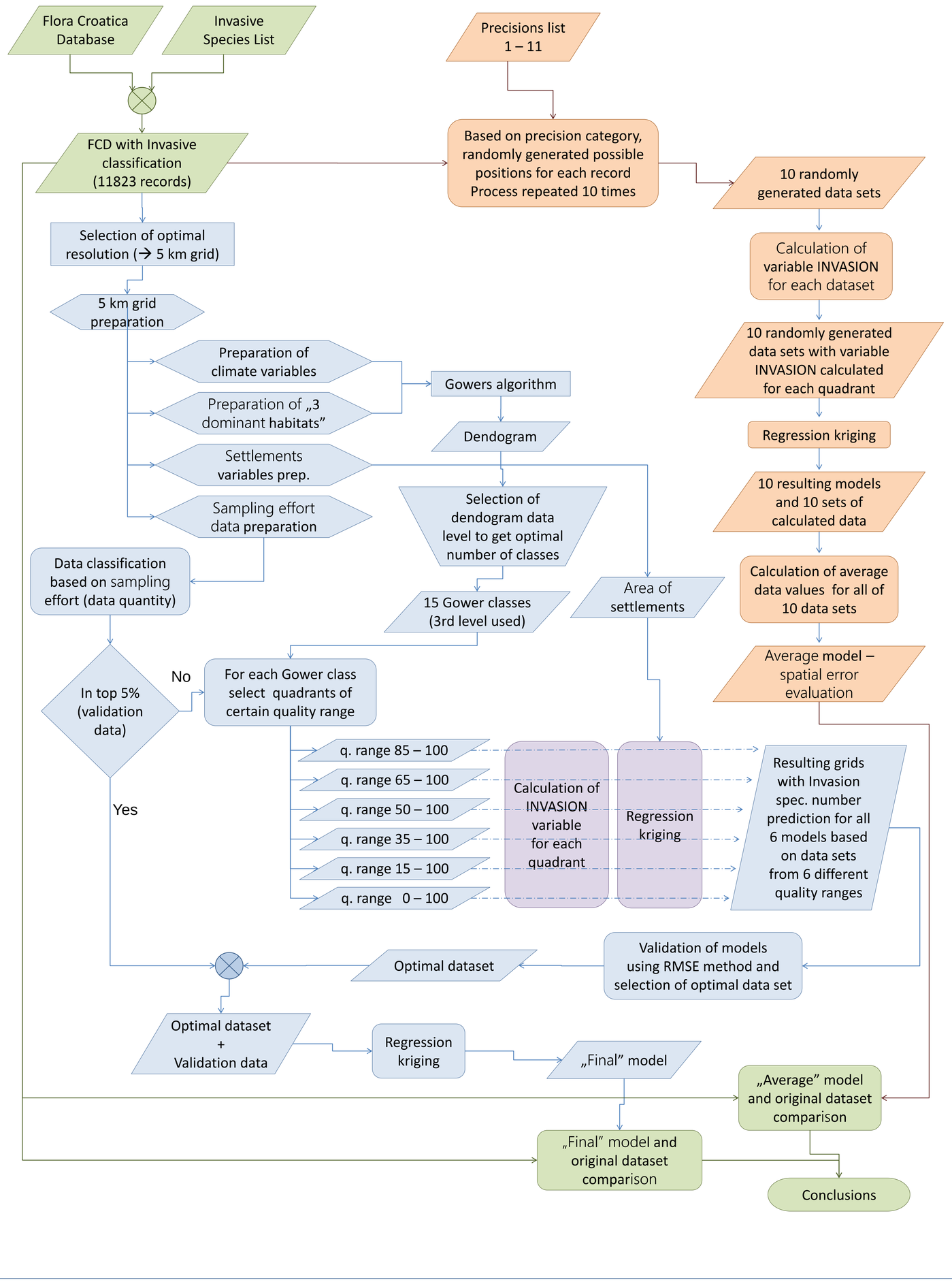

Figure 1. Detailed scheme of the methodological steps conducted in this study

Conclusions

We developed and assessed a new approach for modelling species richness using observational data that were collected with different sampling efforts due to a focus on attractive areas to naturalists and researchers. Our results clearly show that observational databases are a very valuable source for ecological models that can lead to robust results. However, our approach also demonstrates that the usefulness of observational databases would strongly benefit from standardized sampling effort in a whole range of ecological conditions. Ignoring biased sampling efforts and uncertainty of locations might lead to significantly different predictions and to underestimations of numbers and distributions of invasive plant species. The threshold obtained according to the model performance at the validation points certainly depends on the input data, the predictive power of the environmental variables and the modelling techniques used and may well vary in other studies and regions. Thus, we are suggesting described procedure to be made whenever data from observational databases are used in model preparation.

Contact

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