DISTRIBUTION MODELS OF VEGETATION TYPES IN NORWAY

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Study Aims

The representation of boreal and arctic ecosystems in climate models is still burdened with considerable uncertainty. At present, only coarse vegetation maps based on remote sensing data have wall-to-wall coverage. In this study, we explore distribution modelling (DM) as method to predict the current distributions of vegetation types in Norway from environmental information

What is Distribution Modelling?

DM is a framework used to predict potential geographical occurrence of targets in places where it has not been mapped, by relating its present location to environmental variables (Figure 1).

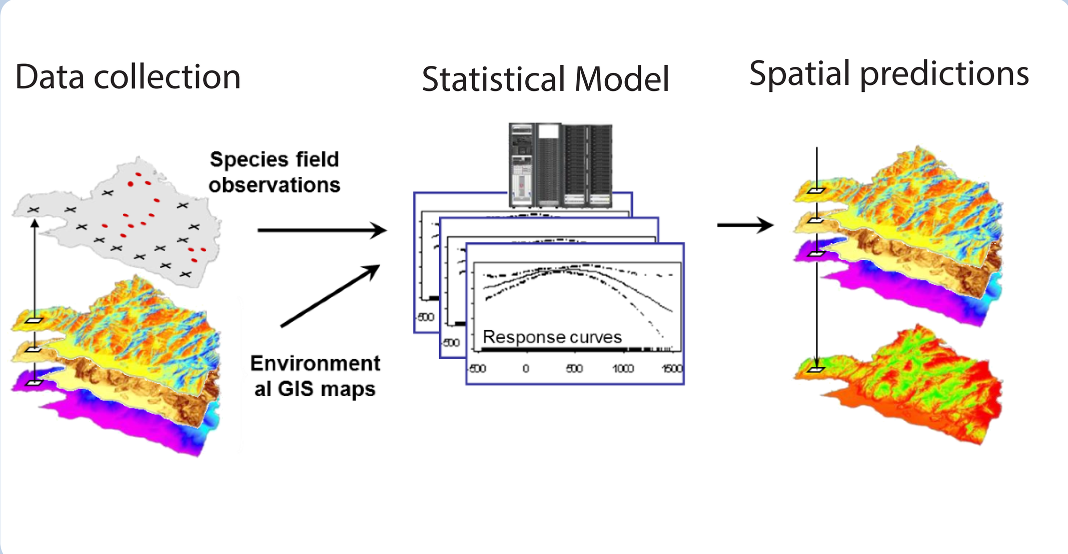

Figure 1: Framework of Distribution Modelling (adapted from A.Guisan, www.unil.ch)

Methods - Predicting vegetation

The vegetation data used for training of the models consists of presence and absence of 31 different vegetation types (VT), derived from an area frame survey carried out by the Norwegian Institute of Bioeconomy Research (Figure 2). We use logistic regression to predict the probability of presence of each VT with a 100x100-m raster resolution. A forward selection procedure with an F-ratio test was applied to 117 predictor variables (Figure 3).

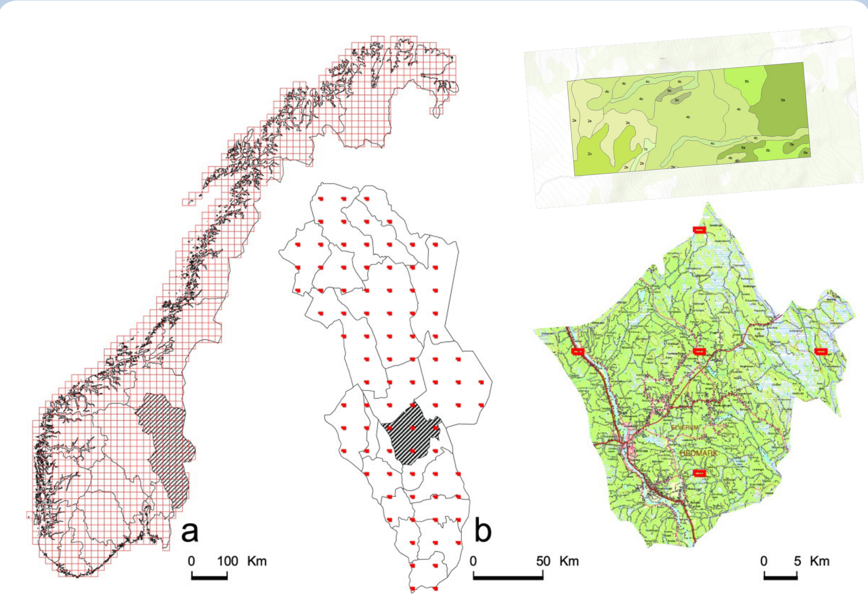

Figure 2: Vegetation data for DM used from Area frame survey, which is a systematic sampling technique with 0.9 km2 sample plots at 18 km intervals. (Strand, 2013).

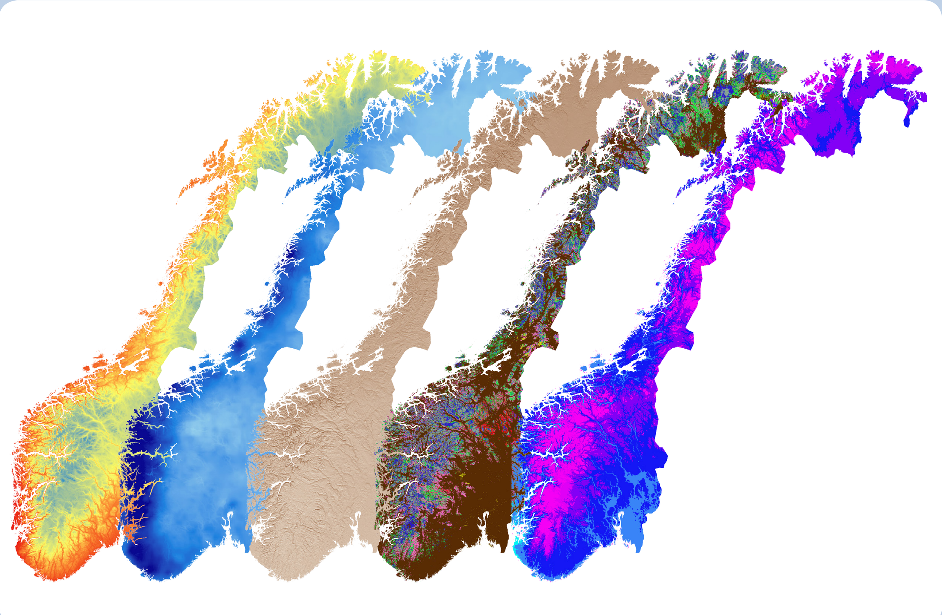

Figure 3: Environmental data for DM represented by Annual temperature, Precipitation, Total Insolation, Land cover, Snow duration etc.

Results - High certainty predictions

All models were evaluated with AUC, using an independently collected vegetation dataset. AUC values for the 31 models suggest that VTs can be predicted with quite high degree of certainty. The highest AUC value (0.989) was obtained for broadleaf deciduous forest, whereas the lowest AUC (0.679) was obtained for pastures.

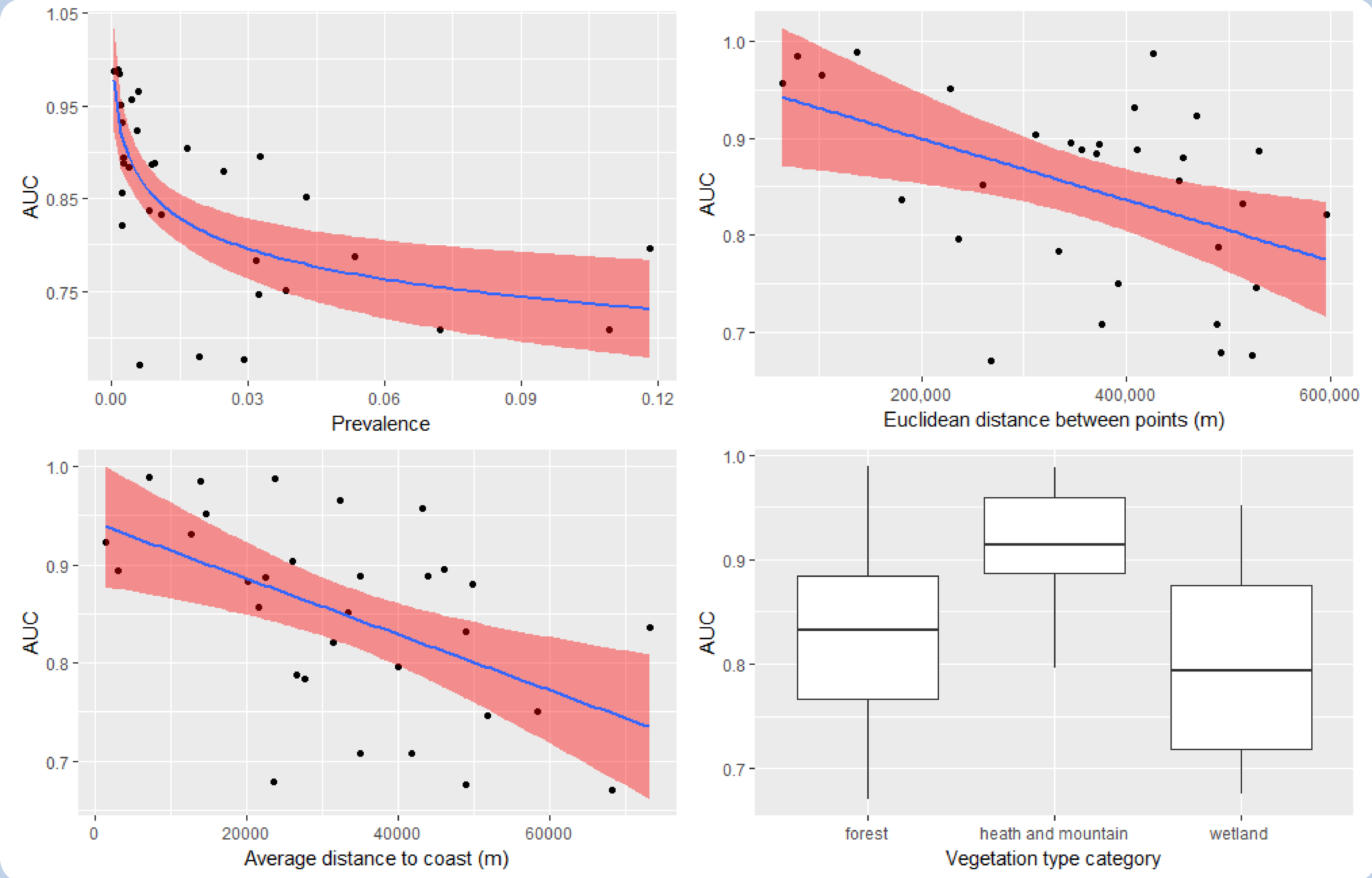

Figure 4: Relationship of AUC values of our models decreased significantly with the prevalence of VTs in the test data set, with average distance between test observations, and with distance to coast. Heath and mountain VTs are significantly better predicted than forest and wetland types.

Conclusions - A Promising tool

Our study demonstrates that DM is a promising tool for spatial prediction of aggregated groups of species such as vegetation types, provided relevant predictor variables are available. Applicability can range from nature management, climate change impacts to ecological risk assessment or restoration.

Further steps

We aim to compare the DM with results from dynamic global vegetation modelling (DGVM), and subsequently suggest improved parameterizations of the DGVM in the Cummunity Land Model (CLM).

Spatial prediction - Lichen heath

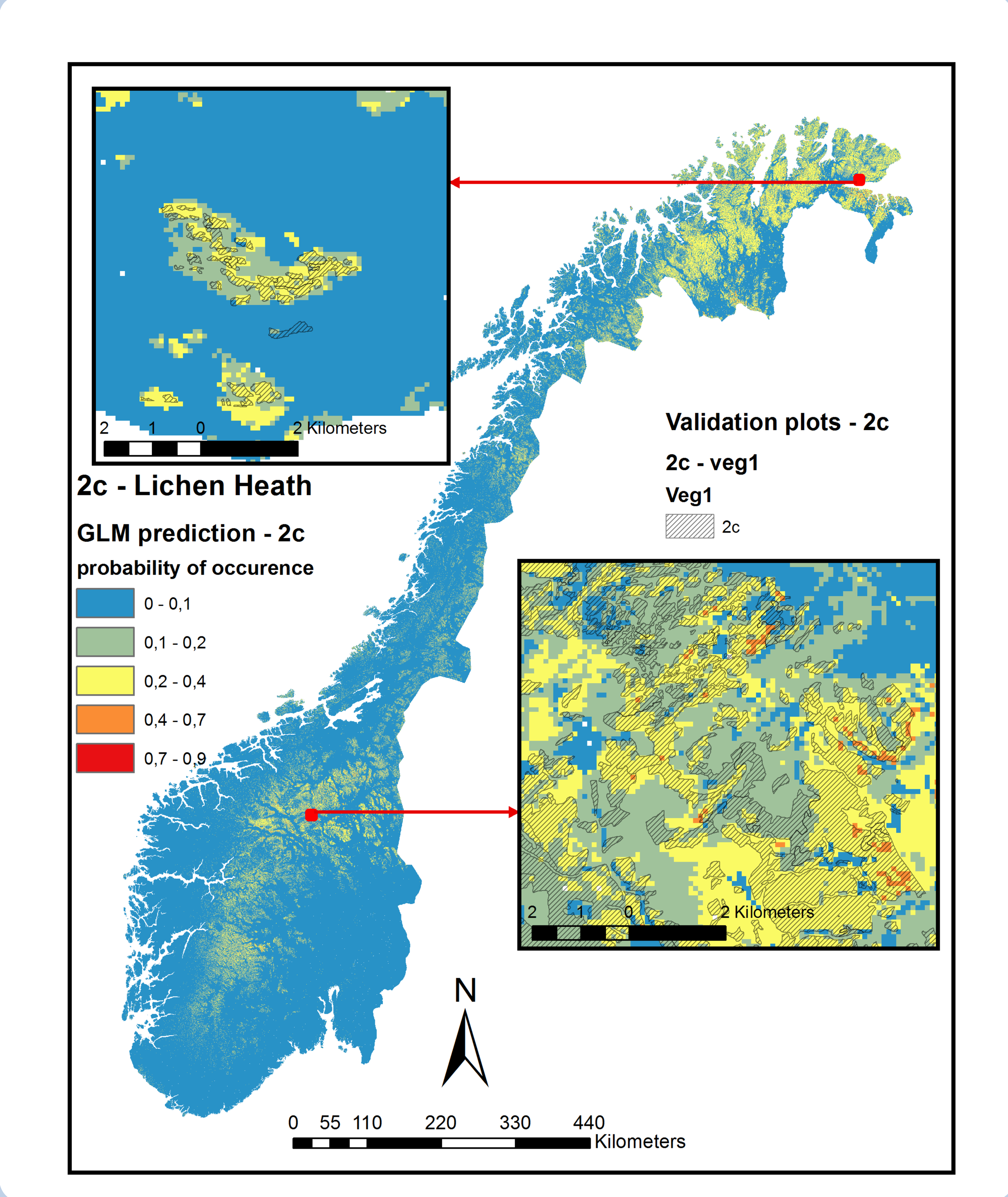

Figure 5: Probability of occurrence of VT Lichen heath in Norway predicted by DM. Probability increases from blue to red. Evaluation plots are represented by dashed polygons.

Lichen heath mainly occurs in dry, low-alpine continental areas with thin snow cover and low productivity.

Picture: Londalen, Vingelen; Anders Bryn

References

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