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Distribution and habitat suitability maps of revised EUNIS coastal and wetland habitats

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Context:

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1 Introduction

In 2019 all EUNIS habitat types belonging to the groups N (Coastal habitats) and Q (Wetlands) have been revised under the Framework Contract EEA/NSS/17/002/Lot 1 (Schaminée et al. 2019, in prep). The revision resulted in an improved classification that was used to assign a large part of the European Vegetation Archive (EVA) to EUNIS habitat types. This work was the starting point for the current study for ETC/BD, Task 1.7.5.A to deliver distribution and suitability maps for the EUNIS habitat types belonging to group N and Q .

2 Habitat suitability modelling

2.1 Introduction

For habitat suitability modelling, the latest version of the widely used software Maxent[1] for maximum entropy modelling of species geographic distributions was used. Maxent is a general-purpose machine-learning method with a simple and precise mathematical formulation, and has a number of aspects that make it well-suited for species distribution modelling when only presence (occurrence) data but not absence data are available (Philips et al. 2006). Because EUNIS habitats have a particular species composition, they are assumed to respond to specific ecological requirements, allowing us to generate correlative estimates of geographic distributions. Modelling habitats that have been floristically defined is a well-known procedure for ecological modelling at local scales, and a promising technique to be applied also at the continental level.

The Maxent modelling procedure considers presence data (known observations of a given entity) and the so-called background data. Background data comprise a set of points used to describe the environmental variation of the study area according to the available environmental layers. It is assumed that these layers represent well the most important ecological gradients on a European scale. The layers were selected from meaningful environmental predictors commonly used for modelling non-tropical plant and vegetation diversity, and are not mutually strongly correlated. In addition to what was selected as predictors in previous years (Hennekens 2016, 2017), also so-called RS-EBV's (Remote Sensed Essential Biodiversity Variables; predictors based on remote sensing data), such as Leaf Area Index (LAI)[2], phenology, land cover, chlorophyll content, inundation, vegetation height have now been applied. It is the same strategy as was followed last year (Hennekens 2018).

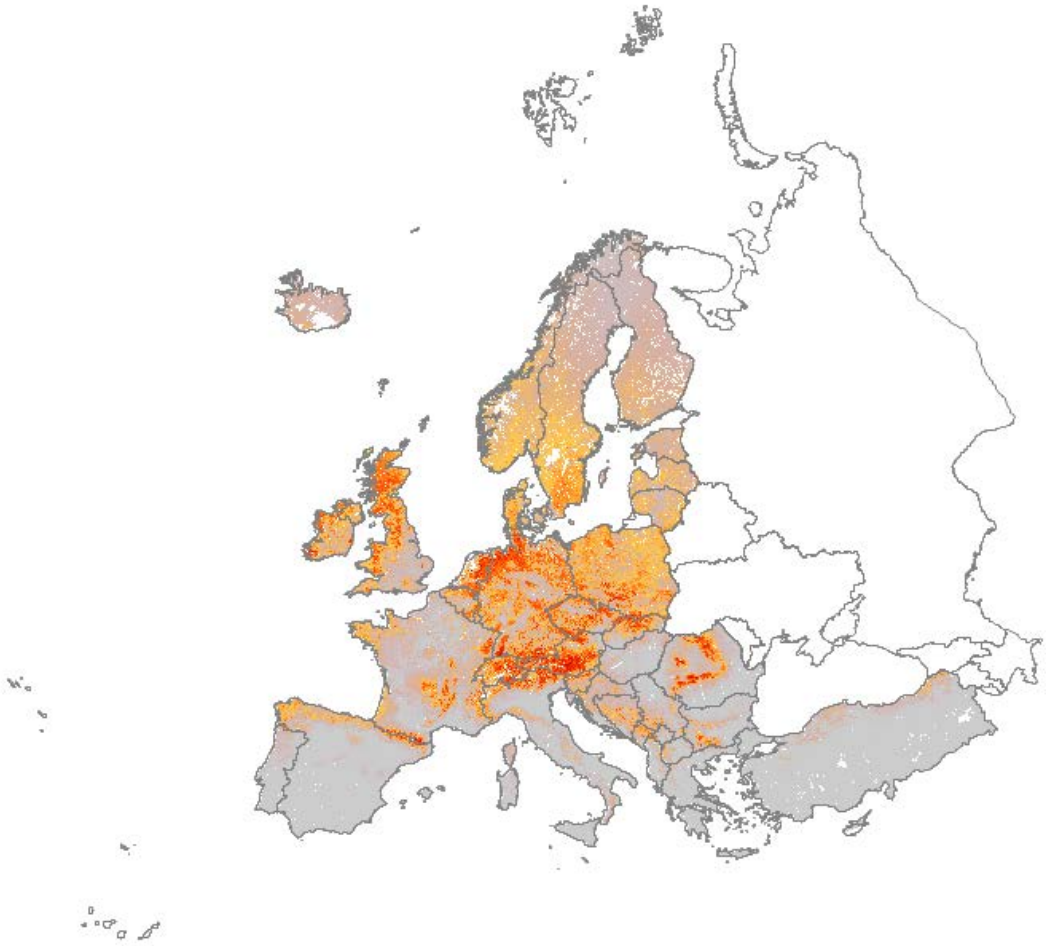
It is assumed that by using additional meaningful predictors such as the RS-EBV's, the modelling will result in more realistic suitability maps with less outliers (prediction in areas where the habitat is not expected to be present).

As a side effect of using the RS-EBS's the study area now excludes countries like Russia, Belarus and Ukraine in the east part of Europe. This also has led to better predictions because the very eastern part of Europe is currently not well represented in EVA.

[1] Maxent version 3.4.1 was used. http://biodiversityinformatics.amnh.org/open_source/maxent/

[2] Unfortunately LAI predictor maps show gaps due to presence of clouds in parts of Europe. Due to these gaps the modelling process will ignore these areas and eventually results in an incomplete suitability map.

Figure 2.1 **Example of a suitability map (Q22) indicating the geographic area with grey colour that has been taken into account for this study**



2.2 Predictors

As predictors (and their sources) the following layers have been used:

Climate

- Potential Evapotranspiration
  http://www.cgiar-csi.org/data/global-aridity-and-pet-database
- Solar radiation
  http://www.worldgrids.org/doku.php?id=wiki:inmsre3
- Temperature Seasonality (standard deviation *100)
  http://www.worldclim.org/bioclim
- Mean Temperature of Wettest Quarter
  http://www.worldclim.org/bioclim

- Annual Precipitation
  http://www.worldclim.org/bioclim
- Precipitation Seasonality (Coefficient of Variation)
  http://www.worldclim.org/bioclim
- Precipitation of Warmest Quarter
  http://www.worldclim.org/bioclim

Topography

- Distance to water (rivers, lakes, sea)
  derived from the shapefile 'Inland_Waters.shp'
- Digital Elevation Map (DEM)

Soil

- Bulk density of the soil (kg/m^3)
  Hengl et al. 2014
- Cation Exchange Capacity of the soil
  Hengl et al. 2014
- Weight in % of clay particles (<0.0002 mm)
  Hengl et al. 2014
- Volume % of coarse fragments (> 2 mm)
  Hengl et al. 2014
- Soil organic carbon content (‰)
  Hengl et al. 2014
- Soil pH (water)
  Hengl et al. 2014
- Weight in % of silt particles (0.0002-0.05 mm)
  Hengl et al. 2014
- Weight in % of sand particles (0.05-2 mm)
  Hengl et al. 2014

RS-EBV's

- Inundation; occurrence
  Global Surface Water Explorer, 1984-2015, 30m, resampled to 1km (resampling methods: average resampling and mode resampling (selects the value which appears most often of all the sampled points))
- Phenology; End of Season (day number)
  End of Season, defined as the point in time where the NDVI drops below the NDVI at the start of the growing season
- Phenology; Length of season (days)
  Length of season, number of days between EoS and Sos [days]
- Phenology; Low of season (day number)
  Phenology; Low of season (day number with lowest NDVI)

- Phenology; NDVI mean
  Mean NDVI [0..10000]
- Phenology; NDVI seasonality
  Minimum NDVI [0..10000]
- Phenology; Peak of season (day number)
  Phenology; Peak of season (day number with highest NDVI)
- Phenology; Start of Season (day number)
  Start of Season, defined as the point in the year with the largest positive rate of change (maximum of 1st derivative) [day of year 1..365]
- Vegetation height (m)
  3D Global Vegetation Map, 2000, 1km

More information on predictors and particularly on RS-EBS's can be found here:
https://www.synbiosys.alterra.nl/nextgeoss/docs/Description_Abiotic_and_RSEBVs.pdf

2.3 Modelling

Maxent is expected to perform well for estimating the geographic distribution of EUNIS habitats in Europe. However, as with any other modelling techniques this method is sensitive to sampling bias, i.e. when the spatial distribution of presence data is reflecting an unequal sampling effort in different geographic regions. In Maxent, it has been proposed that the best way to account for sampling bias (when bias is known or expected to occur) is to generate background data reflecting the same bias of the presence data. When a complete set of presence data is available, a general recommendation is to generate background points from the occurrences of other species/communities that were sampled in a similar way (Elith et al. 2011).

Two different approaches have therefore been followed for the selection of a maximum of 5,000 locations for the background data, assuming biased and non-biased presence data. For the first approach, 5,000 locations were randomly selected by Maxent from the study area, whereas the second approach concerns a random stratified (one sample per 1x1 km grid) selection of 5,000 background locations of plots present in the EVA database. Concerning the observed occurrences of the EUNIS types also a random stratified selection has been applied with a maximum of 5000 observations.

The two modelling approaches (assuming biased and non-biased data) were evaluated for each of the EUNIS habitat types in order to estimate which assumption is more likely. Surprisingly the current study showed that all maps using background data that was randomly selected by Maxent were far more better (by visual inspection) than the maps produced using background randomly derived from the EVA database. Figure 2.2 clearly shows on overestimation of habitat type T17 (Fagus forest on non-acid soils) in a large part of Europe, whereas figure 2.3 present of more realistic picture.

Figure 2.2 **EUNIS type T17; background data based on locations from randomly selected plots in the EVA database**

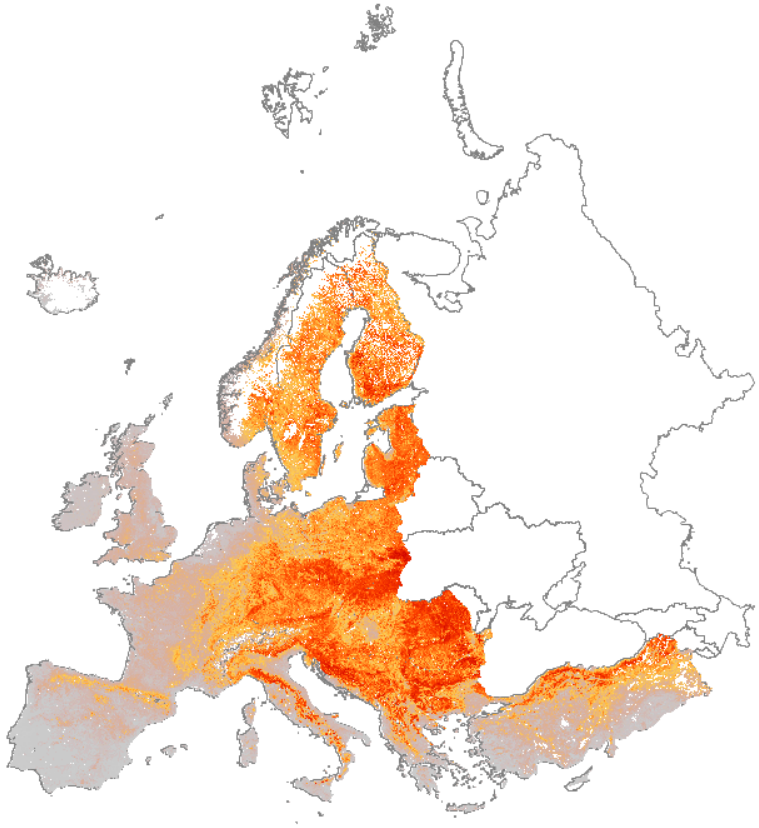
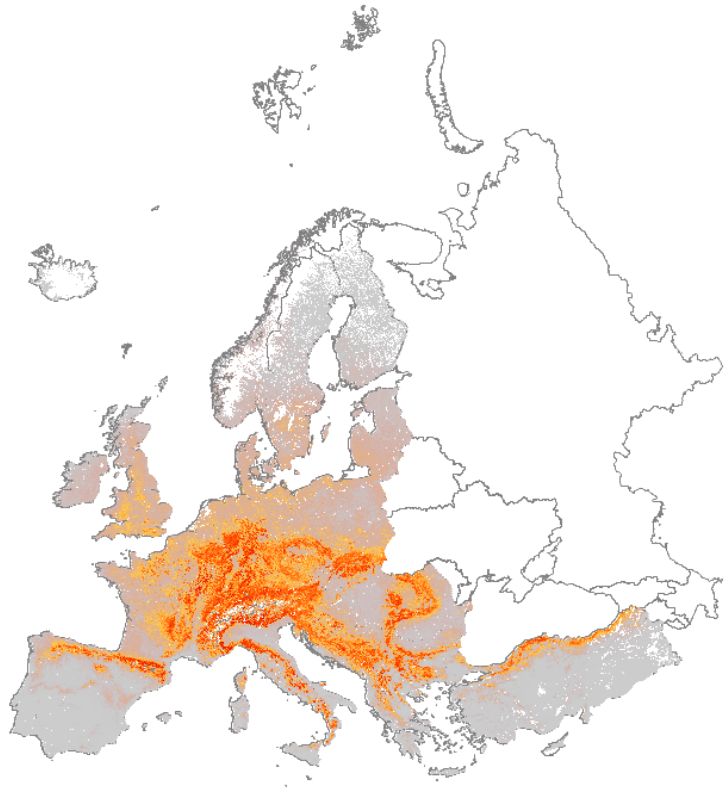


Figure 2.3 **EUNIS type T17; background data randomly selected from the study area by Maxent**



Another test that was performed was running all models with and without the RS-EBV's predictors. In Figure 2.4 and 2.5 it is shown that excluding RS-EBS's from the modelling does not affect the distribution range. However it clearly shows that with the inclusion of RS-EBS's the suitability is much more differentiated within the range.

Figure 2.4 model without RS-EBV's (left) and model with RS-EBV's (right)

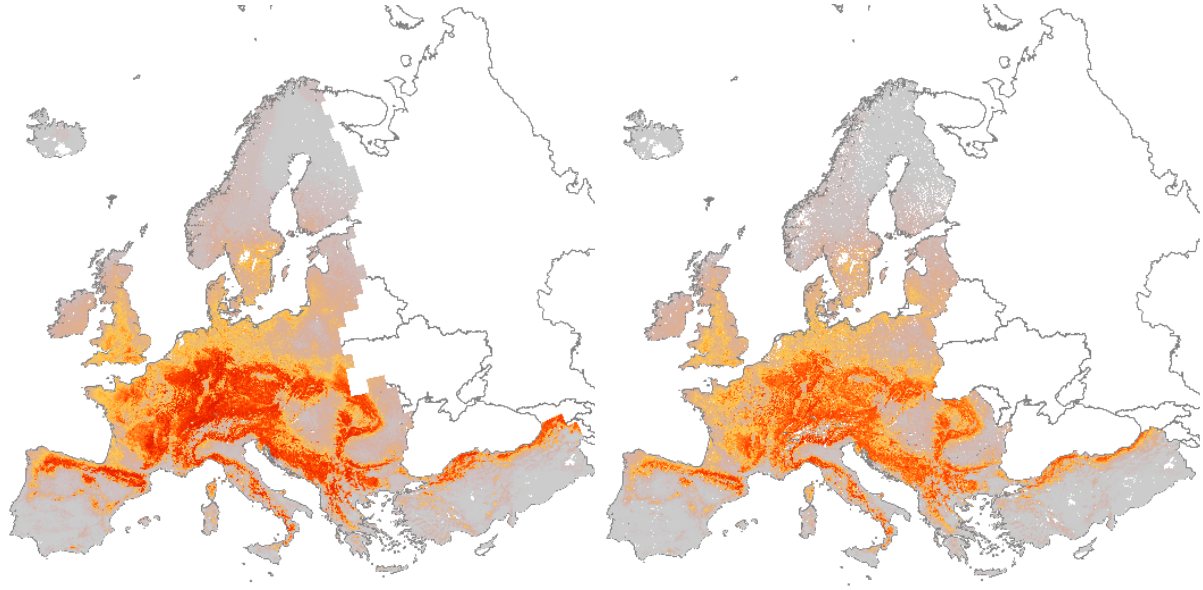
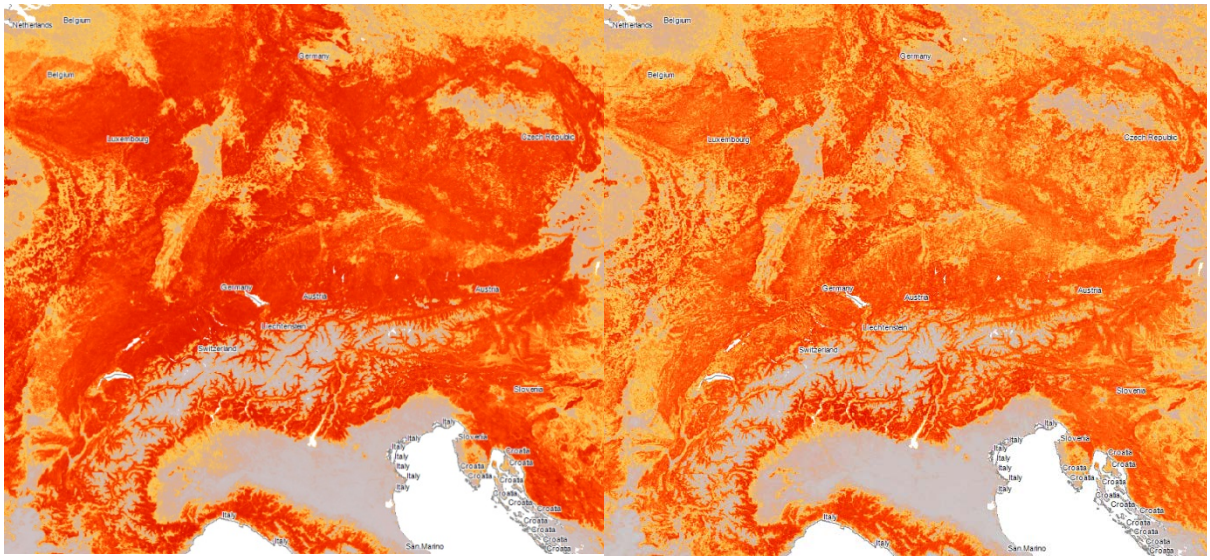


Figure 2.5 Detail of model without RS-EBV's (left) and detail of model with RS-EBV's (right)



3 Results

Annex 1 presents the list of all habitat types included in the revised classification of the EUNIS groups N and Q with indication if a distribution map and a suitability map are provided.
For a number of habitat types no maps could have been provided because:

- The habitat type cannot be defined on a floristic basis and is therefore excluded from the classification process (e.g. N24 - Shingle and gravel beach forest);
- the habitat type occurs outside the study area (e.g. N33 - Macaronesian rocky sea cliff and shore);
- insufficient data is available to produce a model (e.g. N1E - Black Sea broad-leaved coastal dune forest).

In Annex 2 the results of the analysis are presented. For each EUNIS habitat type the following data are presented:

- A distribution map showing the location of the relevés that have been assigned to the EUNIS type concerned and therefore used as observation data. As background for the observations the inventory effort regarding Coastal habitats for the N types and Wetlands for the Q types is presented.
- A habitat suitability map with colours varying from grey, through orange to red, indicating increasingly favourable ecological conditions for the type (expressing the logistic output of the model between 0 and 1).
- AUC, or the Area Under the Curve, as a general estimate of model performance. This is the likeliness that the classifier correctly orders two points (a random positive example and a random negative example). In general, AUC values in the range 0.5-0.7 were considered low, 0.7-0.9 were moderate and > 0.9 were high, suggesting poor, good and very good model performances, respectively. We provide two estimates of the AUC as calculated by Maxent. 'AUC training' reflects the internal fit between observed and predicted occurrences in the computed model. 'AUC test' provides the mean AUC obtained from a 10-fold cross-validation procedure in which ten different models were computed with a random selection of 90% of data (calibration data set) and 10% for testing the model (validation data set).
- Contribution in percentage of the predictors to the Maxent model. It indicates to what extent the environmental variables contribute to the model. A higher contribution value means a higher prediction value.

4 Discussion

In general the range of the **suitability** maps is very much in line with the range of the **distribution** maps, which is in contrast to previous reports on the suitability maps of EUNIS habitats (Hennekens 2016, 2017). This effect is probably caused by the fact that the study area in the current reporting does not included a large part of Eastern Europe, an area that is underrepresented in the EVA database.

The addition of RS-EBV's does not affect the overall range of the suitability map as is demonstrated in Figure 2.4 and 2.5. The contribution of the predictors to the model seem to underpin this assumption (see Figure 2.6 and 2.7), as in almost all models climate and soil parameters are the main explaining predictors. The exception is the Digital Elevation Model (DEM), which – not surprisingly – explains to a large extent the distribution of Coastal habitats, as these types are always located at low altitude.

When it comes to details however, Figure 2.4 and 2.5 show that RS-EBV's do have a significant added value. By including RS-EBV's in the models the distribution becomes much more differentiated, which becomes clear when zooming into the maps.

The suitability maps are the result of a modelling process with all the potential shortcoming associated with it. On the basis of a limited set of predictors (climate and soil parameters, as well as RS-EBV's), and a selection of in situ observations a suitability is calculated for each grid cell. This process contains a number of uncertainties:

- The assignment of a plot observation to a EUNIS habitat type is based on expert rules. These rules may need further refinement, which could lead to different results.
- The number of plot observations may be too small to deliver an accountable model, although in most cases this doesn't seem to be a problem in the present study.
- The degree of detail in the predictor maps could be too limited, in other words the maps with a grid size of 1x1 km could be too coarse. Plants, that form the basis of a habitat type operate on a much smaller scale then 1x1 km. And in the field micro climate and soil parameter may differ significantly over short distances.
- Climate and soil parameters may be well represented in the set of predictors, but there are more factors that determine the suitability of a habitat type. For example chemical soil parameters are very important, but are simply not captured in a map on the European scale.

Figure 2.6 **Summation of contributions of all suitability models for group N (Coastal habitats)**

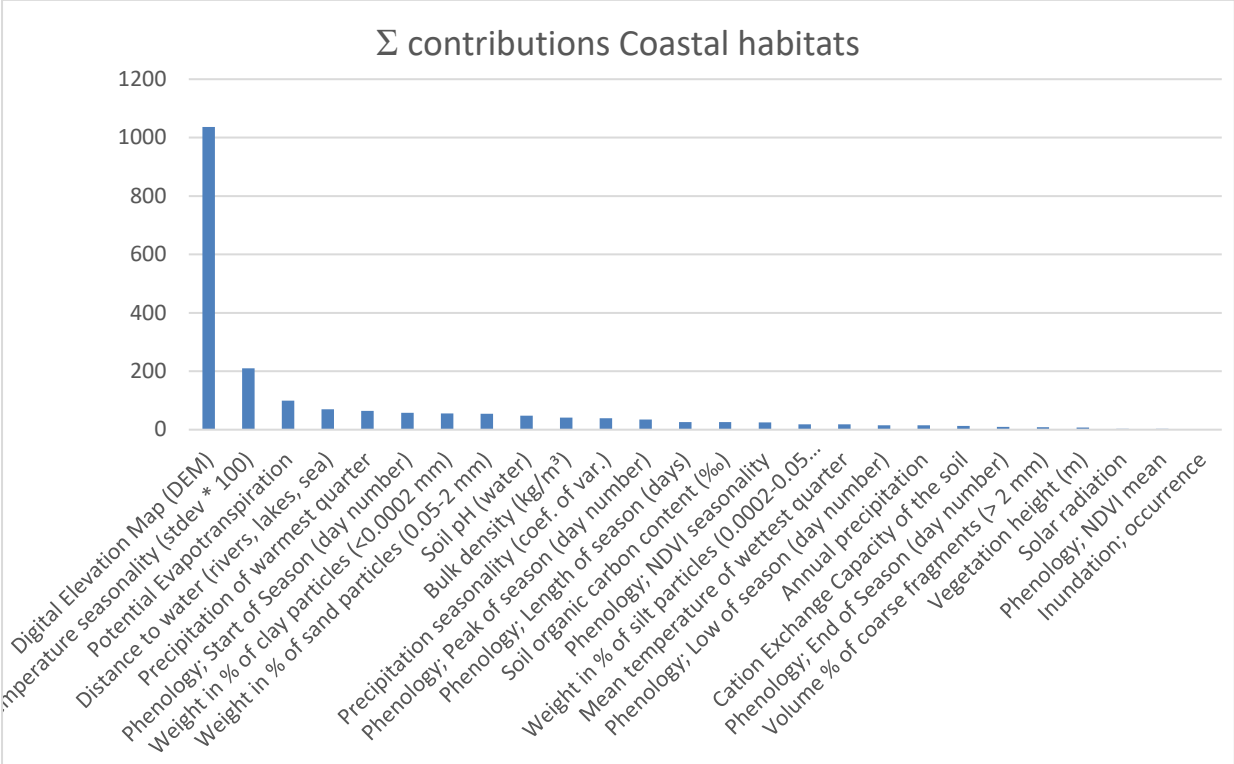
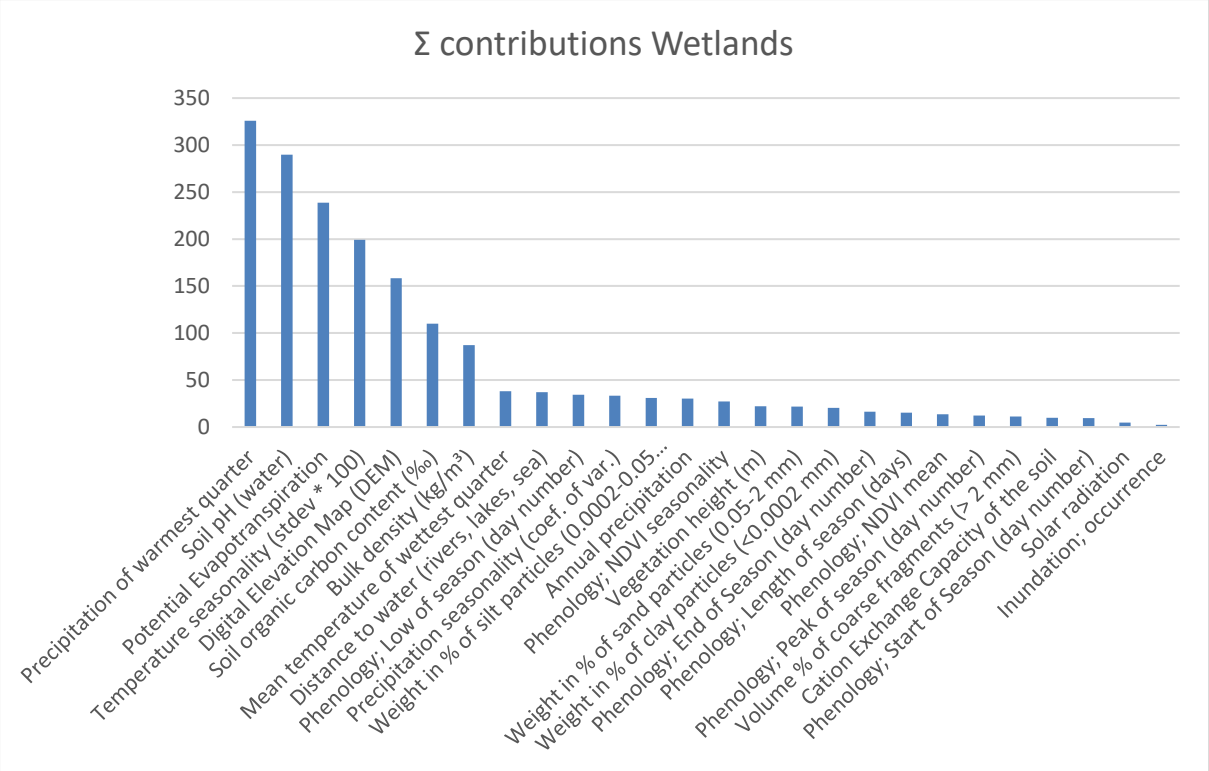


Figure 2.7 **Summation of contributions of all suitability models for group Q (Wetlands)**



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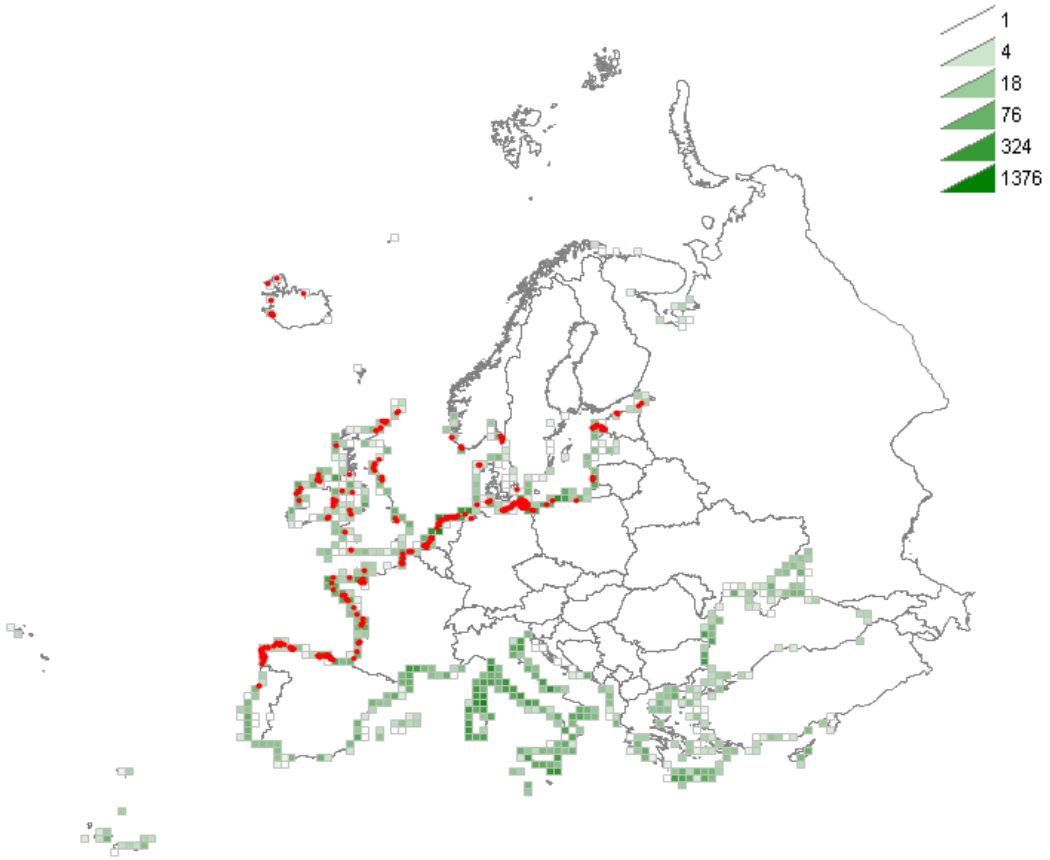
Annex 1 List of EUNIS habitat types (group N & Q) with indication of availability of distribution and suitability maps

New code	EUNIS 2012 code	Habitat name	Distribution maps	Suitability maps
N	B	Coastal habitats		
N1	B1	Coastal dunes and sandy shores		
N11	B1.1; B1.2	Atlantic, Baltic and Arctic sand beach	x	x
N12	B1.1; B1.2	Mediterranean and Black Sea sand beach	x	x
N13	B1.31;B1.311; B1.321	Atlantic and Baltic shifting coastal dune	x	x
N14	B1.3	Mediterranean, Macaronesian and Black Sea shifting coastal dune	x	x
N15	B1.4	Atlantic and Baltic coastal dune grassland (grey dune)	x	x
N16	B1.4	Mediterranean and Macaronesian coastal dune grassland (grey dune)	x	x
N17	B1.4	Black Sea coastal dune grassland (grey dune)	x	x
N18	B1.5; B1.51	Atlantic and Baltic coastal Empetrum heath	x	x
N19	B1.5	Atlantic coastal Calluna and Ulex heath	x	x
N1A	B1.6	Atlantic and Baltic coastal dune scrub	x	x
N1B	B1.6	Mediterranean and Black Sea coastal dune scrub	x	x
N1C	B1.6	Macaronesian coastal dune scrub	x	x
N1D	B1.7; B1.72	Atlantic and Baltic broad-leaved coastal dune forest	x	x
N1E	B1.7	Black Sea broad-leaved coastal dune forest	x	-
N1F	B1.7; B1.71	Baltic coniferous coastal dune forest	x	x
N1G	B1.7; B1.74	Mediterranean coniferous coastal dune forest	x	x
N1H	B1.8	Atlantic and Baltic moist and wet dune slack	x	x
N1J	B1.8	Mediterranean and Black Sea moist and wet dune slack	x	x
N2	B2	Coastal shingle		
N21	B2.1; B2.2; B2.3; B2.4	Atlantic, Baltic and Arctic coastal shingle beach	x	x
N22	B2.1; B2.2; B2.3; B2.4	Mediterranean and Black Sea coastal shingle beach	x	-
N23	B2.5	Shingle and gravel beach with scrub	-	-
N24	B2.6	Shingle and gravel beach forest	-	-
N3	B3	Rock cliffs, ledges and shores, including the supralittoral		

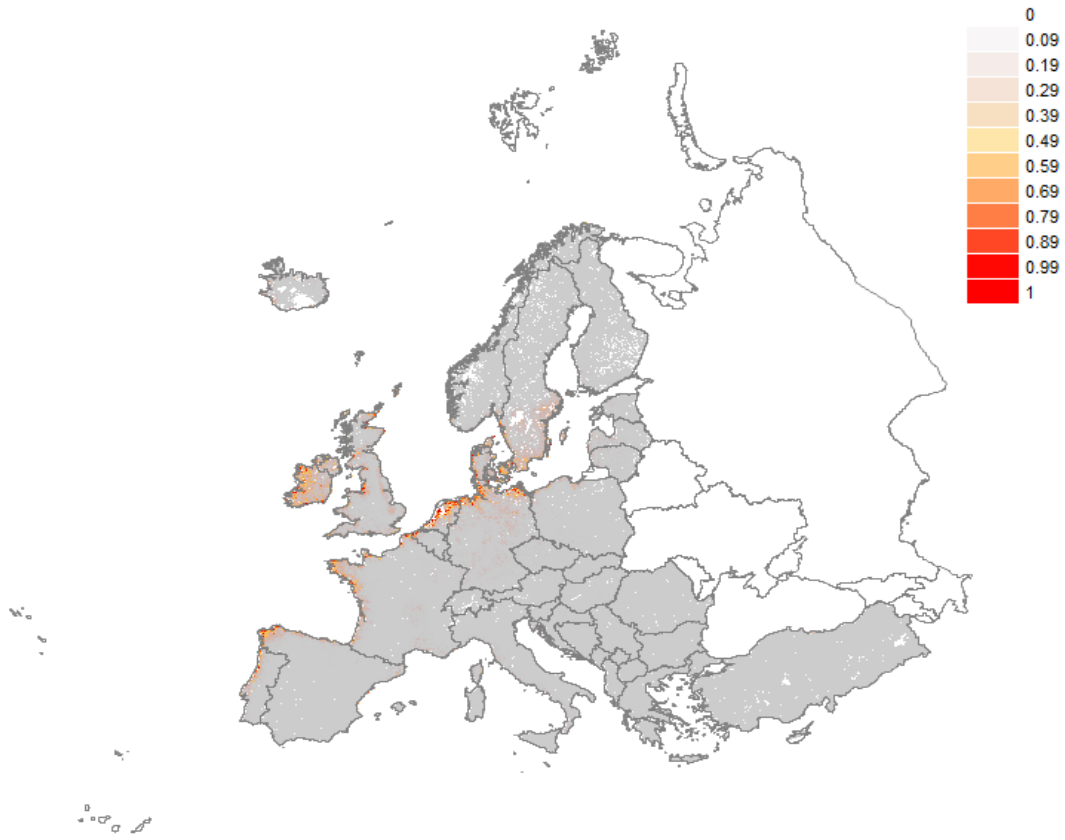
N31	B3.2; B3.3	Atlantic and Baltic rocky sea cliff and shore	x	x
N32	B3.2; B3.3	Mediterranean and Black Sea rocky sea cliff and shore	x	x
N33	B3.2; B3.3	Macaronesian rocky sea cliff and shore	x	-
N34	B3.4	Atlantic and Baltic soft sea cliff	x	x
N35	B3.4	Mediterranean and Black Sea soft sea cliff	x	-
Q	D	Wetlands		
Q1	D1	Raised and blanket bogs		
Q11	D1.1	Raised bog	x	x
Q12	D1.2	Blanket bog	x	x
Q13		Ombrotrophic percolation mire	-	-
Q2	D2	Valley mires, poor fens and transition mires		
Q21	D2.1	Oceanic valley mire	x	x
Q22	D2.2	Poor fen	x	x
Q23	D2.2	Relict mire of Mediterranean mountains	x	x
Q24	D2.2	Intermediate fen and soft-water spring mire	x	x
Q25	D2.3	Non-calcareous quaking mire	x	x
Q3	D3	Aapa, palsa and polygon mires		
Q3132		Palsa and polygon mires	x	x
Q4	D4	Base-rich fens and calcareous spring mire		
Q41	D4.1	Alkaline, calcareous, carbonate-rich small-sedge spring fen	x	x
Q42	D4.1	Extremely rich moss-sedge fen	x	x
Q43	D4.1	Tall-sedge base-rich fen	x	x
Q44	D4.1	Calcareous quaking mire	x	x
Q45	D4.2	Arctic-alpine rich fen	x	x
Q46	D6.14	Carpathian travertine fen with halophytes	x	x
Q5		Helophyte beds		
Q51	C3.2, C5.1	Tall-helophyte bed	x	x
Q52	C3.1, C3.4	Small-helophyte bed	x	x
Q53	D5.2	Tall-sedge bed	x	x
Q54	D6.2	Inland saline or brackish helophyte bed	x	x

Annex 2 Distribution and suitability maps of the revised EUNIS habitat types (group N & Q)

N11 Atlantic, Baltic and Arctic sand beach - distribution



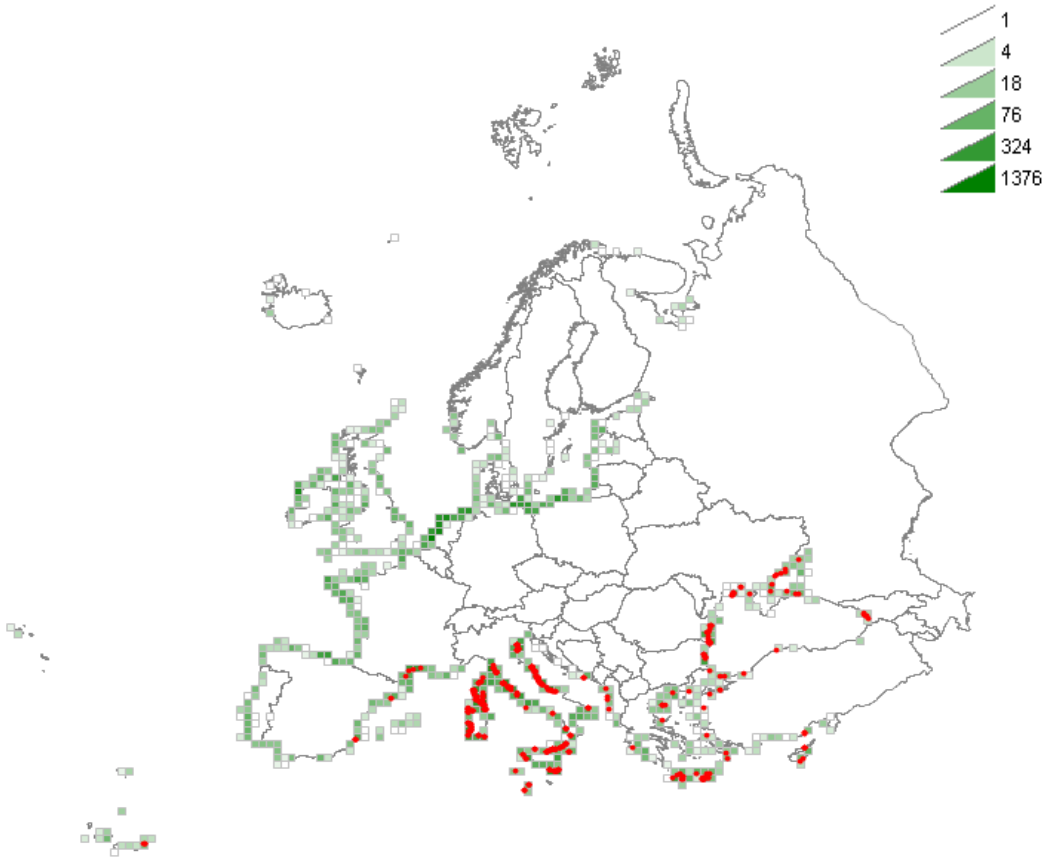
N11 Atlantic, Baltic and Arctic sand beach - suitability



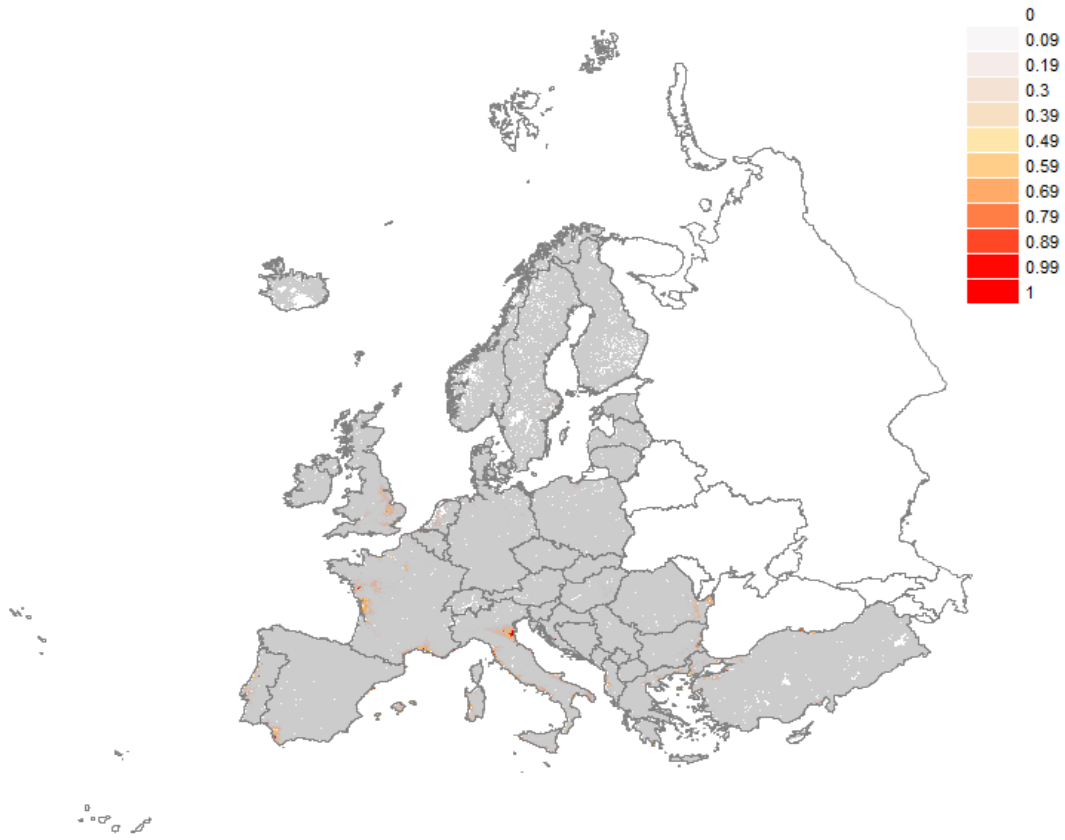
Statistics from Maxent modelling

AUC training (0-1)	0.989
AUC test (0-1)	0.9955
Contribution variables to the Maxent model (%)	
Digital Elevation Map (DEM)	44.172
Temperature seasonality (stdev * 100)	28.7197
Distance to water (rivers, lakes, sea)	7.5798
Precipitation of warmest quarter	3.7847
Precipitation seasonality (coef. of var.)	3.3126
Mean temperature of wettest quarter	2.7542
Soil organic carbon content (‰)	1.5898
Bulk density (kg/m^3)	1.5373
Weight in % of sand particles (0.05-2 mm)	1.0748
Phenology; Length of season (days)	1.0262
Phenology; Peak of season (day number)	0.906
Weight in % of silt particles (0.0002-0.05 mm)	0.5083
Weight in % of clay particles (<0.0002 mm)	0.4852
Vegetation height (m)	0.4374
Phenology; Low of season (day number)	0.4329
Cation Exchange Capacity of the soil	0.3952
Phenology; NDVI seasonality	0.2824
Phenology; End of Season (day number)	0.2744
Volume % of coarse fragments (> 2 mm)	0.2453
Potential Evapotranspiration	0.1734
Phenology; NDVI mean	0.1317
Phenology; Start of Season (day number)	0.1206
Inundation; occurrence	0.0333
Soil pH (water)	0.0228
Annual precipitation	0
Solar radiation	0

N12 Mediterranean and Black Sea sand beach - distribution



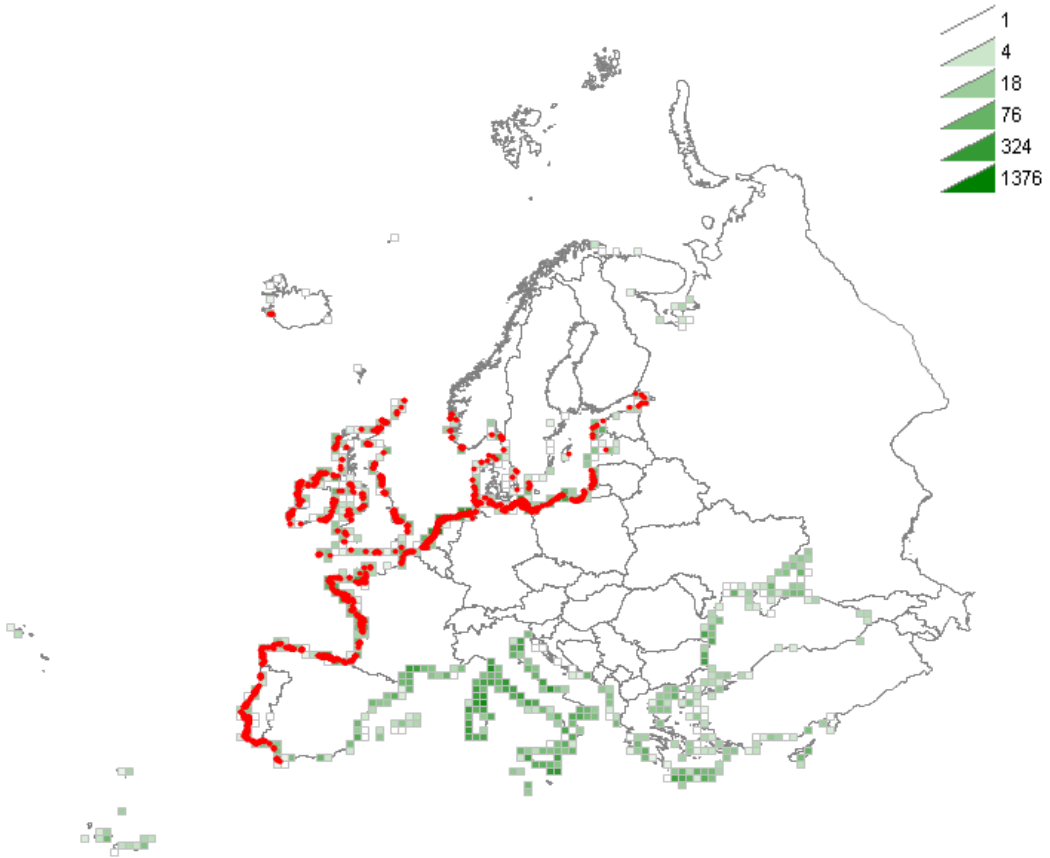
N12 Mediterranean and Black Sea sand beach - suitability



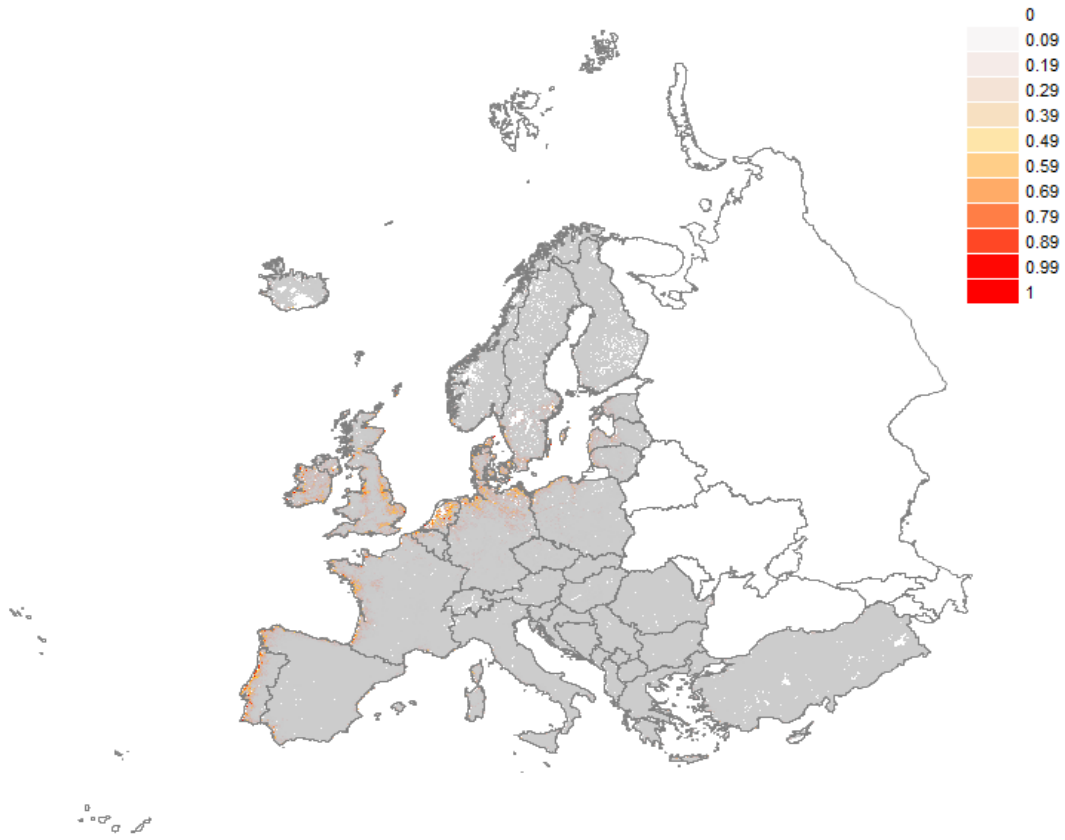
Statistics from Maxent modelling

AUC training (0-1)	0.9966
AUC test (0-1)	0.9955
Contribution variables to the Maxent model (%)	
Digital Elevation Map (DEM)	61.3191
Weight in % of clay particles (<0.0002 mm)	12.4481
Potential Evapotranspiration	8.2276
Phenology; Start of Season (day number)	7.9032
Bulk density (kg/m^3)	2.3631
Mean temperature of wettest quarter	1.7004
Soil pH (water)	1.2179
Precipitation of warmest quarter	1.1329
Phenology; Length of season (days)	0.6285
Phenology; NDVI mean	0.6225
Inundation; occurrence	0.4694
Volume % of coarse fragments (> 2 mm)	0.4399
Annual precipitation	0.3766
Phenology; NDVI seasonality	0.3371
Vegetation height (m)	0.2264
Temperature seasonality (stdev * 100)	0.1802
Soil organic carbon content (‰)	0.1524
Phenology; End of Season (day number)	0.109
Weight in % of silt particles (0.0002-0.05 mm)	0.0663
Weight in % of sand particles (0.05-2 mm)	0.0443
Phenology; Low of season (day number)	0.0349
Distance to water (rivers, lakes, sea)	0
Phenology; Peak of season (day number)	0
Precipitation seasonality (coef. of var.)	0
Cation Exchange Capacity of the soil	0
Solar radiation	0

N13 Atlantic and Baltic shifting coastal dune - distribution



N13 Atlantic and Baltic shifting coastal dune - suitability

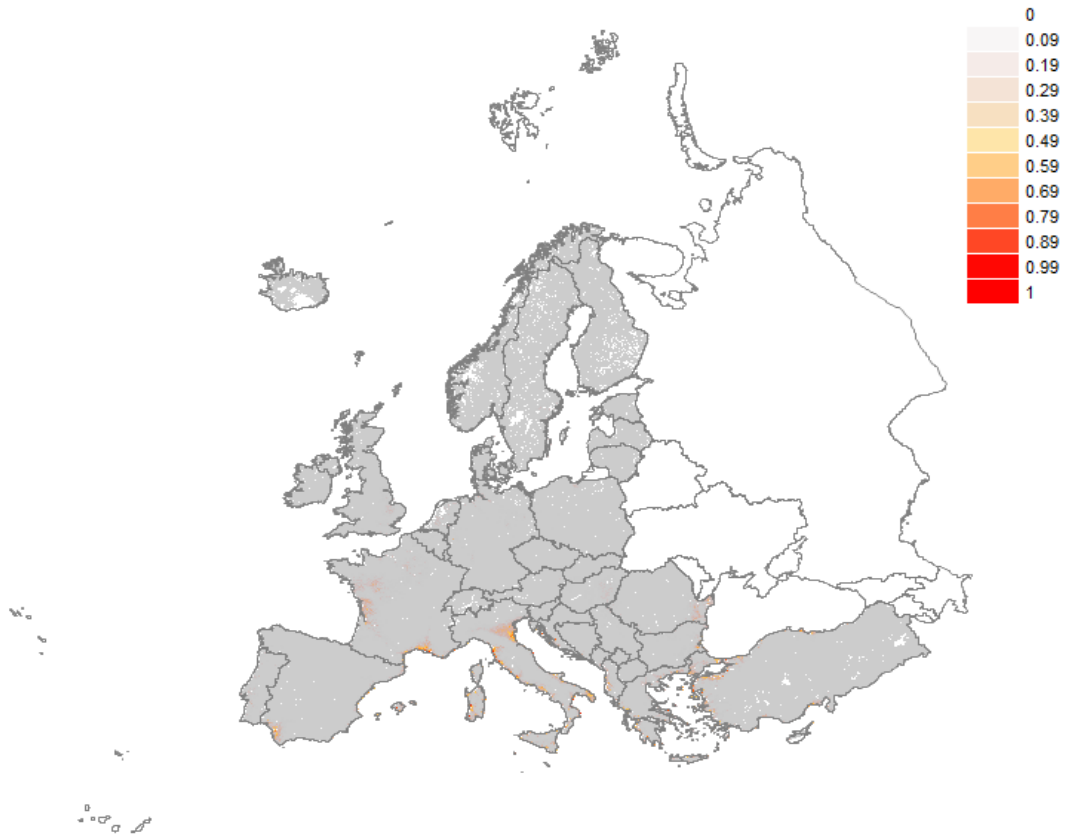


Statistics from Maxent modelling

AUC training (0-1)	0.972
AUC test (0-1)	0.9701
Contribution variables to the Maxent model (%)	
Digital Elevation Map (DEM)	66.5072
Temperature seasonality (stdev * 100)	12.7989
Weight in % of sand particles (0.05-2 mm)	6.6018
Weight in % of clay particles (<0.0002 mm)	2.4184
Bulk density (kg/m^3)	2.1961
Distance to water (rivers, lakes, sea)	1.705
Phenology; Length of season (days)	1.4346
Phenology; NDVI seasonality	1.4276
Vegetation height (m)	0.8828
Phenology; Start of Season (day number)	0.5498
Precipitation of warmest quarter	0.5298
Cation Exchange Capacity of the soil	0.5133
Precipitation seasonality (coef. of var.)	0.503
Phenology; Peak of season (day number)	0.4335
Soil pH (water)	0.3698
Soil organic carbon content (‰)	0.2896
Potential Evapotranspiration	0.2048
Annual precipitation	0.1906
Weight in % of silt particles (0.0002-0.05 mm)	0.1267
Phenology; End of Season (day number)	0.1063
Volume % of coarse fragments (> 2 mm)	0.0659
Mean temperature of wettest quarter	0.0403
Inundation; occurrence	0.0385
Phenology; Low of season (day number)	0.0313
Solar radiation	0.0281
Phenology; NDVI mean	0.0064

N14 Mediterranean, Macaronesian and Black Sea shifting coastal dune - distribution

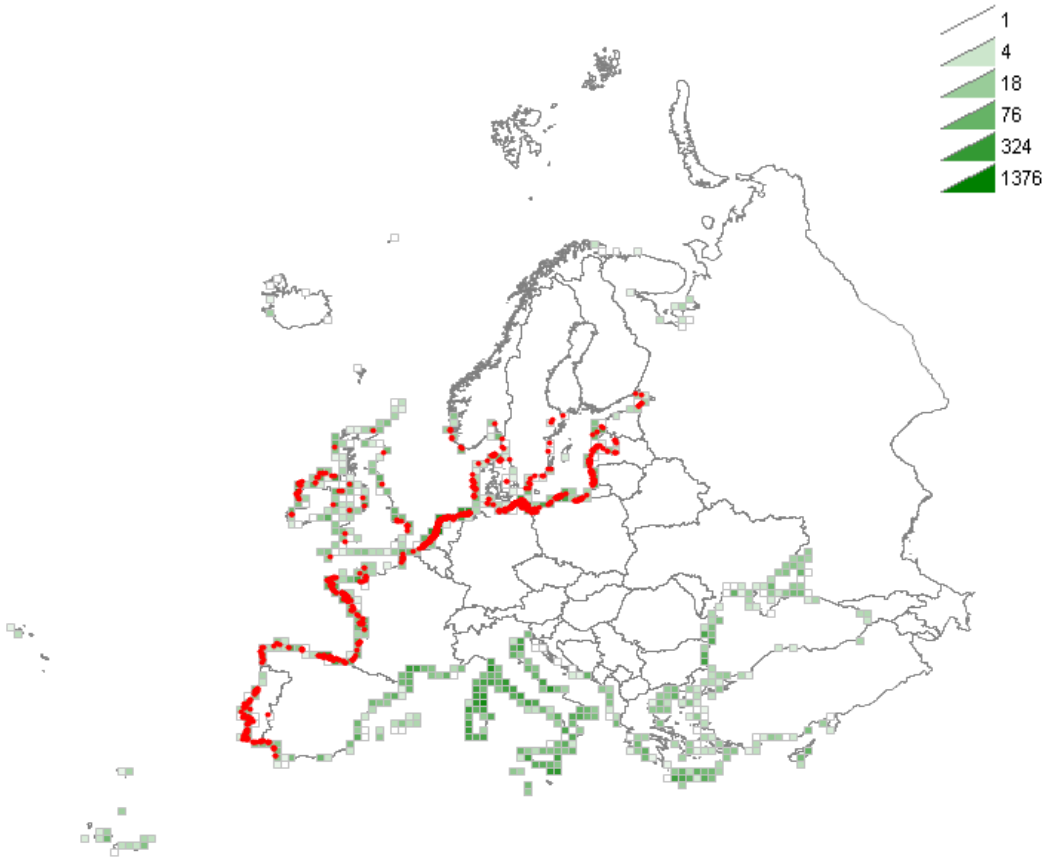
N14 Mediterranean, Macaronesian and Black Sea shifting coastal dune - suitability



Statistics from Maxent modelling

AUC training (0-1)	0.9885
AUC test (0-1)	0.9788
Contribution variables to the Maxent model (%)	
Digital Elevation Map (DEM)	59.4137
Potential Evapotranspiration	13.1643
Precipitation of warmest quarter	10.581
Weight in % of clay particles (<0.0002 mm)	5.0091
Bulk density (kg/m³)	2.2237
Precipitation seasonality (coef. of var.)	1.542
Temperature seasonality (stdev * 100)	1.519
Phenology; Length of season (days)	1.4819
Phenology; Start of Season (day number)	1.1846
Volume % of coarse fragments (> 2 mm)	0.9454
Phenology; NDVI seasonality	0.7672
Soil organic carbon content (‰)	0.5724
Phenology; NDVI mean	0.2618
Phenology; Peak of season (day number)	0.2174
Soil pH (water)	0.1938
Annual precipitation	0.1474
Inundation; occurrence	0.1367
Cation Exchange Capacity of the soil	0.0981
Vegetation height (m)	0.0967
Weight in % of silt particles (0.0002-0.05 mm)	0.0973
Distance to water (rivers, lakes, sea)	0.0839
Mean temperature of wettest quarter	0.082
Weight in % of sand particles (0.05-2 mm)	0.08
Phenology; End of Season (day number)	0.074
Phenology; Low of season (day number)	0.0191
Solar radiation	0.0075

N15 Atlantic and Baltic coastal dune grassland (grey dune) - distribution



N15 Atlantic and Baltic coastal dune grassland (grey dune) - suitability

Statistics from Maxent modelling

AUC training (0-1)	0.9671
AUC test (0-1)	0.9593
Contribution variables to the Maxent model (%)	
Digital Elevation Map (DEM)	71.5449
Weight in % of sand particles (0.05-2 mm)	7.028
Temperature seasonality (stdev * 100)	3.3727
Bulk density (kg/m³)	2.7158
Precipitation seasonality (coef. of var.)	2.3415
Phenology; Length of season (days)	2.1278
Distance to water (rivers, lakes, sea)	1.6746
Weight in % of silt particles (0.0002-0.05 mm)	1.6066
Potential Evapotranspiration	1.6019
Soil pH (water)	1.3832
Weight in % of clay particles (<0.0002 mm)	0.7945
Cation Exchange Capacity of the soil	0.7154
Phenology; NDVI seasonality	0.6091
Precipitation of warmest quarter	0.5568
Phenology; Start of Season (day number)	0.413
Mean temperature of wettest quarter	0.4086
Volume % of coarse fragments (> 2 mm)	0.2954
Phenology; Peak of season (day number)	0.2578
Vegetation height (m)	0.2178
Phenology; End of Season (day number)	0.1555
Annual precipitation	0.1419
Soil organic carbon content (‰)	0.0209
Phenology; Low of season (day number)	0.0161
Inundation; occurrence	0
Solar radiation	0
Phenology; NDVI mean	0.0004

N16 Mediterranean and Macaronesian coastal dune grassland (grey dune) - distribution

N16 Mediterranean and Macaronesian coastal dune grassland (grey dune) - suitability

Statistics from Maxent modelling

AUC training (0-1)	0.9874
AUC test (0-1)	0.9892
Contribution variables to the Maxent model (%)	
Digital Elevation Map (DEM)	57.5119
Soil pH (water)	14.4929
Phenology; End of Season (day number)	4.1905
Potential Evapotranspiration	4.1014
Phenology; Start of Season (day number)	3.1261
Temperature seasonality (stdev * 100)	2.4553
Phenology; NDVI seasonality	1.809
Bulk density (kg/m^3)	1.652
Precipitation of warmest quarter	1.6423
Weight in % of clay particles (<0.0002 mm)	1.6235
Soil organic carbon content (‰)	1.5929
Mean temperature of wettest quarter	1.3317
Precipitation seasonality (coef. of var.)	1.1191
Solar radiation	0.9672
Phenology; NDVI mean	0.6519
Vegetation height (m)	0.4602
Volume % of coarse fragments (> 2 mm)	0.3942
Phenology; Length of season (days)	0.2351
Weight in % of silt particles (0.0002-0.05 mm)	0.1693
Distance to water (rivers, lakes, sea)	0.1248
Weight in % of sand particles (0.05-2 mm)	0.0772
Inundation; occurrence	0.0642
Phenology; Peak of season (day number)	0.0643
Annual precipitation	0.0572
Phenology; Low of season (day number)	0.0574
Cation Exchange Capacity of the soil	0.0283

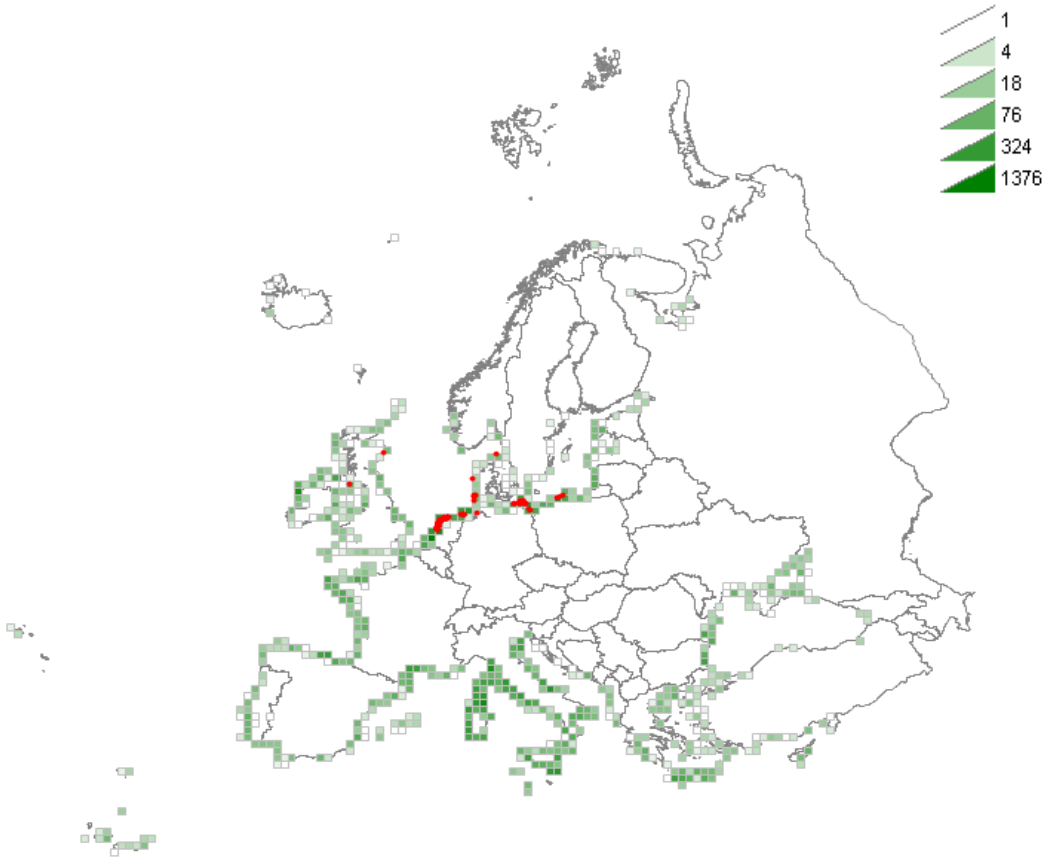
N17 Black Sea coastal dune grassland (grey dune) - distribution

N17 Black Sea coastal dune grassland (grey dune) - suitability

Statistics from Maxent modelling

AUC training (0-1)	0.9966
AUC test (0-1)	0.9985
Contribution variables to the Maxent model (%)	
Digital Elevation Map (DEM)	51.7143
Annual precipitation	10.4149
Soil pH (water)	8.4544
Precipitation seasonality (coef. of var.)	7.6561
Temperature seasonality (stdev * 100)	7.3985
Weight in % of clay particles (<0.0002 mm)	6.1549
Precipitation of warmest quarter	1.3574
Potential Evapotranspiration	1.3379
Soil organic carbon content (‰)	0.9338
Phenology; Start of Season (day number)	0.8329
Mean temperature of wettest quarter	0.6846
Bulk density (kg/m³)	0.5725
Phenology; Low of season (day number)	0.5289
Phenology; NDVI mean	0.4851
Vegetation height (m)	0.4166
Phenology; Peak of season (day number)	0.3785
Phenology; NDVI seasonality	0.2708
Volume % of coarse fragments (> 2 mm)	0.1747
Weight in % of silt particles (0.0002-0.05 mm)	0.0735
Weight in % of sand particles (0.05-2 mm)	0.0685
Distance to water (rivers, lakes, sea)	0.0448
Inundation; occurrence	0.0256
Phenology; End of Season (day number)	0.0208
Cation Exchange Capacity of the soil	0
Solar radiation	0
Phenology; Length of season (days)	0

N18 Atlantic and Baltic coastal Empetrum heath - distribution

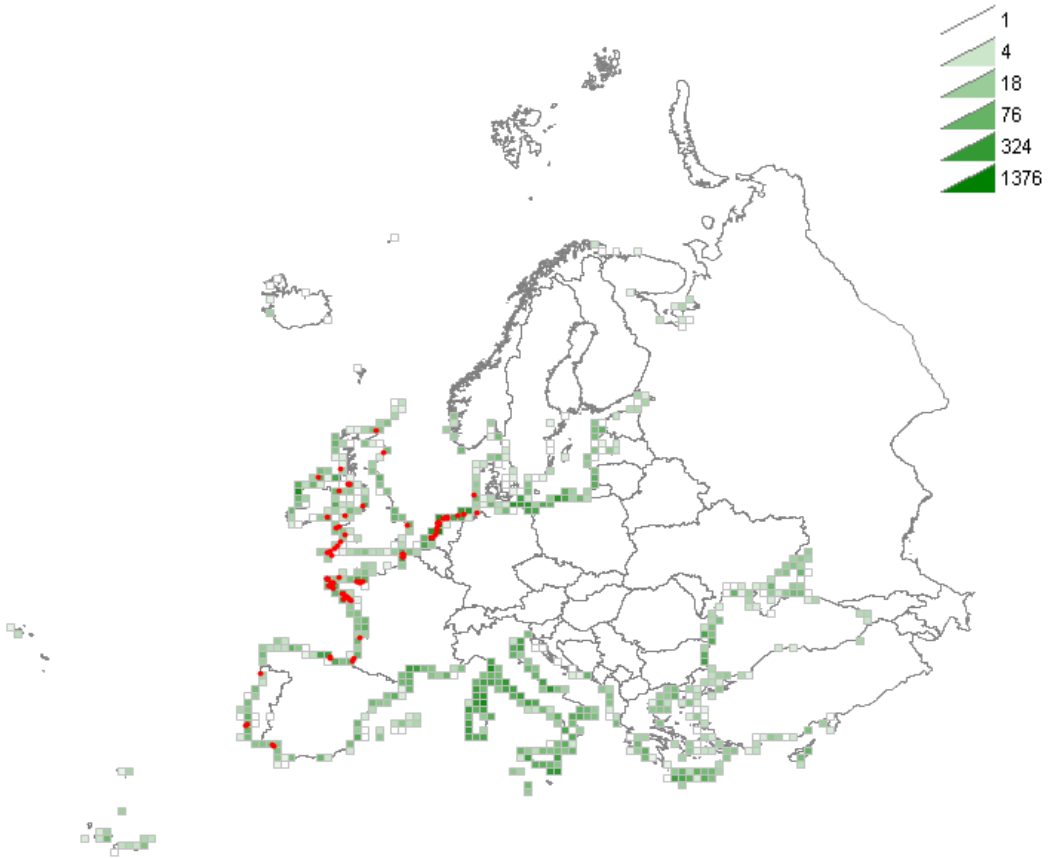


N18 Atlantic and Baltic coastal Empetrum heath - suitability

Statistics from Maxent modelling

AUC training (0-1)	0.9974
AUC test (0-1)	0.9999
Contribution variables to the Maxent model (%)	
Digital Elevation Map (DEM)	61.9984
Distance to water (rivers, lakes, sea)	23.4936
Weight in % of sand particles (0.05-2 mm)	4.6551
Weight in % of silt particles (0.0002-0.05 mm)	2.6001
Potential Evapotranspiration	1.4433
Cation Exchange Capacity of the soil	1.0827
Phenology; Low of season (day number)	0.8897
Vegetation height (m)	0.8124
Phenology; NDVI seasonality	0.8013
Mean temperature of wettest quarter	0.7301
Precipitation seasonality (coef. of var.)	0.4279
Bulk density (kg/m^3)	0.4189
Phenology; Start of Season (day number)	0.3507
Phenology; Peak of season (day number)	0.1566
Soil organic carbon content (‰)	0.0916
Phenology; Length of season (days)	0.0471
Weight in % of clay particles (<0.0002 mm)	0
Volume % of coarse fragments (> 2 mm)	0
Soil pH (water)	0
Phenology; NDVI mean	0
Inundation; occurrence	0.0005
Phenology; End of Season (day number)	0
Annual precipitation	0
Temperature seasonality (stdev * 100)	0
Solar radiation	0
Precipitation of warmest quarter	0

N19 Atlantic coastal Calluna and Ulex heath - distribution

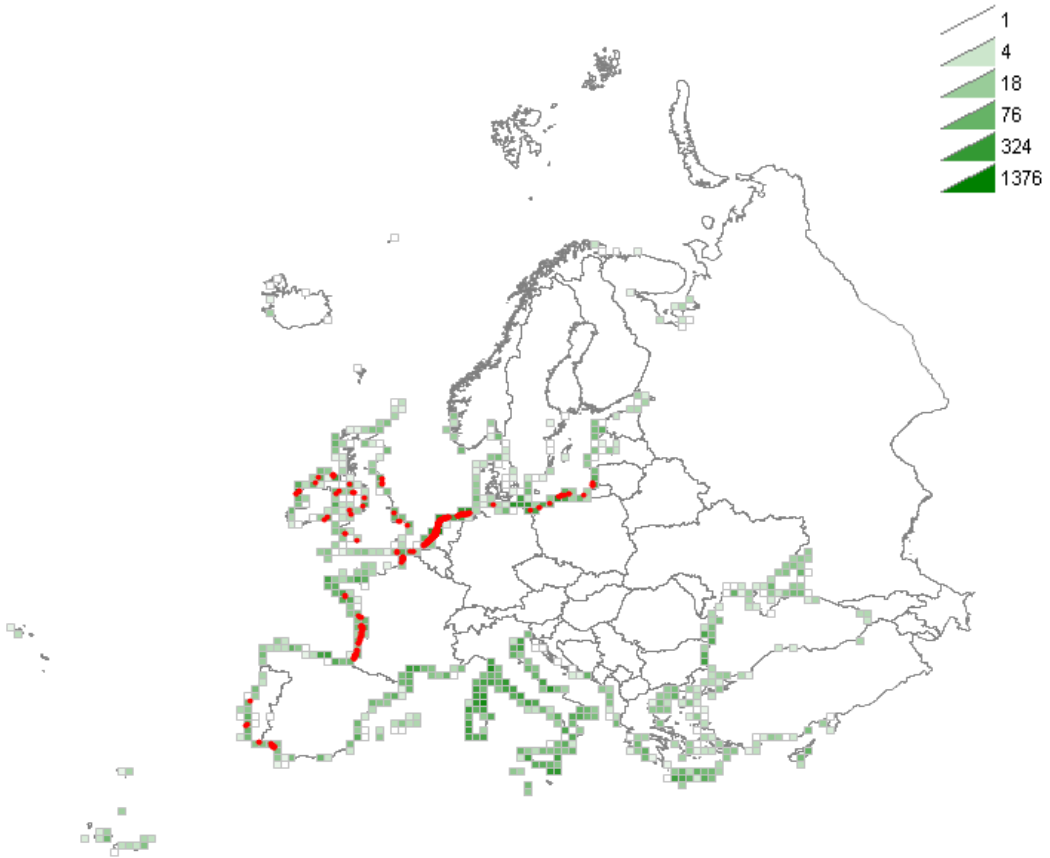


N19 Atlantic coastal Calluna and Ulex heath - suitability

Statistics from Maxent modelling

AUC training (0-1)	0.997
AUC test (0-1)	0.9715
Contribution variables to the Maxent model (%)	
Digital Elevation Map (DEM)	44.0208
Temperature seasonality (stdev * 100)	20.9093
Distance to water (rivers, lakes, sea)	7.3973
Mean temperature of wettest quarter	6.7578
Phenology; NDVI seasonality	4.8411
Precipitation seasonality (coef. of var.)	2.9165
Phenology; NDVI mean	2.3559
Annual precipitation	2.249
Phenology; Peak of season (day number)	1.6693
Weight in % of silt particles (0.0002-0.05 mm)	1.4765
Phenology; Length of season (days)	1.1015
Potential Evapotranspiration	1.0016
Phenology; Low of season (day number)	0.9976
Soil pH (water)	0.9607
Phenology; End of Season (day number)	0.7054
Soil organic carbon content (‰)	0.258
Weight in % of sand particles (0.05-2 mm)	0.1702
Bulk density (kg/m^3)	0.1145
Volume % of coarse fragments (> 2 mm)	0.0361
Phenology; Start of Season (day number)	0.0337
Weight in % of clay particles (<0.0002 mm)	0.027
Vegetation height (m)	0
Inundation; occurrence	0
Precipitation of warmest quarter	0
Cation Exchange Capacity of the soil	0
Solar radiation	0

N1A Atlantic and Baltic coastal dune scrub - distribution

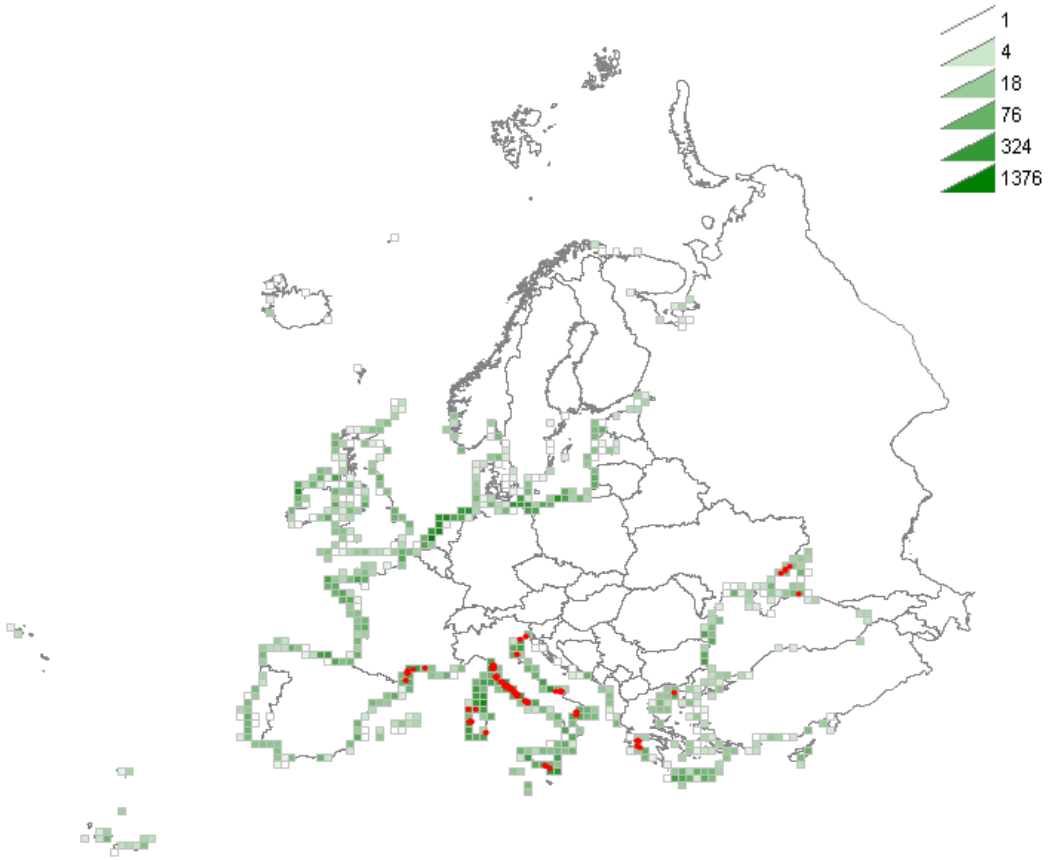


N1A Atlantic and Baltic coastal dune scrub - suitability

Statistics from Maxent modelling

AUC training (0-1)	0.9866
AUC test (0-1)	0.9853
Contribution variables to the Maxent model (%)	
Digital Elevation Map (DEM)	66.4433
Temperature seasonality (stdev * 100)	9.9115
Weight in % of silt particles (0.0002-0.05 mm)	5.2161
Weight in % of sand particles (0.05-2 mm)	3.3551
Precipitation seasonality (coef. of var.)	3.0592
Phenology; Length of season (days)	2.6879
Mean temperature of wettest quarter	2.4847
Phenology; Peak of season (day number)	1.5413
Phenology; NDVI mean	1.4857
Distance to water (rivers, lakes, sea)	0.77
Cation Exchange Capacity of the soil	0.7436
Phenology; NDVI seasonality	0.4274
Bulk density (kg/m^3)	0.4145
Potential Evapotranspiration	0.3403
Phenology; End of Season (day number)	0.2267
Weight in % of clay particles (<0.0002 mm)	0.1613
Volume % of coarse fragments (> 2 mm)	0.1451
Soil pH (water)	0.1412
Solar radiation	0.1223
Soil organic carbon content (‰)	0.1101
Phenology; Low of season (day number)	0.0717
Phenology; Start of Season (day number)	0.0641
Vegetation height (m)	0.0392
Precipitation of warmest quarter	0.0237
Inundation; occurrence	0.0142
Annual precipitation	0

N1B Mediterranean and Black Sea coastal dune scrub - distribution

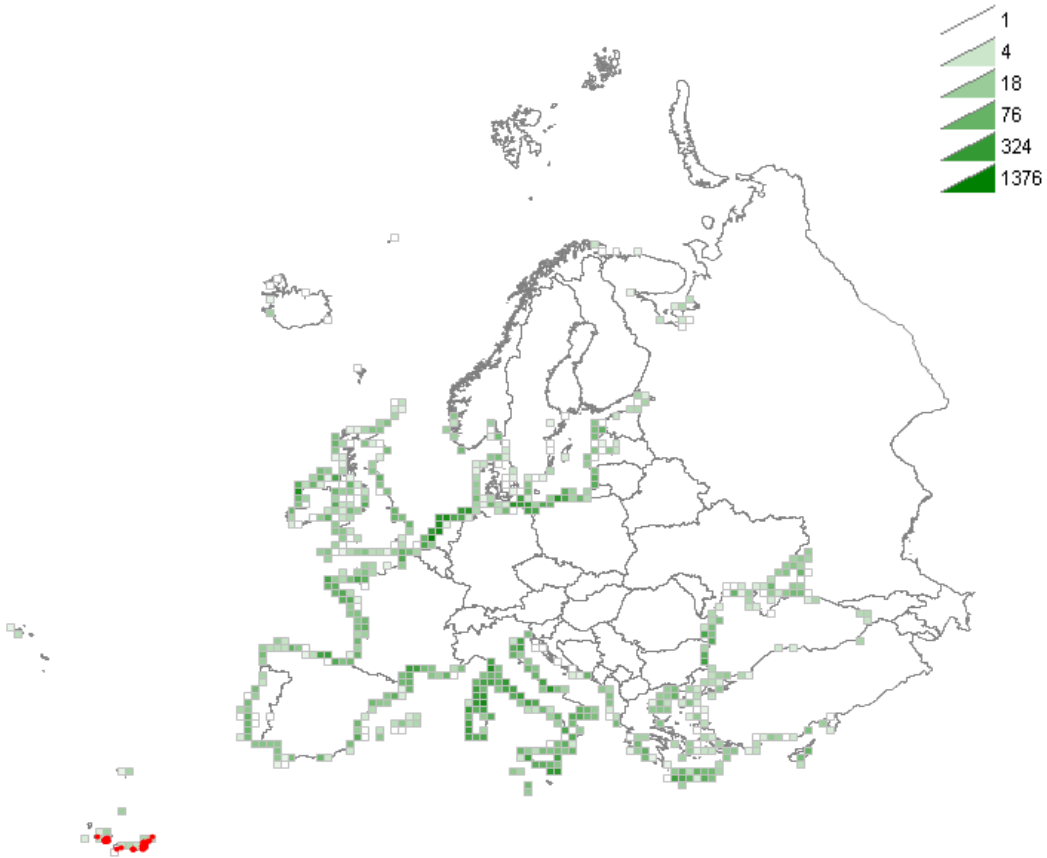


N1B Mediterranean and Black Sea coastal dune scrub - suitability

Statistics from Maxent modelling

AUC training (0-1)	0.9969
AUC test (0-1)	0.9914
Contribution variables to the Maxent model (%)	
Digital Elevation Map (DEM)	47.7881
Potential Evapotranspiration	15.1517
Phenology; Start of Season (day number)	8.3272
Phenology; NDVI seasonality	7.4506
Soil organic carbon content (‰)	5.5755
Weight in % of clay particles (<0.0002 mm)	3.8245
Distance to water (rivers, lakes, sea)	2.4094
Bulk density (kg/m³)	1.6067
Soil pH (water)	1.516
Temperature seasonality (stdev * 100)	1.3169
Weight in % of silt particles (0.0002-0.05 mm)	0.9076
Mean temperature of wettest quarter	0.8668
Precipitation of warmest quarter	0.8151
Phenology; Peak of season (day number)	0.6362
Phenology; End of Season (day number)	0.5395
Vegetation height (m)	0.2949
Phenology; Low of season (day number)	0.2894
Phenology; NDVI mean	0.1983
Cation Exchange Capacity of the soil	0.1887
Annual precipitation	0.1497
Solar radiation	0.0908
Weight in % of sand particles (0.05-2 mm)	0.0313
Precipitation seasonality (coef. of var.)	0.0251
Inundation; occurrence	0
Volume % of coarse fragments (> 2 mm)	0
Phenology; Length of season (days)	0

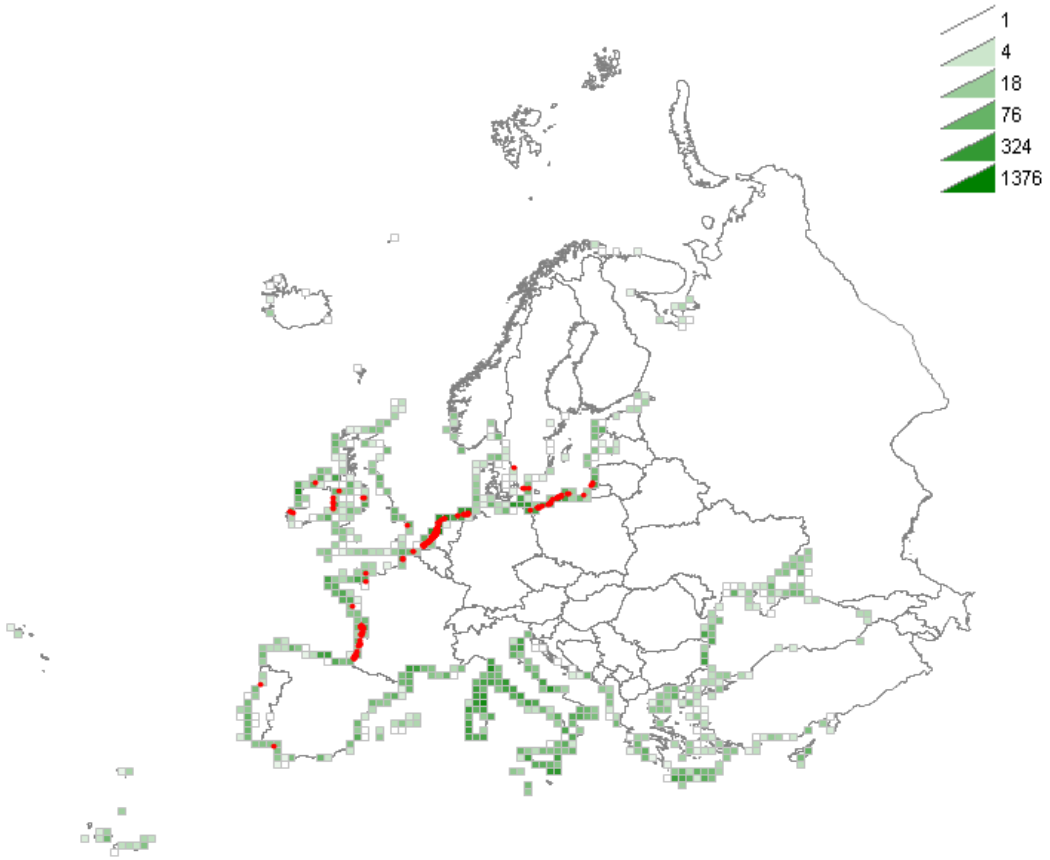
N1C Macaronesian coastal dune scrub - distribution



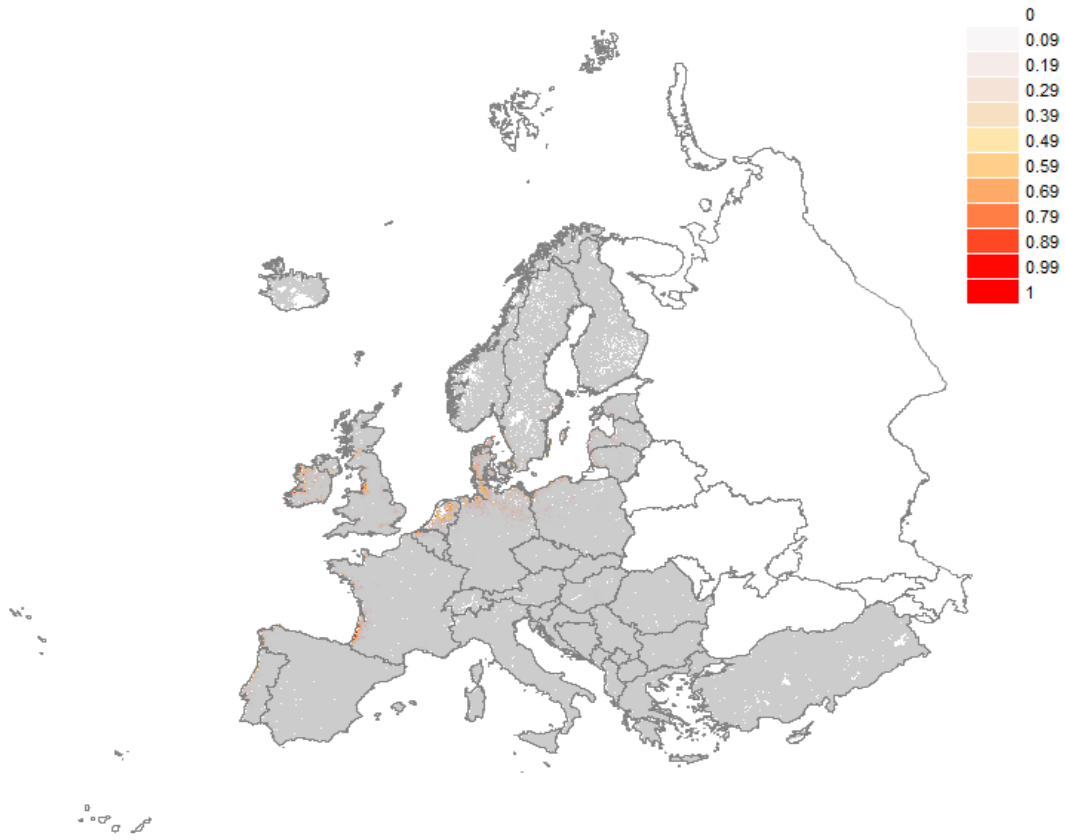
N1C Macaronesian coastal dune scrub - suitability

Not enough data to run a Maxent model or the habitat type only occurs outside the study area.

N1D Atlantic and Baltic broad-leaved coastal dune forest - distribution



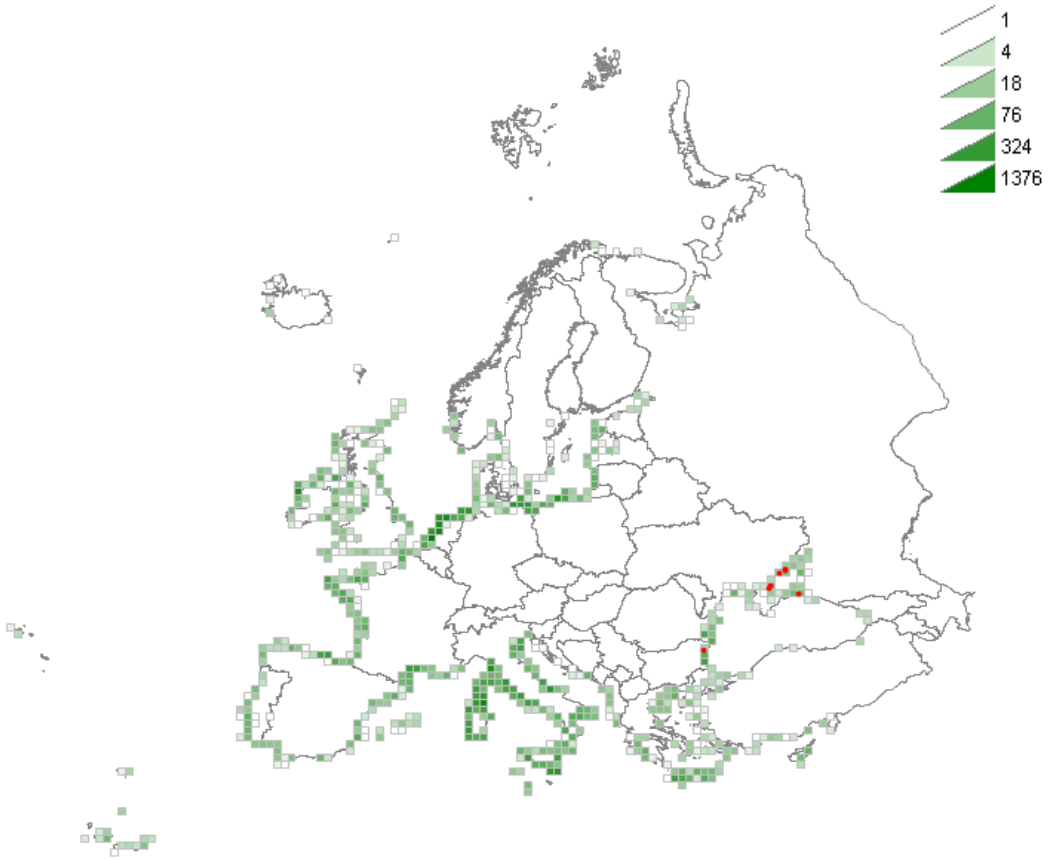
N1D Atlantic and Baltic broad-leaved coastal dune forest - suitability



Statistics from Maxent modelling

AUC training (0-1)	0.9859
AUC test (0-1)	0.9878
Contribution variables to the Maxent model (%)	
Digital Elevation Map (DEM)	63.3319
Weight in % of sand particles (0.05-2 mm)	13.8002
Temperature seasonality (stdev * 100)	6.5728
Phenology; Low of season (day number)	2.1403
Precipitation seasonality (coef. of var.)	1.8718
Mean temperature of wettest quarter	1.7385
Phenology; Peak of season (day number)	1.4823
Distance to water (rivers, lakes, sea)	1.4203
Phenology; Length of season (days)	1.369
Cation Exchange Capacity of the soil	1.3534
Phenology; NDVI seasonality	1.0094
Weight in % of clay particles (<0.0002 mm)	0.6848
Bulk density (kg/m^3)	0.6255
Vegetation height (m)	0.5357
Potential Evapotranspiration	0.4701
Phenology; End of Season (day number)	0.4678
Phenology; Start of Season (day number)	0.37
Soil organic carbon content (‰)	0.2263
Weight in % of silt particles (0.0002-0.05 mm)	0.2001
Precipitation of warmest quarter	0.1933
Volume % of coarse fragments (> 2 mm)	0.0716
Phenology; NDVI mean	0.0264
Annual precipitation	0.0239
Soil pH (water)	0.0147
Inundation; occurrence	0
Solar radiation	0

N1E Black Sea broad-leaved coastal dune forest - distribution



N1E Black Sea broad-leaved coastal dune forest - suitability

Not enough data to run a Maxent model or the habitat type only occurs outside the study area.

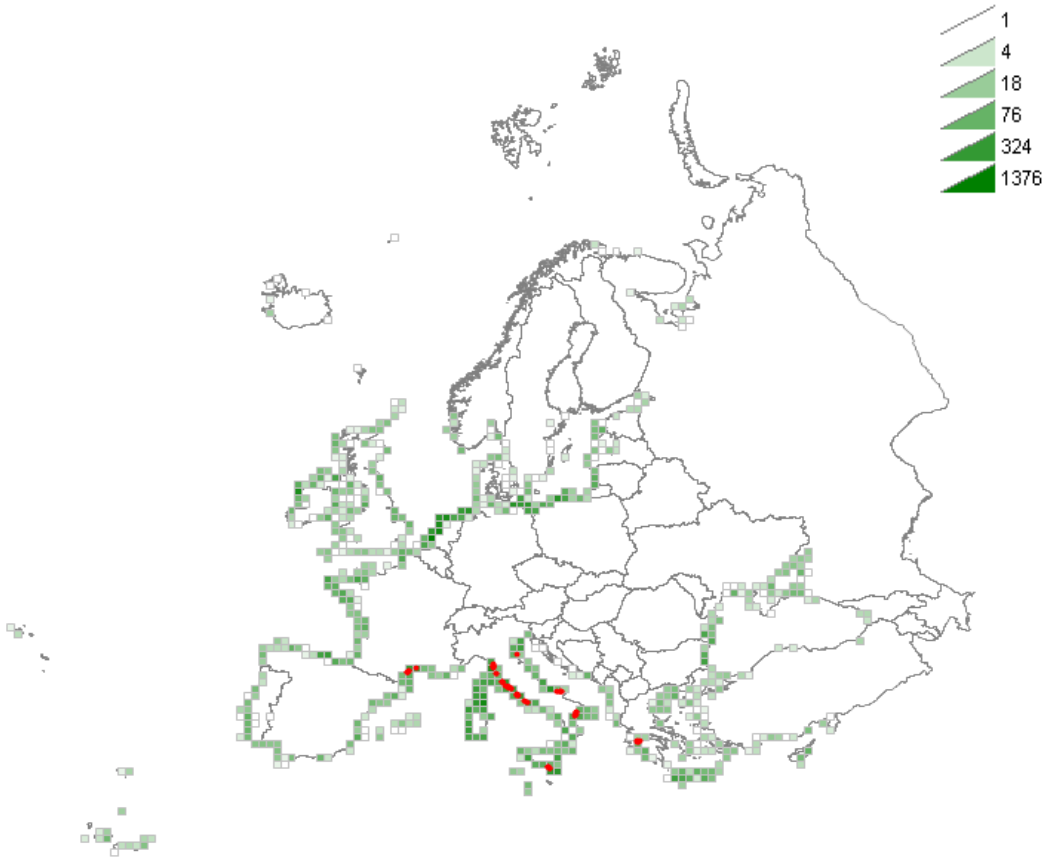
N1F Baltic coniferous coastal dune forest - distribution

N1F Baltic coniferous coastal dune forest - suitability

Statistics from Maxent modelling

AUC training (0-1)	0.9972
AUC test (0-1)	0.9933
Contribution variables to the Maxent model (%)	
Digital Elevation Map (DEM)	46.702
Weight in % of silt particles (0.0002-0.05 mm)	16.0103
Weight in % of sand particles (0.05-2 mm)	12.4783
Temperature seasonality (stdev * 100)	9.9859
Phenology; Length of season (days)	4.1898
Phenology; Peak of season (day number)	4.1283
Precipitation seasonality (coef. of var.)	3.3107
Cation Exchange Capacity of the soil	0.8424
Phenology; End of Season (day number)	0.6518
Phenology; NDVI seasonality	0.5881
Volume % of coarse fragments (> 2 mm)	0.4525
Potential Evapotranspiration	0.4237
Weight in % of clay particles (<0.0002 mm)	0.0863
Mean temperature of wettest quarter	0.0618
Distance to water (rivers, lakes, sea)	0.0391
Phenology; Low of season (day number)	0.0248
Phenology; Start of Season (day number)	0.0188
Vegetation height (m)	0.0053
Soil pH (water)	0
Annual precipitation	0
Phenology; NDVI mean	0
Inundation; occurrence	0
Precipitation of warmest quarter	0
Soil organic carbon content (‰)	0.0002
Bulk density (kg/m^3)	0
Solar radiation	0

N1G Mediterranean coniferous coastal dune forest - distribution

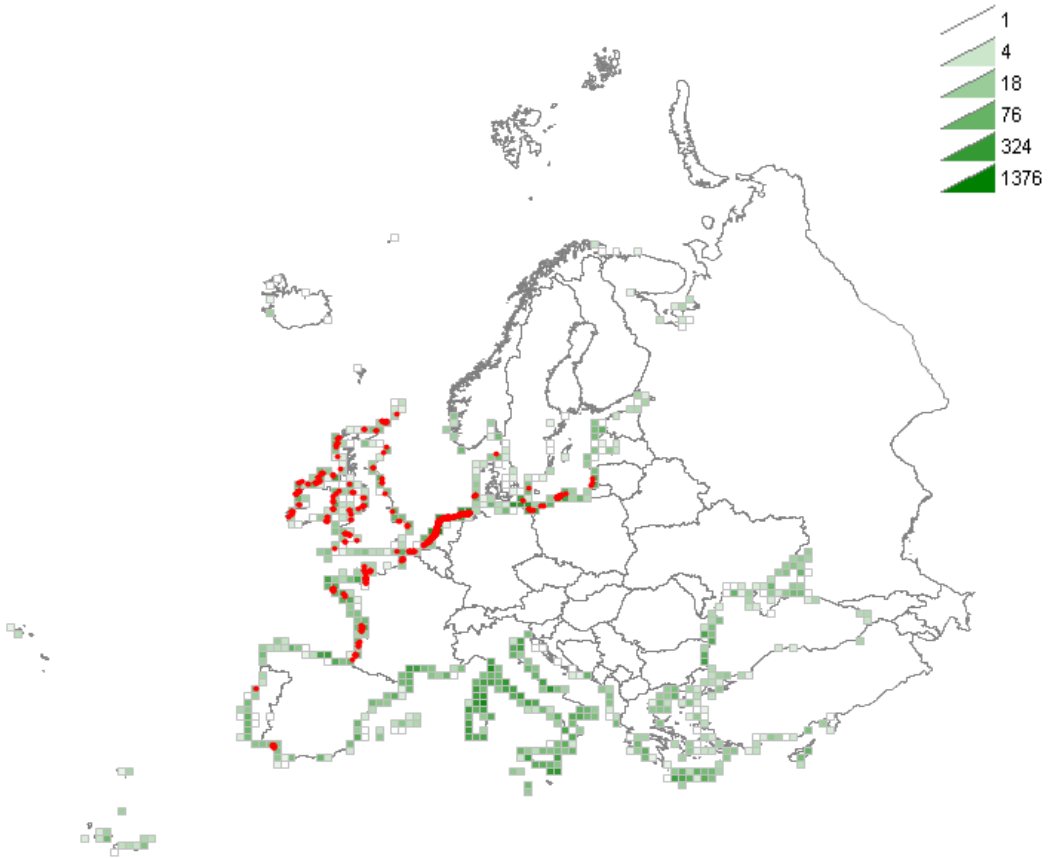


N1G Mediterranean coniferous coastal dune forest - suitability

Statistics from Maxent modelling

AUC training (0-1)	0.9983
AUC test (0-1)	0.999
Contribution variables to the Maxent model (%)	
Digital Elevation Map (DEM)	40.895
Phenology; Peak of season (day number)	23.628
Phenology; End of Season (day number)	11.6598
Phenology; NDVI seasonality	3.4894
Potential Evapotranspiration	3.3739
Vegetation height (m)	3.3461
Phenology; Start of Season (day number)	3.0557
Mean temperature of wettest quarter	1.9504
Annual precipitation	1.93
Cation Exchange Capacity of the soil	1.5433
Weight in % of clay particles (<0.0002 mm)	1.2468
Temperature seasonality (stdev * 100)	1.0628
Precipitation of warmest quarter	0.947
Distance to water (rivers, lakes, sea)	0.8588
Soil pH (water)	0.4225
Weight in % of silt particles (0.0002-0.05 mm)	0.4195
Soil organic carbon content (‰)	0.1205
Precipitation seasonality (coef. of var.)	0.0459
Bulk density (kg/m^3)	0.0026
Volume % of coarse fragments (> 2 mm)	0.0017
Phenology; Low of season (day number)	0
Phenology; NDVI mean	0
Inundation; occurrence	0
Solar radiation	0
Phenology; Length of season (days)	0
Weight in % of sand particles (0.05-2 mm)	0.0004

N1H Atlantic and Baltic moist and wet dune slack - distribution

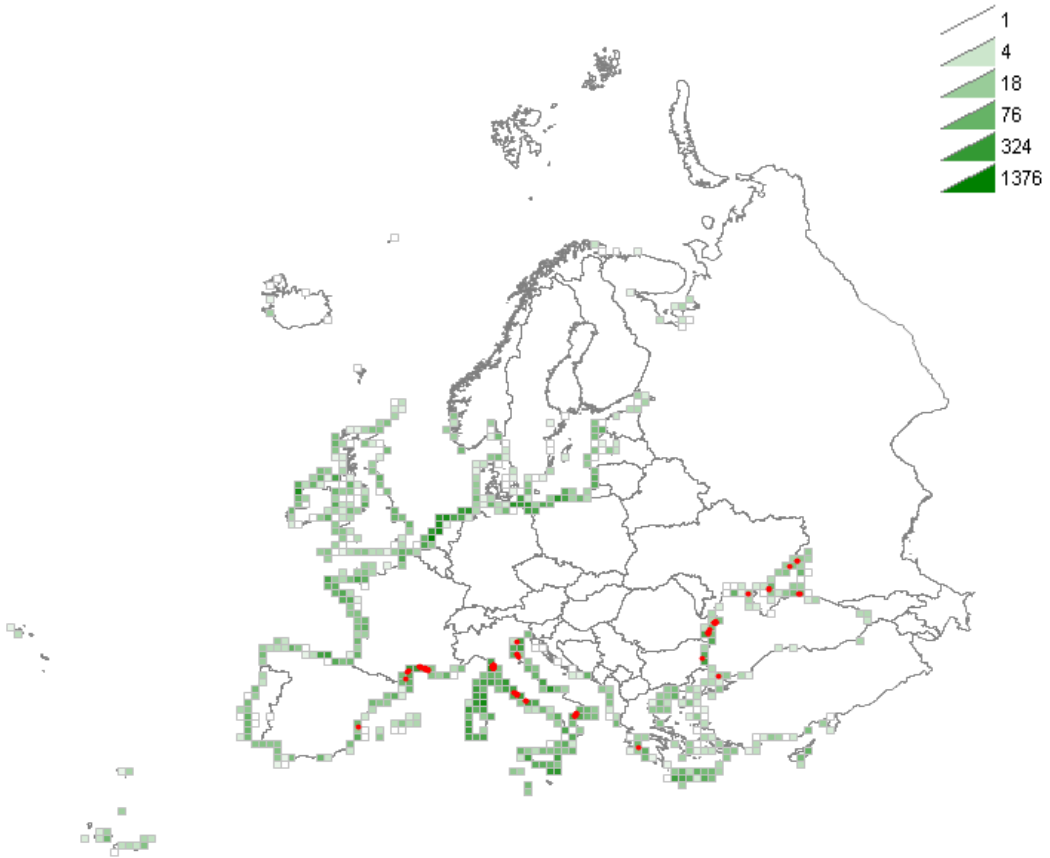


N1H Atlantic and Baltic moist and wet dune slack - suitability

Statistics from Maxent modelling

AUC training (0-1)	0.973
AUC test (0-1)	0.9781
Contribution variables to the Maxent model (%)	
Digital Elevation Map (DEM)	79.8365
Temperature seasonality (stdev * 100)	3.5324
Phenology; Length of season (days)	2.847
Potential Evapotranspiration	2.6359
Distance to water (rivers, lakes, sea)	1.8833
Precipitation seasonality (coef. of var.)	1.367
Weight in % of sand particles (0.05-2 mm)	1.2814
Bulk density (kg/m^3)	1.1789
Weight in % of clay particles (<0.0002 mm)	0.8429
Precipitation of warmest quarter	0.8306
Cation Exchange Capacity of the soil	0.8065
Phenology; Peak of season (day number)	0.6308
Phenology; Low of season (day number)	0.5267
Phenology; End of Season (day number)	0.3391
Phenology; NDVI seasonality	0.2861
Weight in % of silt particles (0.0002-0.05 mm)	0.2786
Phenology; Start of Season (day number)	0.208
Annual precipitation	0.188
Mean temperature of wettest quarter	0.1464
Solar radiation	0.1121
Volume % of coarse fragments (> 2 mm)	0.0936
Soil pH (water)	0.0653
Vegetation height (m)	0.0421
Soil organic carbon content (‰)	0.0308
Inundation; occurrence	0.0086
Phenology; NDVI mean	0.0014

N1J Mediterranean and Black Sea moist and wet dune slack - distribution

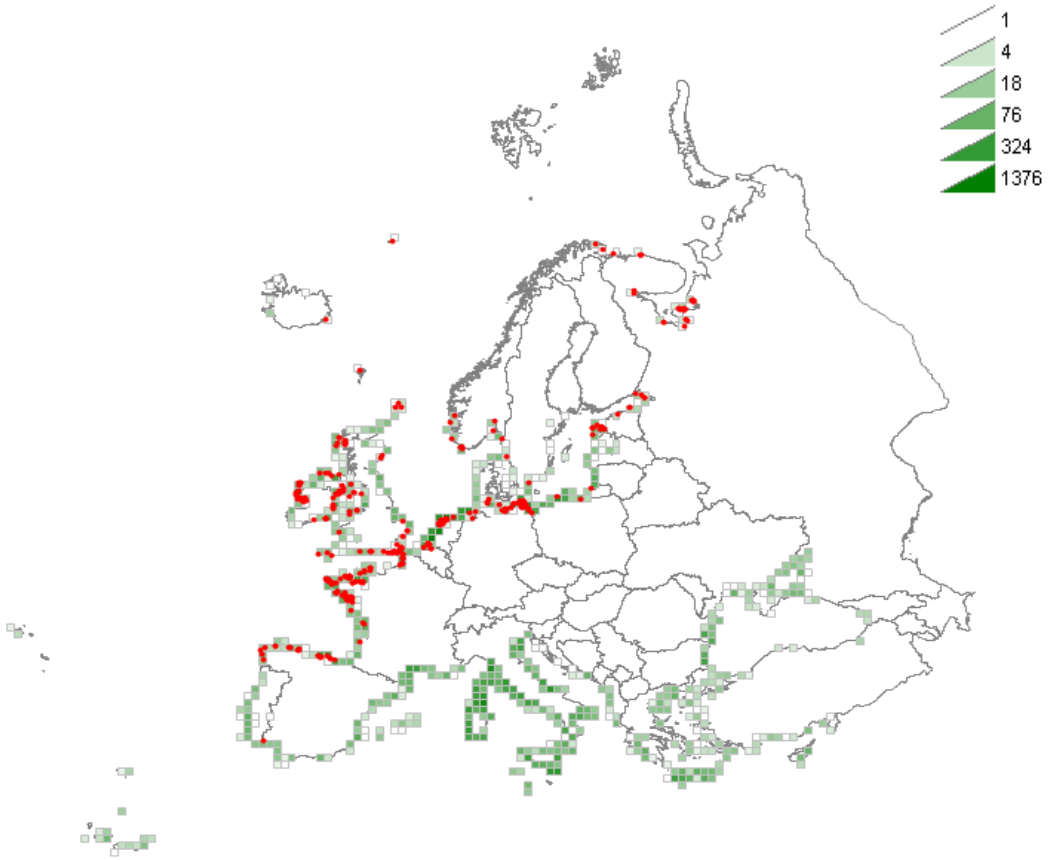


N1J Mediterranean and Black Sea moist and wet dune slack - suitability

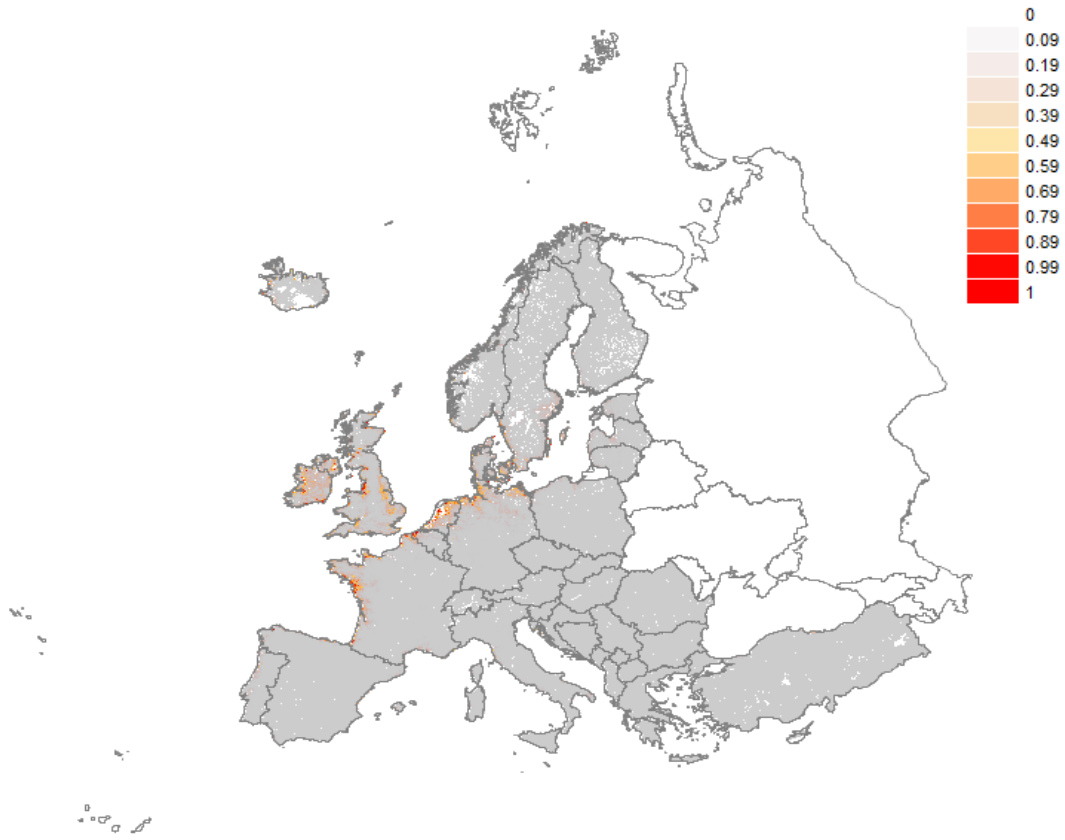
Statistics from Maxent modelling

AUC training (0-1)	0.9988
AUC test (0-1)	0.9968
Contribution variables to the Maxent model (%)	
Digital Elevation Map (DEM)	52.9187
Precipitation of warmest quarter	17.4863
Soil pH (water)	9.6852
Phenology; Low of season (day number)	6.4389
Phenology; NDVI seasonality	2.9523
Precipitation seasonality (coef. of var.)	2.7046
Volume % of coarse fragments (> 2 mm)	2.6508
Soil organic carbon content (‰)	2.5411
Phenology; End of Season (day number)	1.0959
Weight in % of clay particles (<0.0002 mm)	0.6316
Phenology; Length of season (days)	0.4564
Vegetation height (m)	0.3815
Potential Evapotranspiration	0.0461
Weight in % of silt particles (0.0002-0.05 mm)	0.0066
Distance to water (rivers, lakes, sea)	0.0038
Cation Exchange Capacity of the soil	0
Weight in % of sand particles (0.05-2 mm)	0
Annual precipitation	0
Mean temperature of wettest quarter	0
Phenology; Peak of season (day number)	0
Phenology; Start of Season (day number)	0
Inundation; occurrence	0
Temperature seasonality (stdev * 100)	0
Bulk density (kg/m^3)	0
Phenology; NDVI mean	0
Solar radiation	0

N21 Atlantic, Baltic and Arctic coastal shingle beach - distribution



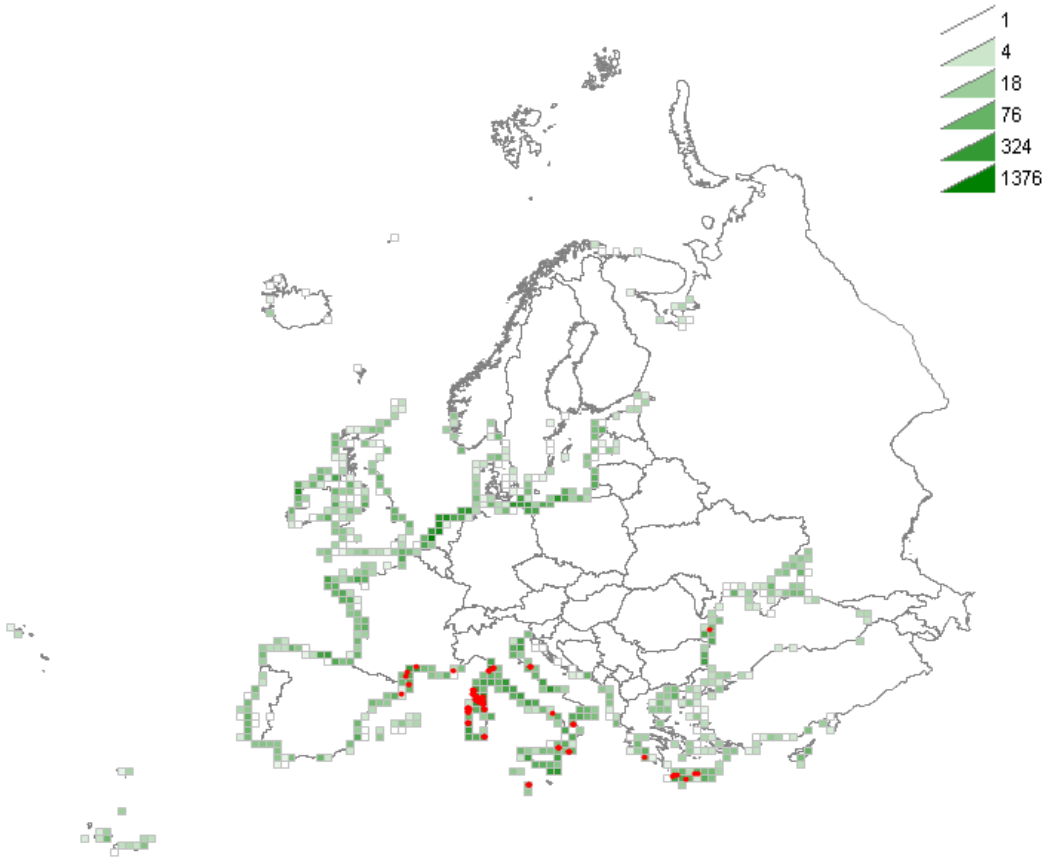
N21 Atlantic, Baltic and Arctic coastal shingle beach - suitability



Statistics from Maxent modelling

AUC training (0-1)	0.9903
AUC test (0-1)	0.9656
Contribution variables to the Maxent model (%)	
Digital Elevation Map (DEM)	63.8035
Temperature seasonality (stdev * 100)	17.7981
Weight in % of sand particles (0.05-2 mm)	3.8652
Distance to water (rivers, lakes, sea)	3.7725
Precipitation seasonality (coef. of var.)	2.1021
Precipitation of warmest quarter	1.9645
Phenology; Length of season (days)	1.7093
Phenology; NDVI mean	1.1157
Phenology; NDVI seasonality	0.8577
Bulk density (kg/m^3)	0.7581
Potential Evapotranspiration	0.5673
Vegetation height (m)	0.4198
Mean temperature of wettest quarter	0.2985
Phenology; Low of season (day number)	0.2709
Weight in % of silt particles (0.0002-0.05 mm)	0.1593
Phenology; End of Season (day number)	0.1496
Cation Exchange Capacity of the soil	0.1448
Weight in % of clay particles (<0.0002 mm)	0.0985
Soil organic carbon content (‰)	0.085
Volume % of coarse fragments (> 2 mm)	0.0449
Annual precipitation	0.013
Phenology; Peak of season (day number)	0.0015
Inundation; occurrence	0
Solar radiation	0
Phenology; Start of Season (day number)	0
Soil pH (water)	0

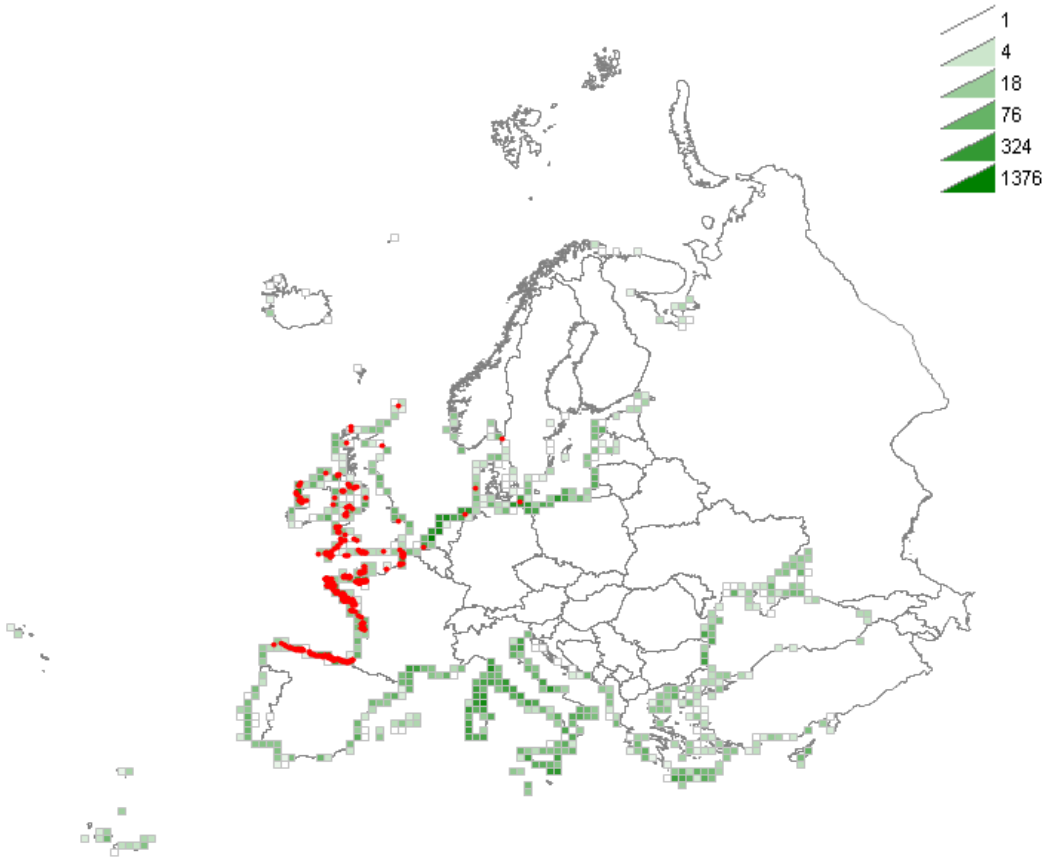
N22 Mediterranean and Black Sea coastal shingle beach - distribution



N22 Mediterranean and Black Sea coastal shingle beach - suitability

Not enough data to run a Maxent model or the habitat type only occurs outside the study area.

N31 Atlantic and Baltic rocky sea cliff and shore - distribution

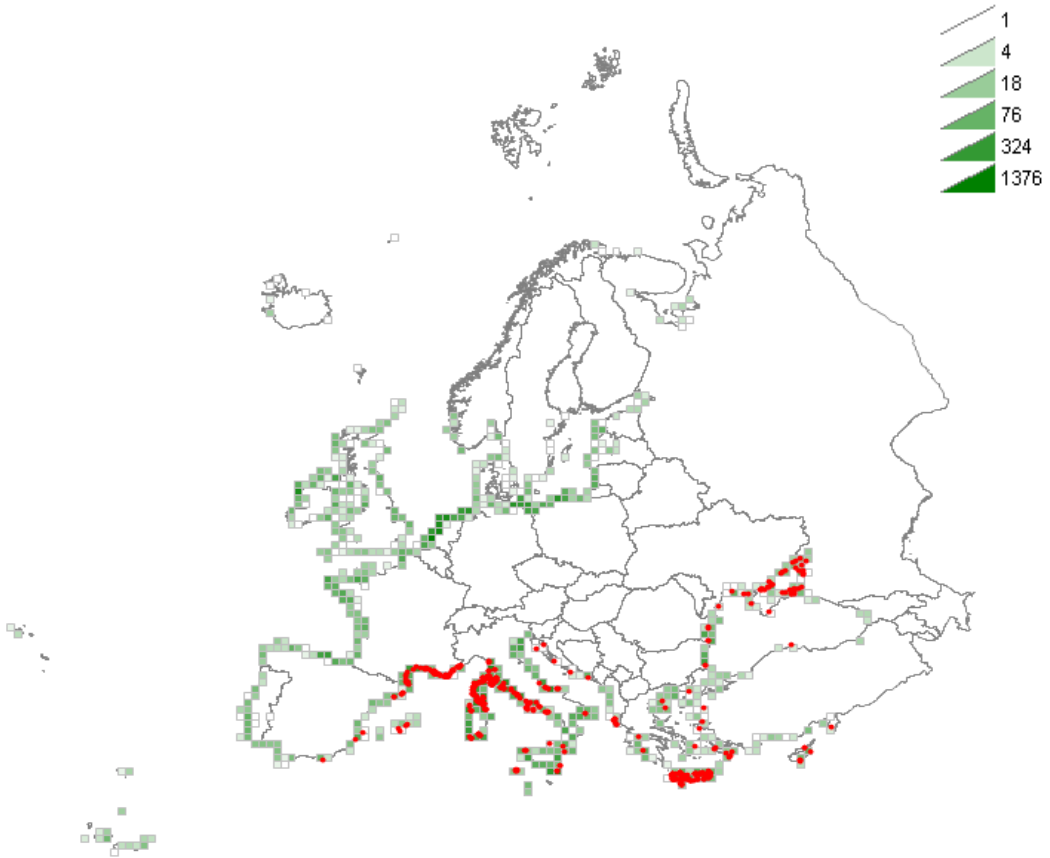


N31 Atlantic and Baltic rocky sea cliff and shore - suitability

Statistics from Maxent modelling

AUC training (0-1)	0.9914
AUC test (0-1)	0.9947
Contribution variables to the Maxent model (%)	
Temperature seasonality (stdev * 100)	48.9653
Digital Elevation Map (DEM)	23.9204
Distance to water (rivers, lakes, sea)	5.8826
Precipitation seasonality (coef. of var.)	4.705
Potential Evapotranspiration	4.2096
Precipitation of warmest quarter	3.3826
Phenology; Start of Season (day number)	3.0776
Weight in % of sand particles (0.05-2 mm)	3.0492
Cation Exchange Capacity of the soil	0.9878
Mean temperature of wettest quarter	0.4602
Phenology; Peak of season (day number)	0.3864
Phenology; NDVI mean	0.3142
Phenology; Length of season (days)	0.2202
Bulk density (kg/m^3)	0.1713
Phenology; Low of season (day number)	0.089
Phenology; NDVI seasonality	0.048
Weight in % of clay particles (<0.0002 mm)	0.0442
Vegetation height (m)	0.036
Soil organic carbon content (‰)	0.023
Phenology; End of Season (day number)	0.0102
Volume % of coarse fragments (> 2 mm)	0.009
Inundation; occurrence	0.0065
Soil pH (water)	0.0016
Solar radiation	0
Annual precipitation	0
Weight in % of silt particles (0.0002-0.05 mm)	0

N32 Mediterranean and Black Sea rocky sea cliff and shore - distribution

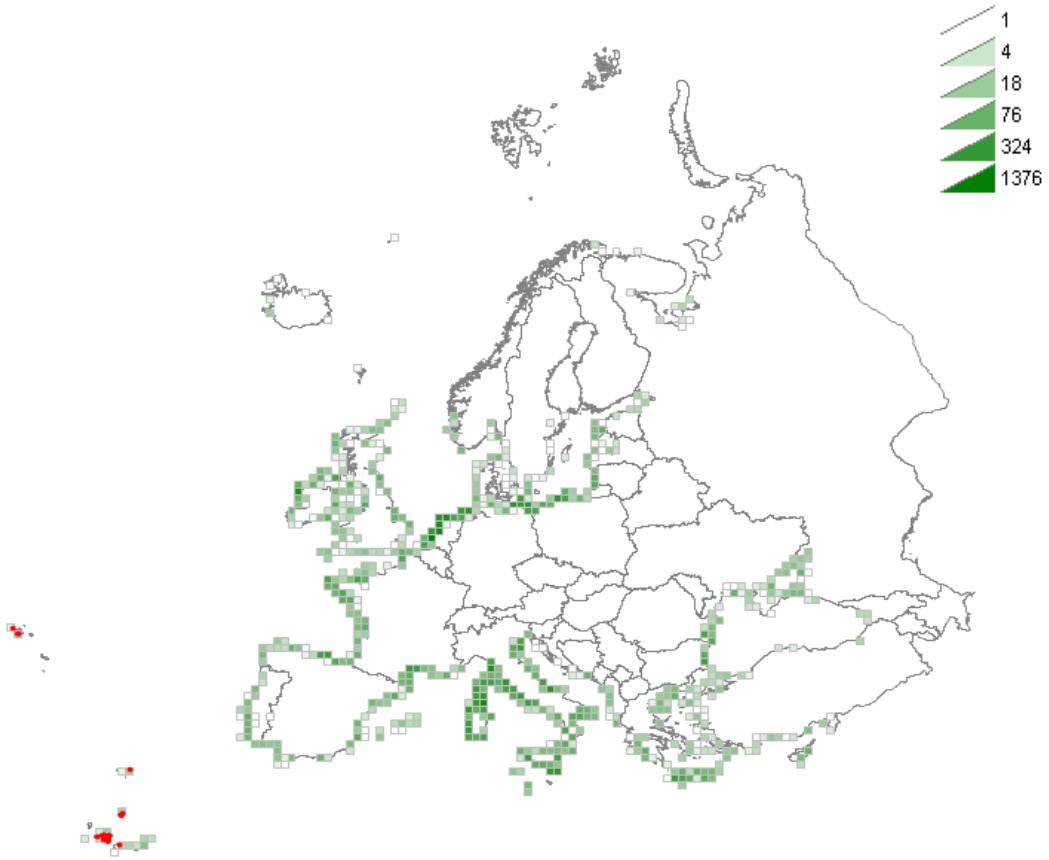


N32 Mediterranean and Black Sea rocky sea cliff and shore - suitability

Statistics from Maxent modelling

AUC training (0-1)	0.9924
AUC test (0-1)	0.9879
Contribution variables to the Maxent model (%)	
Digital Elevation Map (DEM)	27.3559
Precipitation of warmest quarter	23.5218
Phenology; Start of Season (day number)	11.2361
Weight in % of clay particles (<0.0002 mm)	8.3568
Distance to water (rivers, lakes, sea)	7.6361
Phenology; NDVI seasonality	6.9471
Soil organic carbon content (‰)	3.7203
Temperature seasonality (stdev * 100)	2.8518
Mean temperature of wettest quarter	2.597
Potential Evapotranspiration	2.3891
Soil pH (water)	1.2447
Vegetation height (m)	0.4615
Phenology; Low of season (day number)	0.3846
Annual precipitation	0.3428
Weight in % of silt particles (0.0002-0.05 mm)	0.1807
Cation Exchange Capacity of the soil	0.1774
Bulk density (kg/m^3)	0.1649
Phenology; Peak of season (day number)	0.1314
Precipitation seasonality (coef. of var.)	0.1229
Solar radiation	0.0862
Phenology; End of Season (day number)	0.0769
Phenology; NDVI mean	0.0082
Volume % of coarse fragments (> 2 mm)	0.006
Phenology; Length of season (days)	0
Inundation; occurrence	0
Weight in % of sand particles (0.05-2 mm)	0

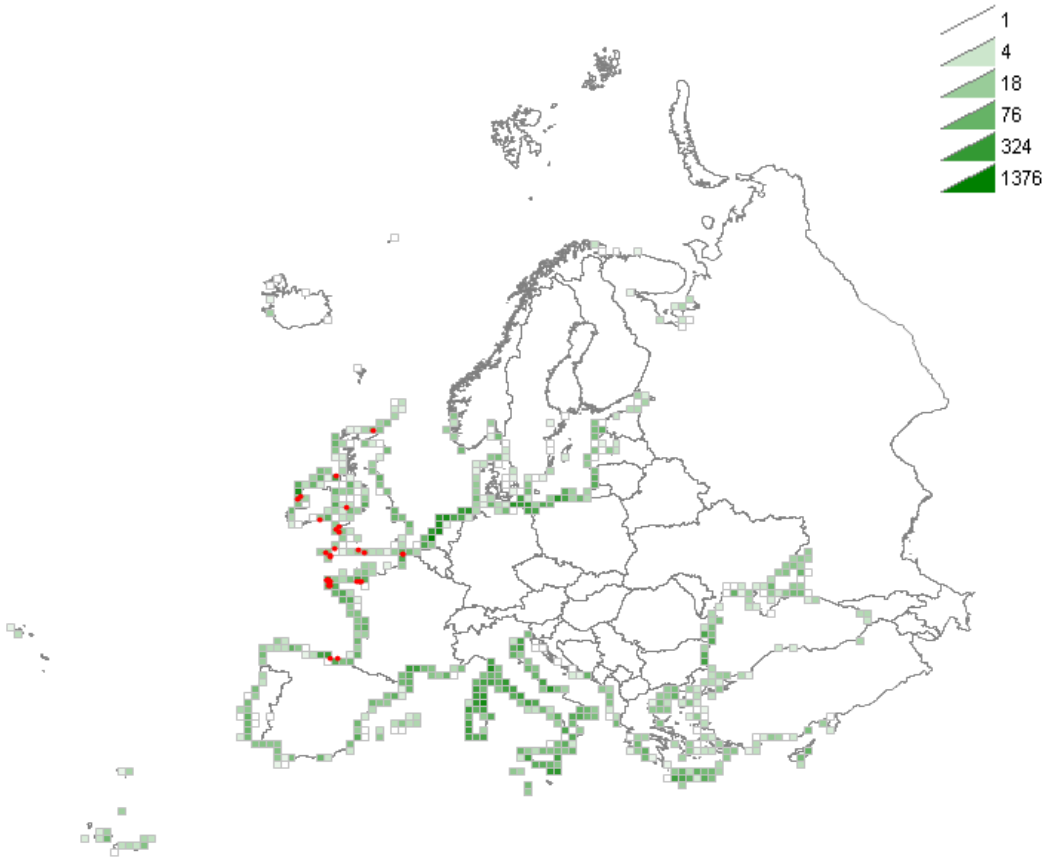
N33 Macaronesian rocky sea cliff and shore - distribution



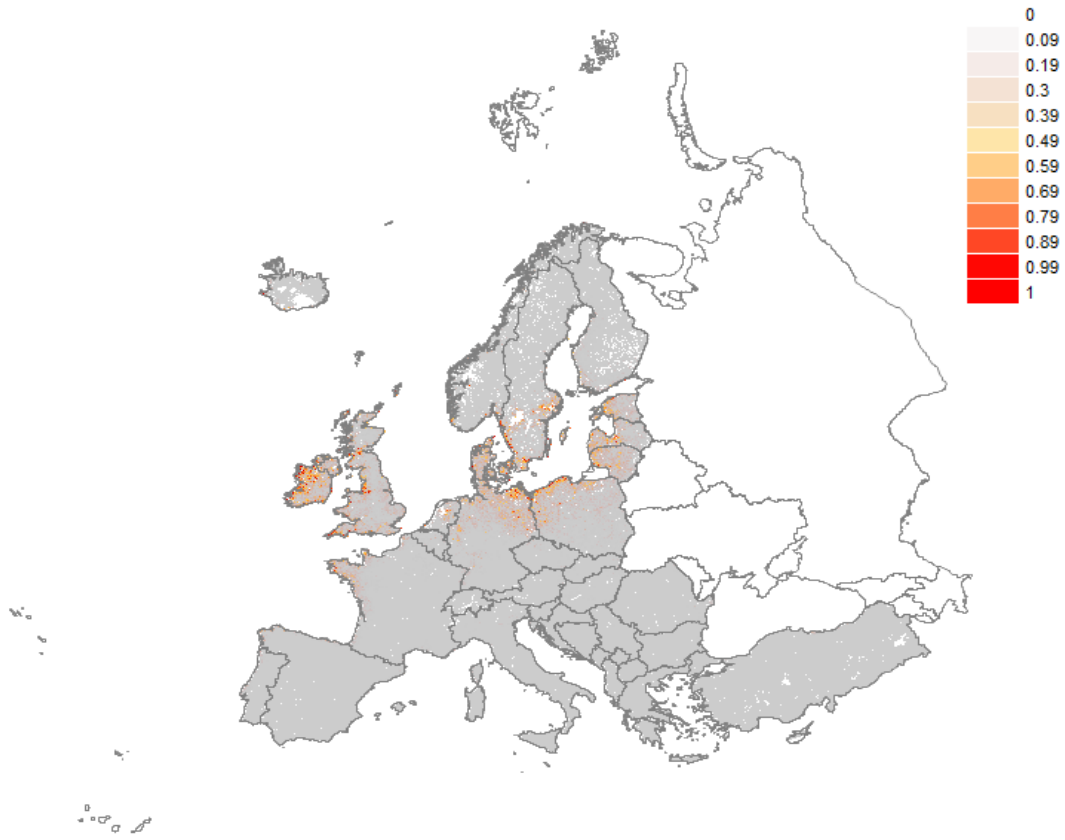
N33 Macaronesian rocky sea cliff and shore - suitability

Not enough data to run a Maxent model or the habitat type only occurs outside the study area.

N34 Atlantic and Baltic soft sea cliff - distribution

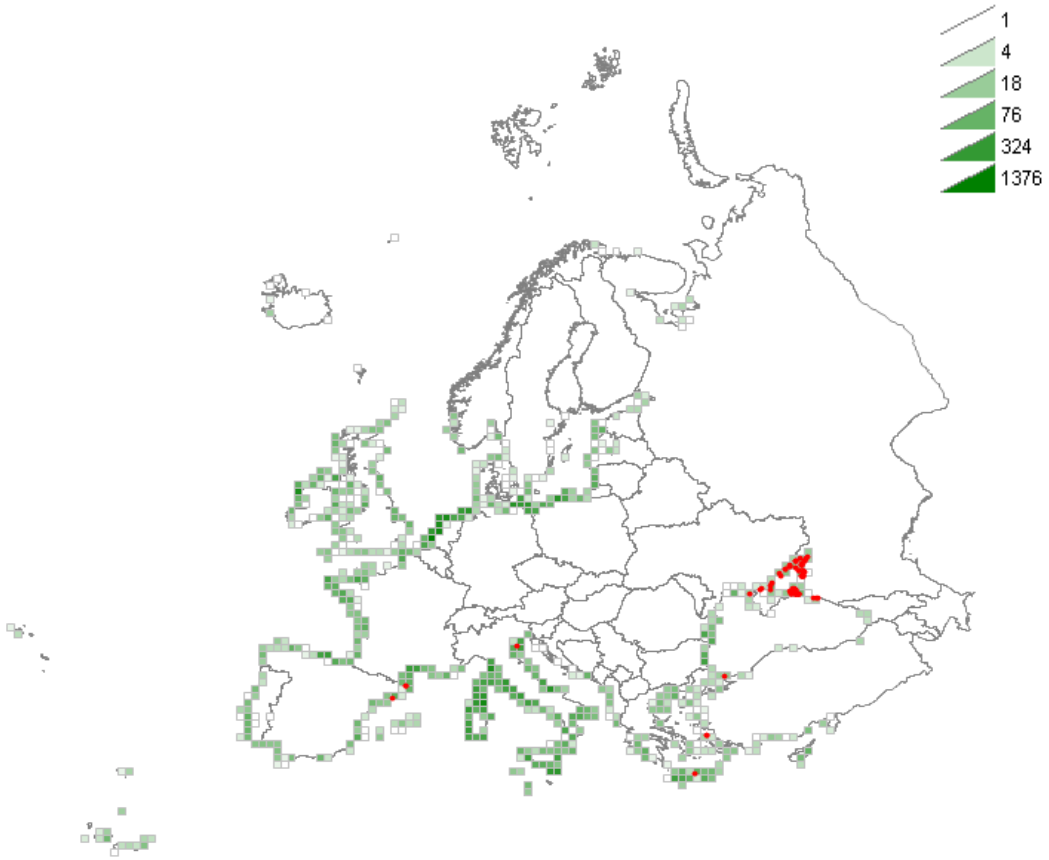


N34 Atlantic and Baltic soft sea cliff - suitability



Not enough data to run a Maxent model or the habitat type only occurs outside the study area.

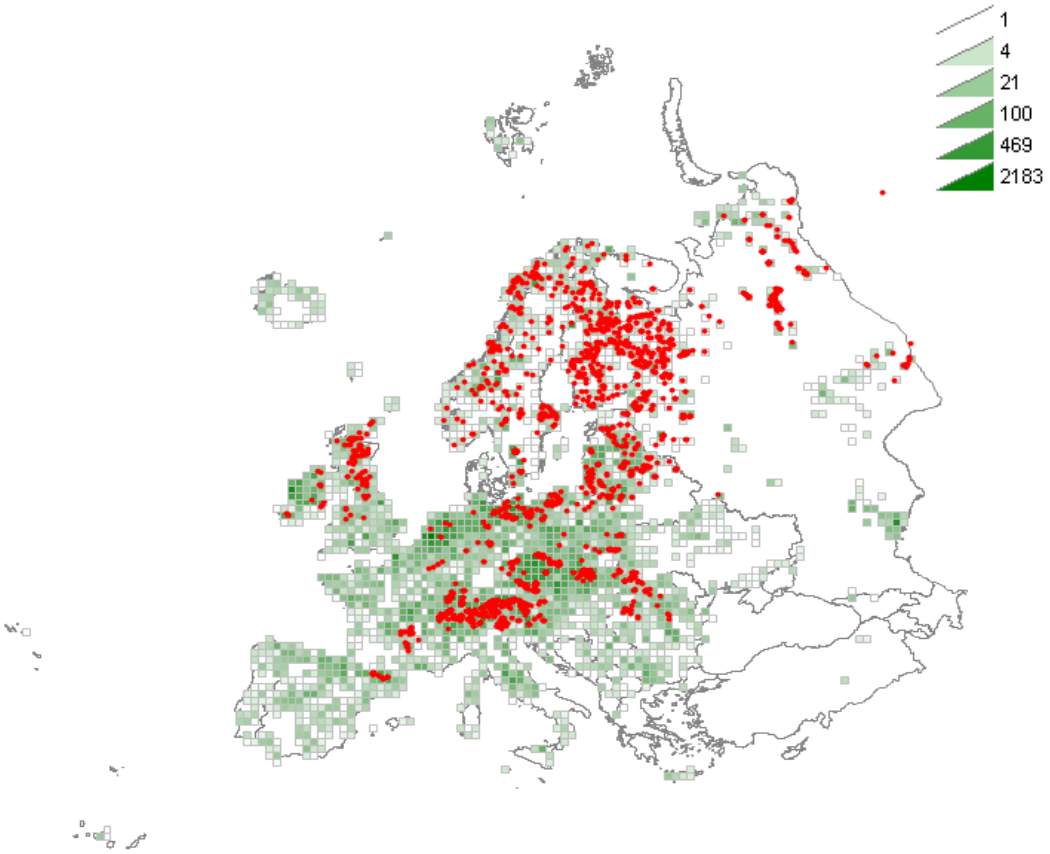
N35 Mediterranean and Black Sea soft sea cliff - distribution



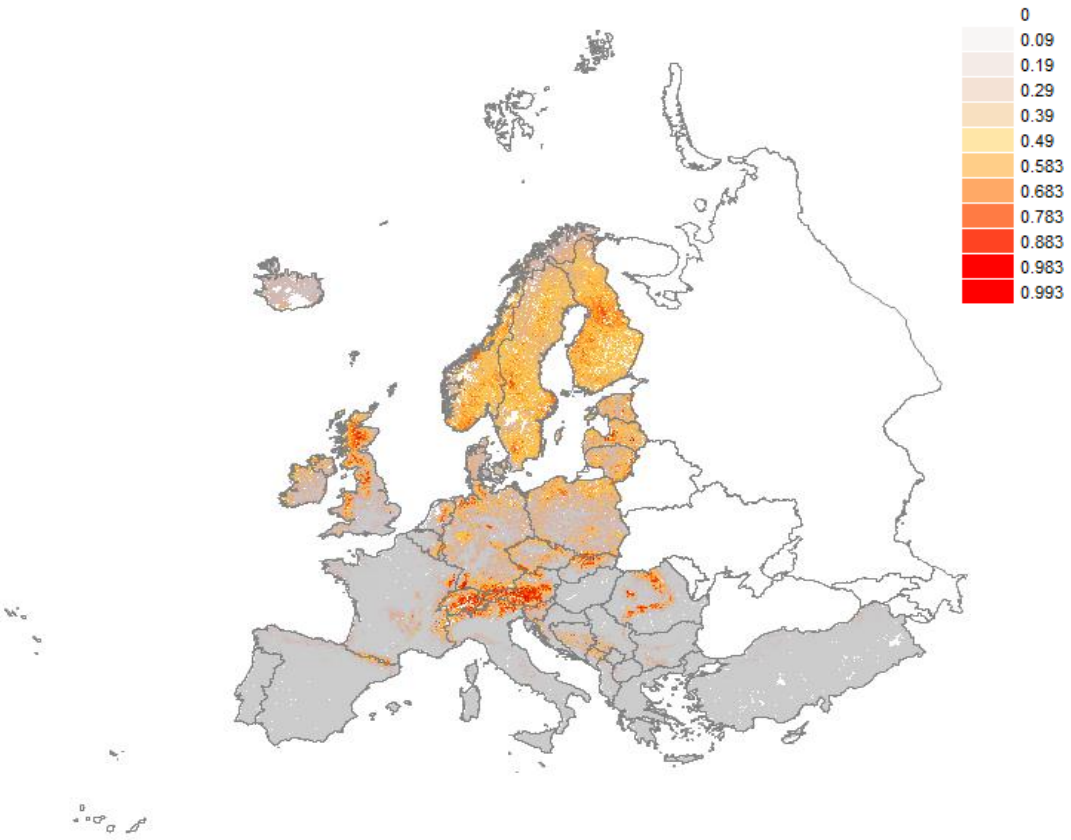
N35 Mediterranean and Black Sea soft sea cliff - suitability

Not enough data to run a Maxent model or the habitat type only occurs outside the study area.

Q11 Raised bog - distribution



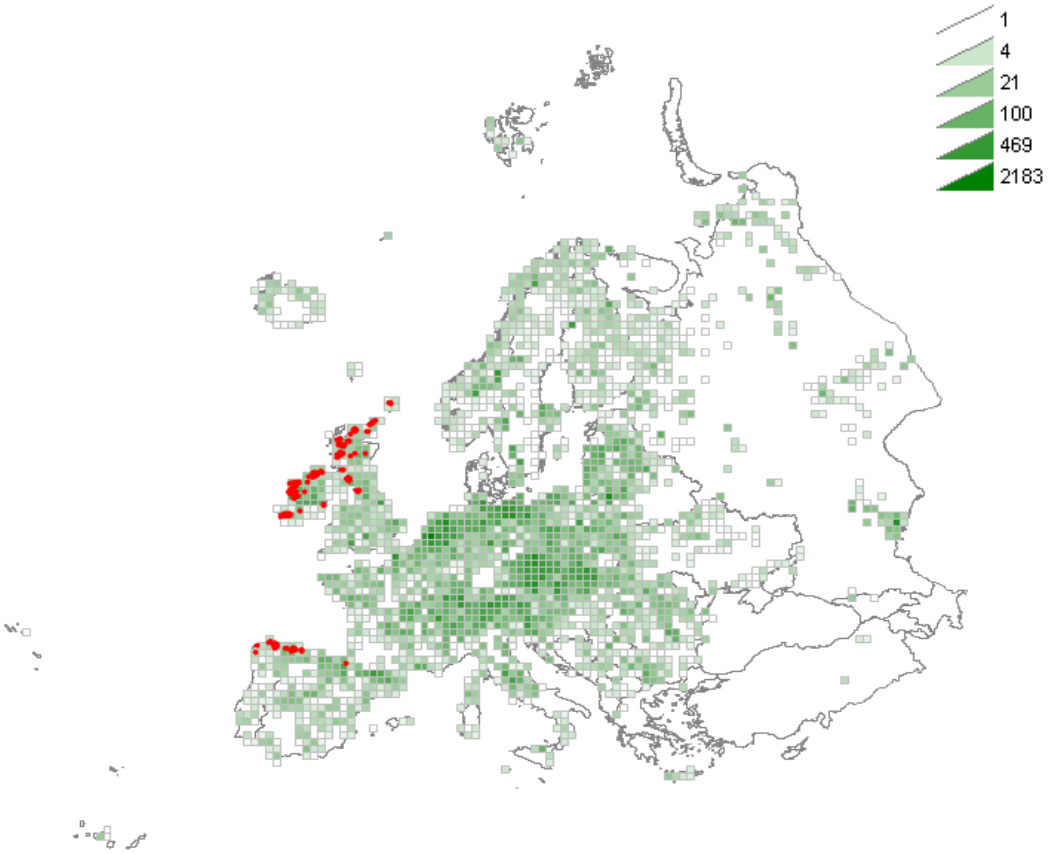
Q11 Raised bog - suitability



Statistics from Maxent modelling

AUC training (0-1)	0.841
AUC test (0-1)	0.8358
Contribution variables to the Maxent model (%)	
Soil organic carbon content (‰)	40.9458
Soil pH (water)	21.4337
Precipitation of warmest quarter	14.5746
Potential Evapotranspiration	7.954
Phenology; End of Season (day number)	2.5756
Phenology; NDVI mean	1.4313
Mean temperature of wettest quarter	1.2788
Solar radiation	1.0949
Annual precipitation	1.0806
Vegetation height (m)	1.0694
Digital Elevation Map (DEM)	1.0332
Volume % of coarse fragments (> 2 mm)	0.9787
Temperature seasonality (stdev * 100)	0.9763
Phenology; Low of season (day number)	0.9316
Phenology; Peak of season (day number)	0.8836
Phenology; Start of Season (day number)	0.6802
Weight in % of clay particles (<0.0002 mm)	0.3693
Cation Exchange Capacity of the soil	0.1997
Precipitation seasonality (coef. of var.)	0.155
Weight in % of sand particles (0.05-2 mm)	0.1311
Phenology; Length of season (days)	0.0846
Phenology; NDVI seasonality	0.0573
Weight in % of silt particles (0.0002-0.05 mm)	0.0359
Bulk density (kg/m^3)	0.033
Inundation; occurrence	0.0075
Distance to water (rivers, lakes, sea)	0.0043

Q12 Blanket bog - distribution

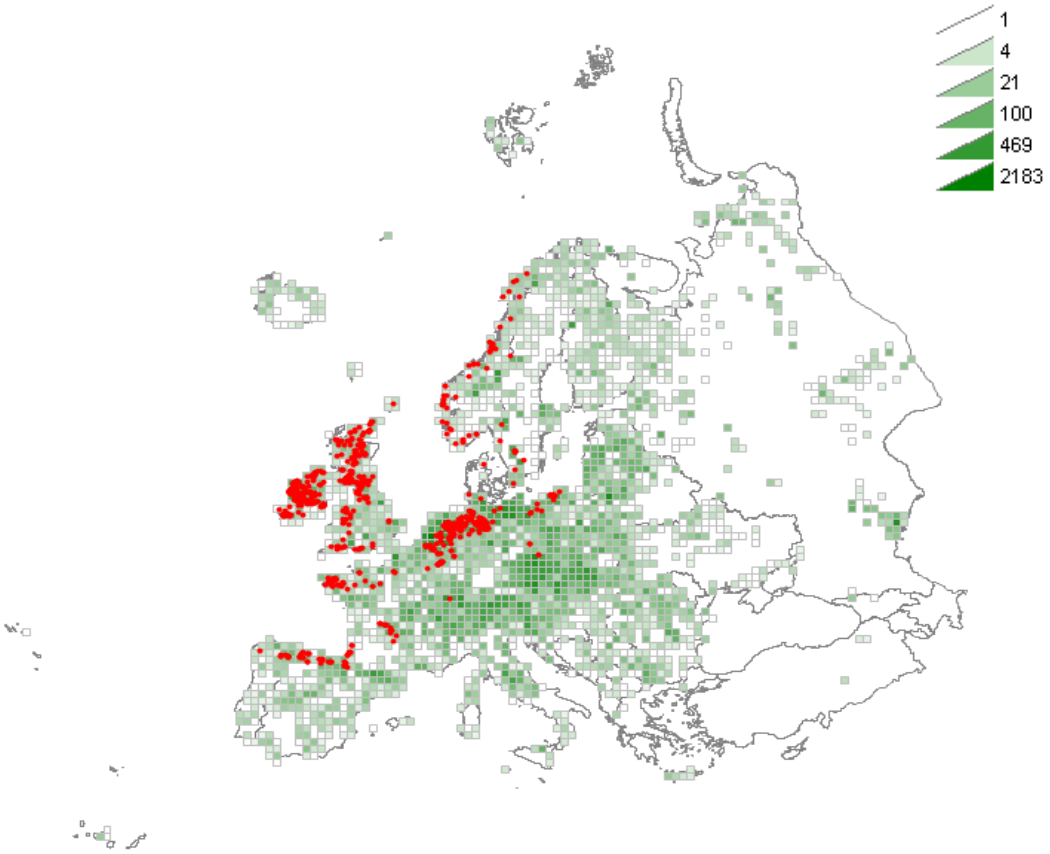


Q12 Blanket bog - suitability

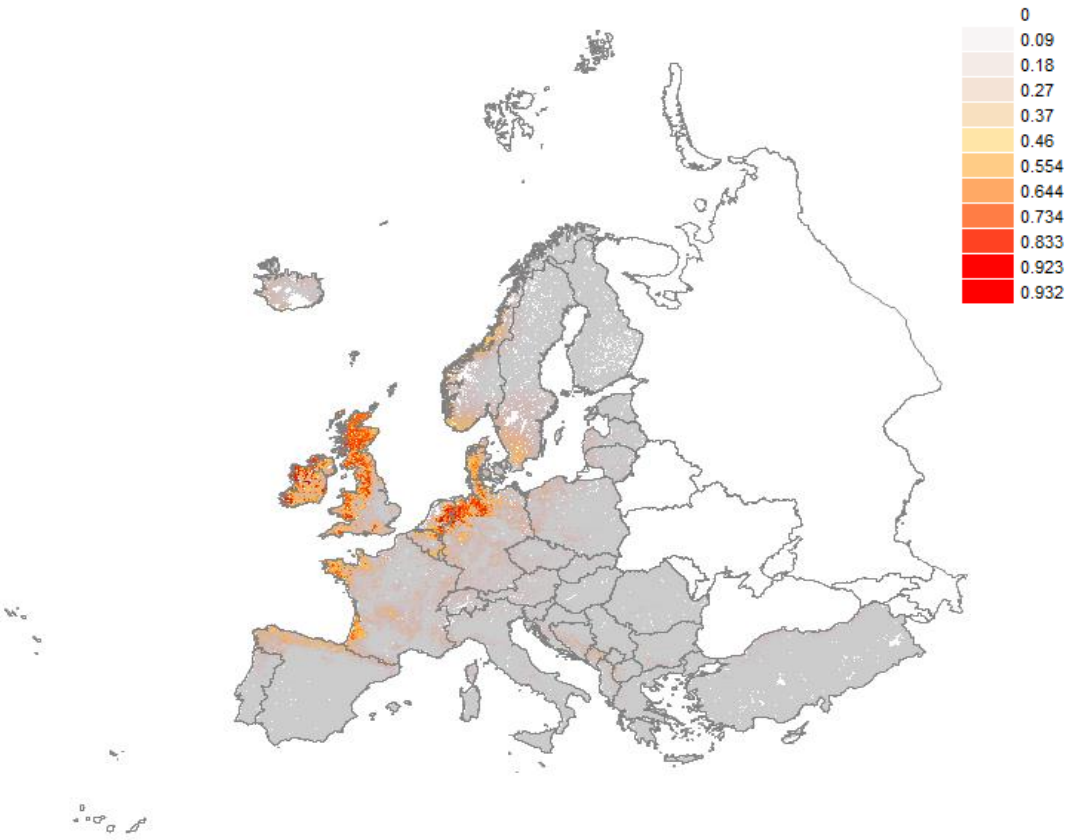
Statistics from Maxent modelling

AUC training (0-1)	0.973
AUC test (0-1)	0.9704
Contribution variables to the Maxent model (%)	
Temperature seasonality (stdev * 100)	81.4626
Soil organic carbon content (‰)	3.6327
Potential Evapotranspiration	2.67
Bulk density (kg/m³)	2.0014
Precipitation seasonality (coef. of var.)	1.6565
Precipitation of warmest quarter	1.3469
Phenology; NDVI mean	1.312
Solar radiation	1.0589
Vegetation height (m)	1.0554
Annual precipitation	0.8384
Soil pH (water)	0.8019
Phenology; Length of season (days)	0.518
Weight in % of silt particles (0.0002-0.05 mm)	0.2846
Weight in % of clay particles (<0.0002 mm)	0.2074
Volume % of coarse fragments (> 2 mm)	0.2015
Phenology; End of Season (day number)	0.1958
Weight in % of sand particles (0.05-2 mm)	0.1819
Phenology; Low of season (day number)	0.1689
Phenology; NDVI seasonality	0.1555
Phenology; Start of Season (day number)	0.0864
Phenology; Peak of season (day number)	0.0586
Cation Exchange Capacity of the soil	0.0519
Mean temperature of wettest quarter	0.0294
Distance to water (rivers, lakes, sea)	0.0117
Digital Elevation Map (DEM)	0.0119
Inundation; occurrence	0

Q21 Oceanic valley mire - distribution



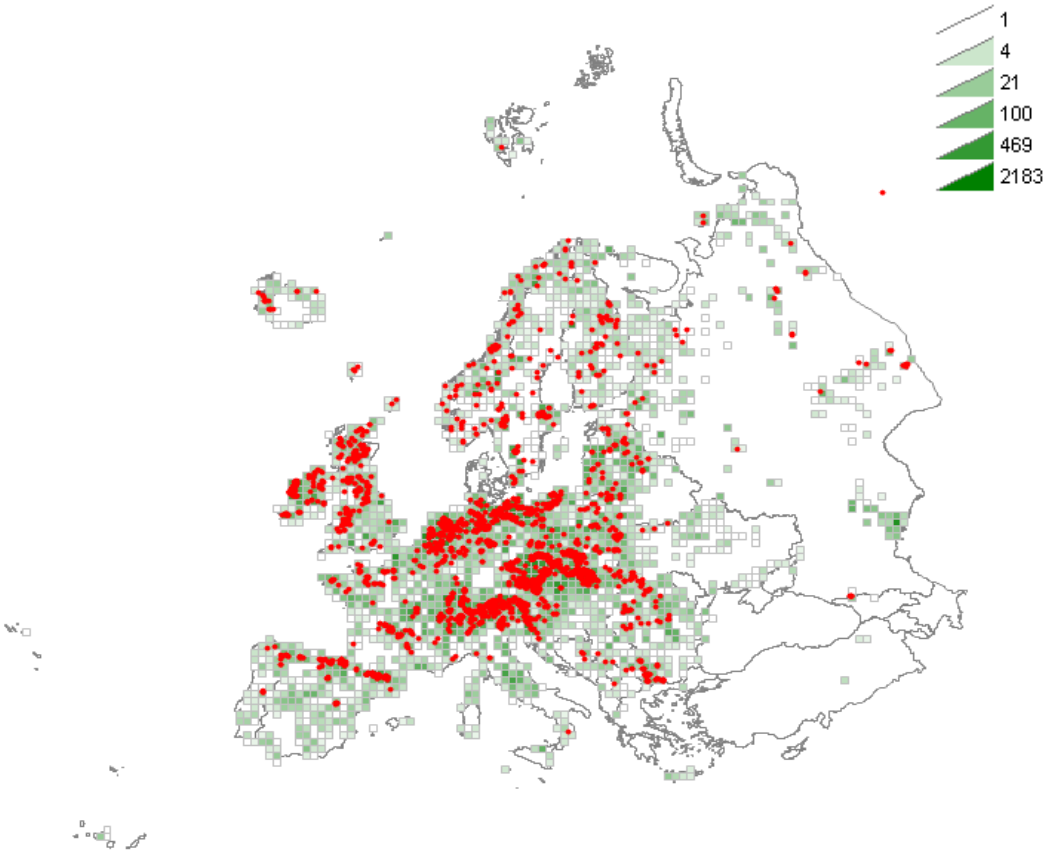
Q21 Oceanic valley mire - suitability



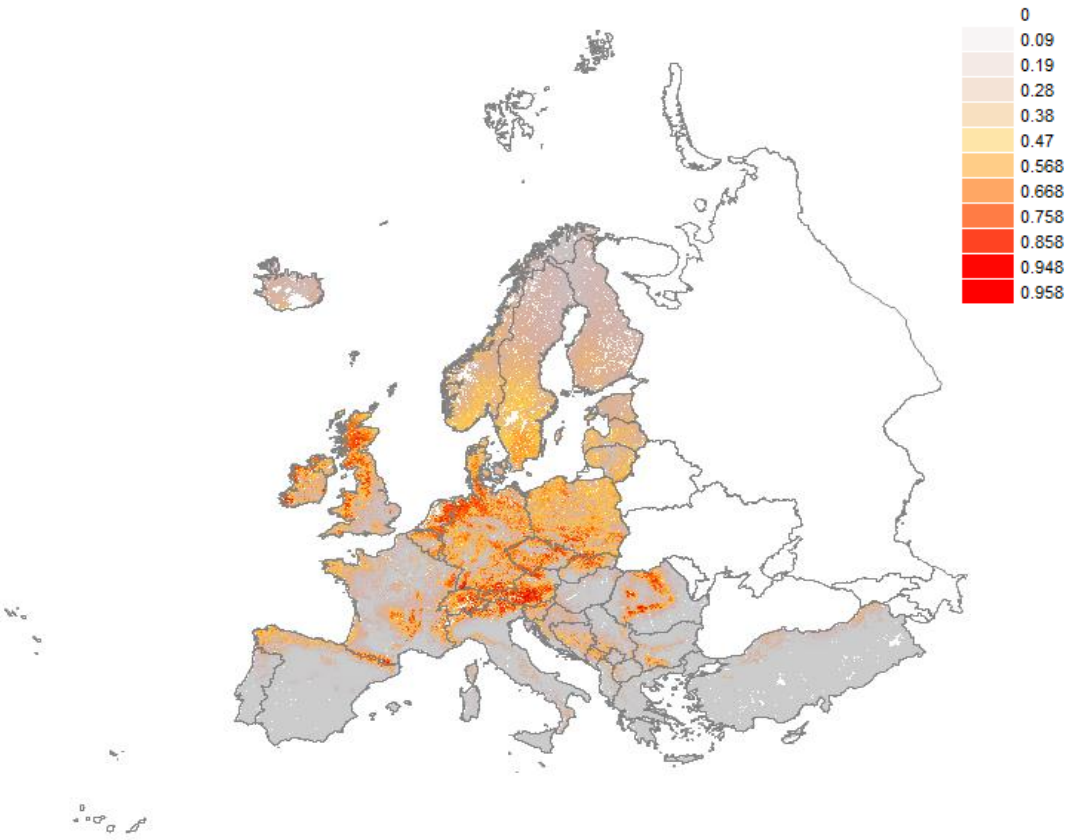
Statistics from Maxent modelling

AUC training (0-1)	0.9142
AUC test (0-1)	0.9217
Contribution variables to the Maxent model (%)	
Temperature seasonality (stdev * 100)	48.5436
Soil pH (water)	25.4206
Weight in % of silt particles (0.0002-0.05 mm)	7.1107
Potential Evapotranspiration	5.0901
Phenology; Low of season (day number)	3.8152
Digital Elevation Map (DEM)	1.7162
Bulk density (kg/m^3)	1.0119
Phenology; NDVI mean	0.8606
Precipitation of warmest quarter	0.7649
Phenology; Peak of season (day number)	0.7143
Soil organic carbon content (‰)	0.6866
Vegetation height (m)	0.5614
Mean temperature of wettest quarter	0.5403
Solar radiation	0.4817
Phenology; End of Season (day number)	0.4631
Annual precipitation	0.4354
Weight in % of clay particles (<0.0002 mm)	0.3859
Phenology; Start of Season (day number)	0.3585
Precipitation seasonality (coef. of var.)	0.3501
Cation Exchange Capacity of the soil	0.3041
Weight in % of sand particles (0.05-2 mm)	0.298
Volume % of coarse fragments (> 2 mm)	0.0281
Phenology; NDVI seasonality	0.025
Distance to water (rivers, lakes, sea)	0.0239
Phenology; Length of season (days)	0.0051
Inundation; occurrence	0.0046

Q22 Poor fen - distribution



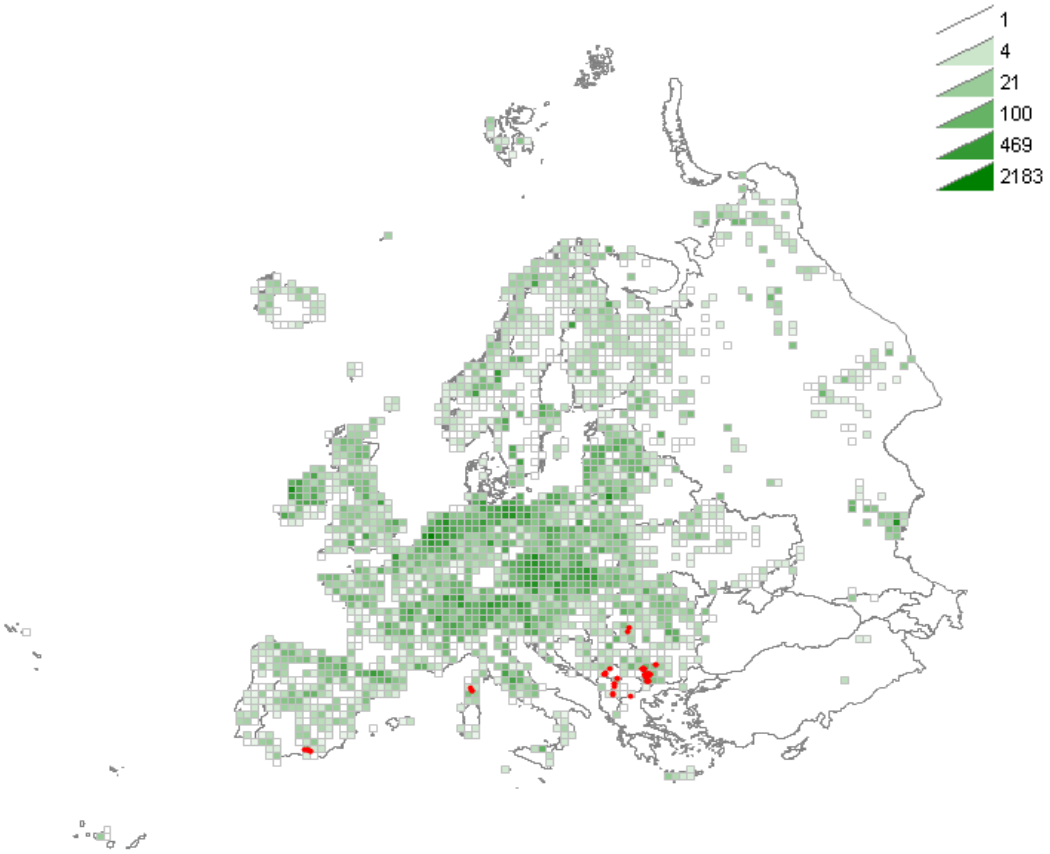
Q22 Poor fen - suitability



Statistics from Maxent modelling

AUC training (0-1)	0.7898
AUC test (0-1)	0.7784
Contribution variables to the Maxent model (%)	
Soil pH (water)	46.0719
Precipitation of warmest quarter	22.3043
Potential Evapotranspiration	10.3374
Temperature seasonality (stdev * 100)	9.3667
Phenology; Length of season (days)	2.3554
Weight in % of sand particles (0.05-2 mm)	1.6859
Digital Elevation Map (DEM)	1.5048
Phenology; End of Season (day number)	1.1047
Weight in % of clay particles (<0.0002 mm)	1.0899
Phenology; Peak of season (day number)	0.8574
Vegetation height (m)	0.7626
Phenology; Low of season (day number)	0.502
Annual precipitation	0.4135
Phenology; NDVI mean	0.3086
Bulk density (kg/m³)	0.2613
Phenology; NDVI seasonality	0.216
Volume % of coarse fragments (> 2 mm)	0.2165
Weight in % of silt particles (0.0002-0.05 mm)	0.1557
Precipitation seasonality (coef. of var.)	0.1346
Soil organic carbon content (‰)	0.1103
Distance to water (rivers, lakes, sea)	0.0689
Phenology; Start of Season (day number)	0.0561
Mean temperature of wettest quarter	0.0549
Cation Exchange Capacity of the soil	0.0382
Solar radiation	0.0176
Inundation; occurrence	0.0051

Q23 Relict mire of Mediterranean mountains - distribution

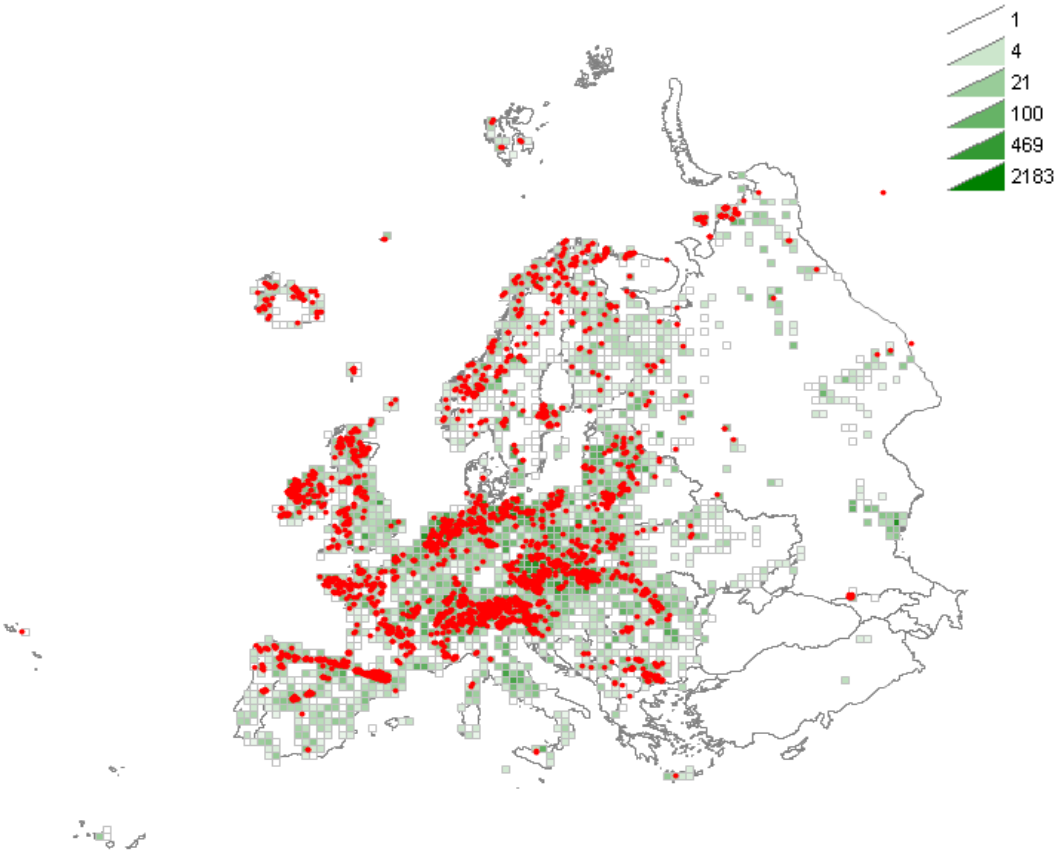


Q23 Relict mire of Mediterranean mountains - suitability

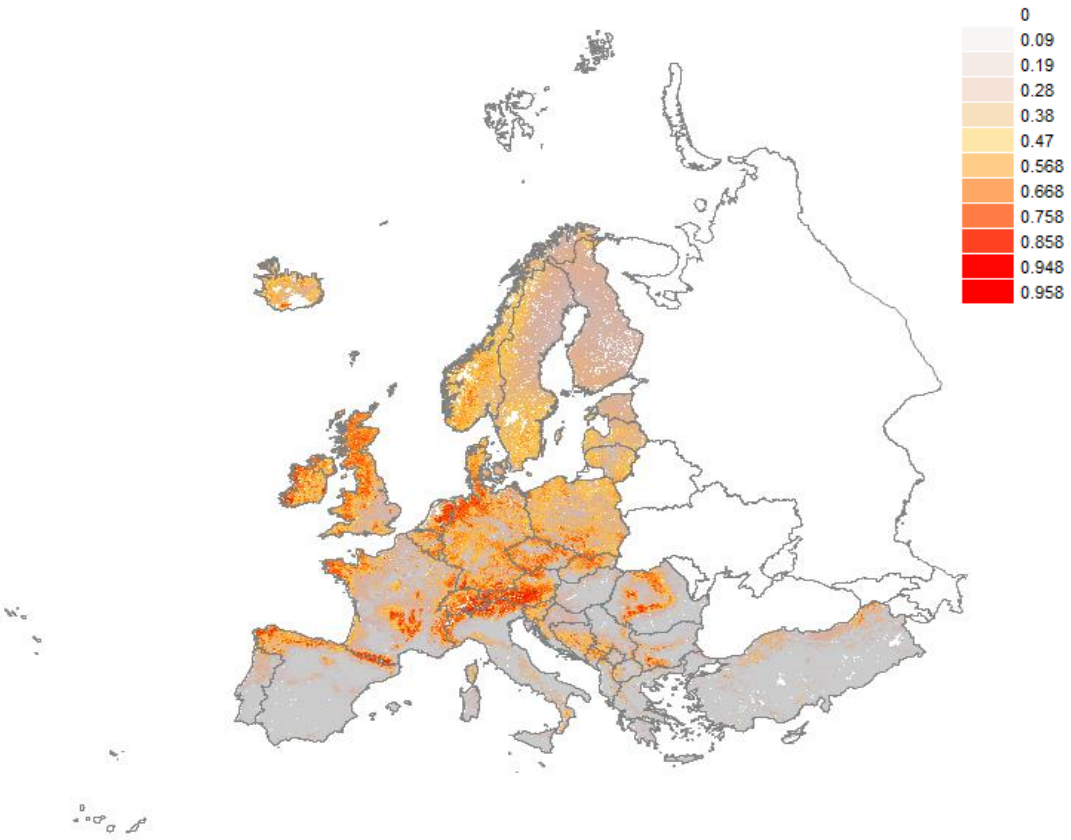
Statistics from Maxent modelling

AUC training (0-1)	0.9928
AUC test (0-1)	0.9904
Contribution variables to the Maxent model (%)	
Digital Elevation Map (DEM)	72.4598
Precipitation of warmest quarter	12.5889
Soil pH (water)	6.6011
Temperature seasonality (stdev * 100)	5.8068
Mean temperature of wettest quarter	0.8896
Potential Evapotranspiration	0.5582
Precipitation seasonality (coef. of var.)	0.2143
Phenology; End of Season (day number)	0.1994
Solar radiation	0.1691
Weight in % of clay particles (<0.0002 mm)	0.1012
Weight in % of sand particles (0.05-2 mm)	0.0989
Annual precipitation	0.0968
Volume % of coarse fragments (> 2 mm)	0.0827
Phenology; Start of Season (day number)	0.0412
Distance to water (rivers, lakes, sea)	0.0365
Phenology; Low of season (day number)	0.0241
Phenology; NDVI mean	0.0133
Vegetation height (m)	0.0058
Phenology; Length of season (days)	0.0042
Phenology; NDVI seasonality	0.0029
Cation Exchange Capacity of the soil	0.0028
Phenology; Peak of season (day number)	0.0014
Soil organic carbon content (‰)	0.0006
Weight in % of silt particles (0.0002-0.05 mm)	0
Inundation; occurrence	0
Bulk density (kg/m^3)	0

Q24 Intermediate fen and soft-water spring mire - distribution



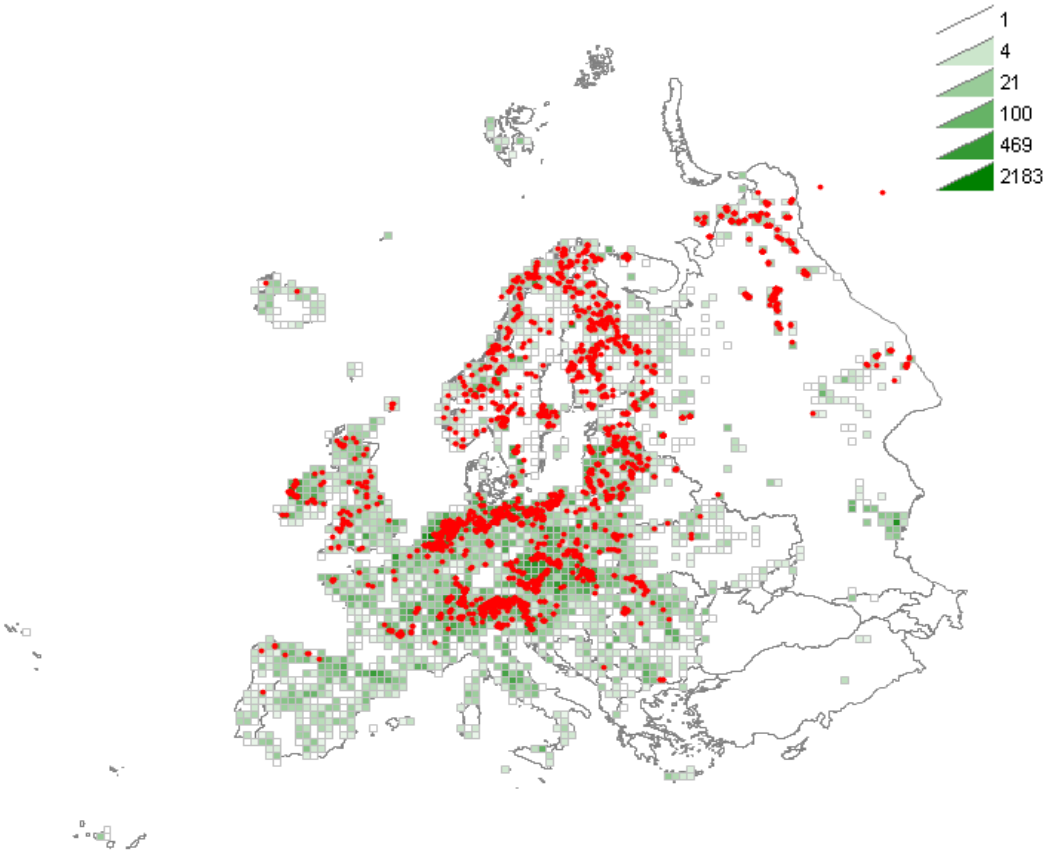
Q24 Intermediate fen and soft-water spring mire - suitability



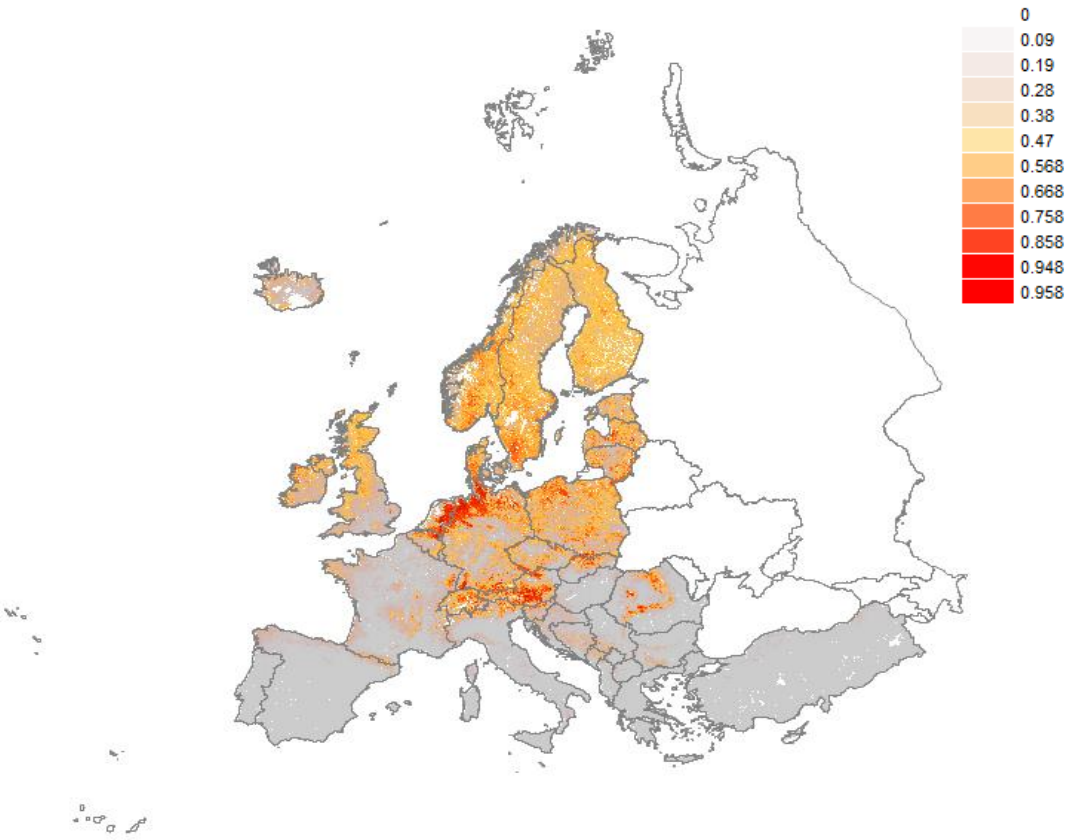
Statistics from Maxent modelling

AUC training (0-1)	0.7588
AUC test (0-1)	0.7437
Contribution variables to the Maxent model (%)	
Soil pH (water)	53.713
Temperature seasonality (stdev * 100)	11.7595
Bulk density (kg/m^3)	10.3048
Precipitation of warmest quarter	7.3397
Potential Evapotranspiration	5.1934
Digital Elevation Map (DEM)	2.9108
Annual precipitation	2.243
Weight in % of clay particles (<0.0002 mm)	0.8738
Solar radiation	0.832
Phenology; Length of season (days)	0.6033
Volume % of coarse fragments (> 2 mm)	0.5362
Vegetation height (m)	0.522
Distance to water (rivers, lakes, sea)	0.4475
Weight in % of sand particles (0.05-2 mm)	0.4147
Phenology; Start of Season (day number)	0.4038
Soil organic carbon content (‰)	0.3932
Phenology; End of Season (day number)	0.3827
Phenology; Peak of season (day number)	0.2813
Weight in % of silt particles (0.0002-0.05 mm)	0.2114
Phenology; Low of season (day number)	0.207
Phenology; NDVI mean	0.1778
Inundation; occurrence	0.1047
Phenology; NDVI seasonality	0.0572
Mean temperature of wettest quarter	0.0479
Precipitation seasonality (coef. of var.)	0.0349
Cation Exchange Capacity of the soil	0.0044

Q25 Non-calcareous quaking mire - distribution



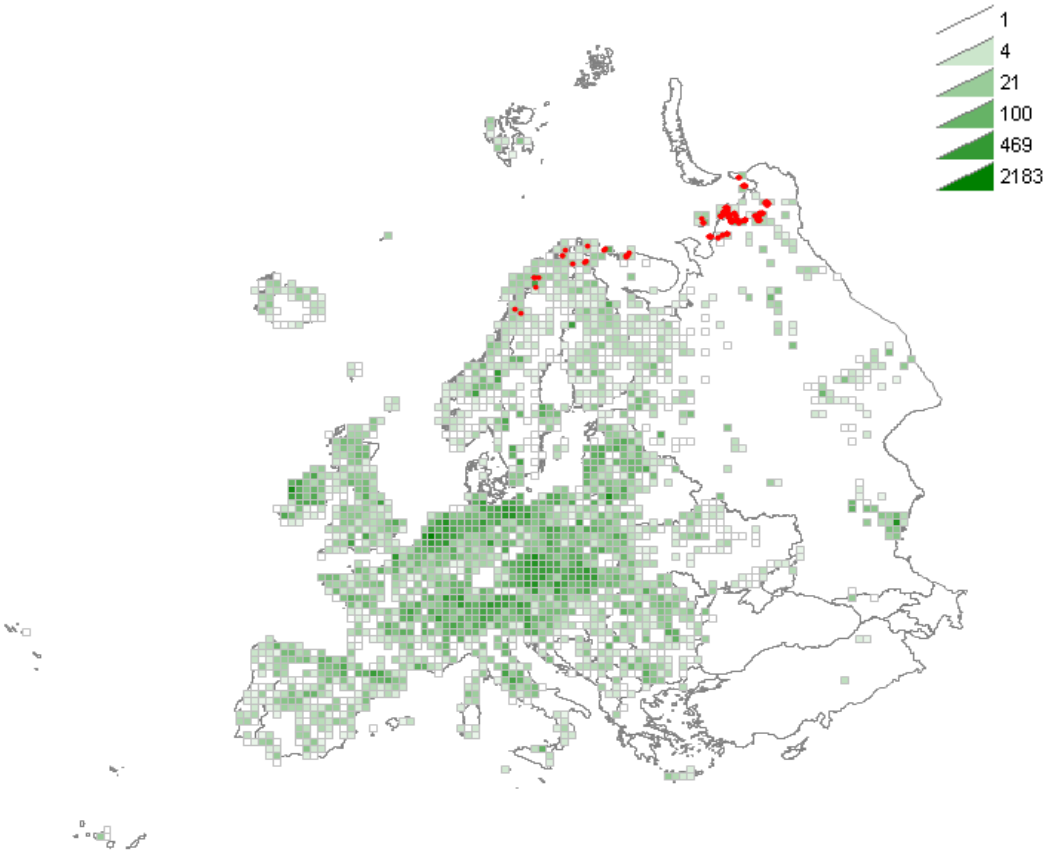
Q25 Non-calcareous quaking mire - suitability



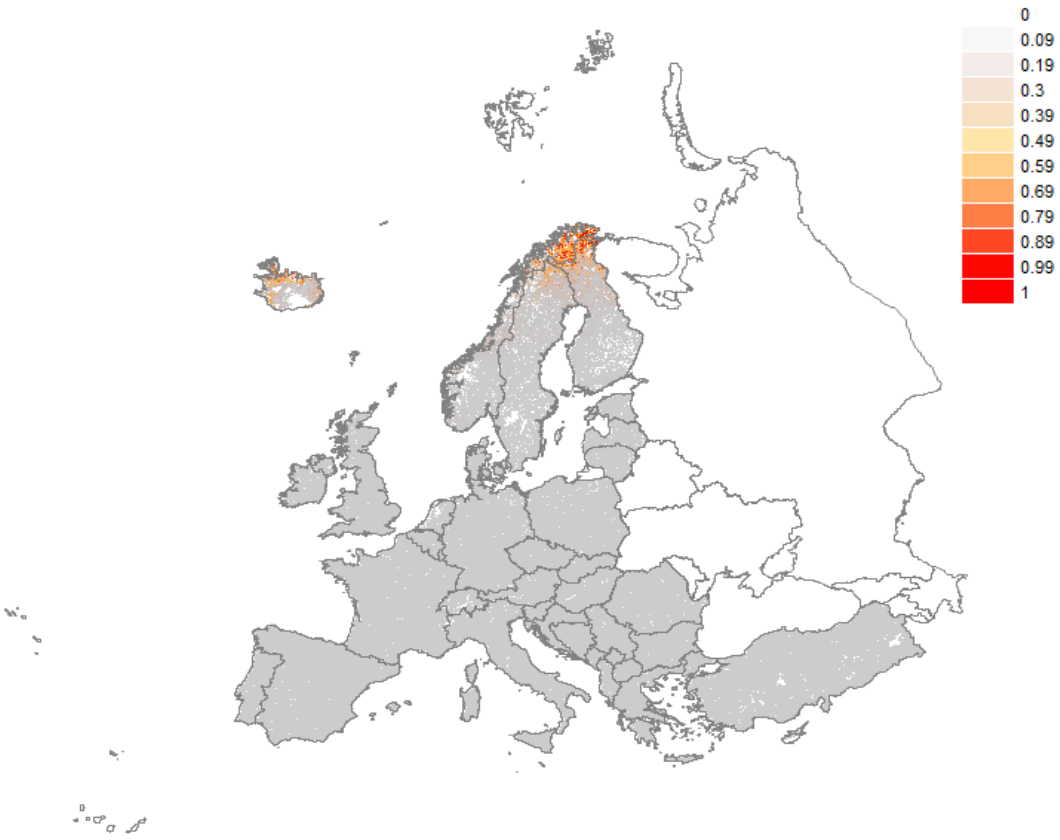
Statistics from Maxent modelling

AUC training (0-1)	0.8026
AUC test (0-1)	0.7974
Contribution variables to the Maxent model (%)	
Soil pH (water)	47.9096
Precipitation of warmest quarter	19.4402
Potential Evapotranspiration	10.3876
Weight in % of sand particles (0.05-2 mm)	4.865
Digital Elevation Map (DEM)	3.9693
Weight in % of clay particles (<0.0002 mm)	2.4312
Mean temperature of wettest quarter	1.4129
Phenology; NDVI mean	1.4063
Bulk density (kg/m³)	1.3728
Weight in % of silt particles (0.0002-0.05 mm)	1.2286
Phenology; Peak of season (day number)	1.1006
Temperature seasonality (stdev * 100)	1.0324
Annual precipitation	0.9551
Solar radiation	0.6951
Phenology; Low of season (day number)	0.4591
Vegetation height (m)	0.4474
Volume % of coarse fragments (> 2 mm)	0.4391
Precipitation seasonality (coef. of var.)	0.1083
Phenology; NDVI seasonality	0.0805
Distance to water (rivers, lakes, sea)	0.0804
Inundation; occurrence	0.0416
Phenology; Start of Season (day number)	0.0383
Phenology; End of Season (day number)	0.0374
Cation Exchange Capacity of the soil	0.0276
Phenology; Length of season (days)	0.0171
Soil organic carbon content (‰)	0.0165

Q3132 Palsa and polygon mires - distribution



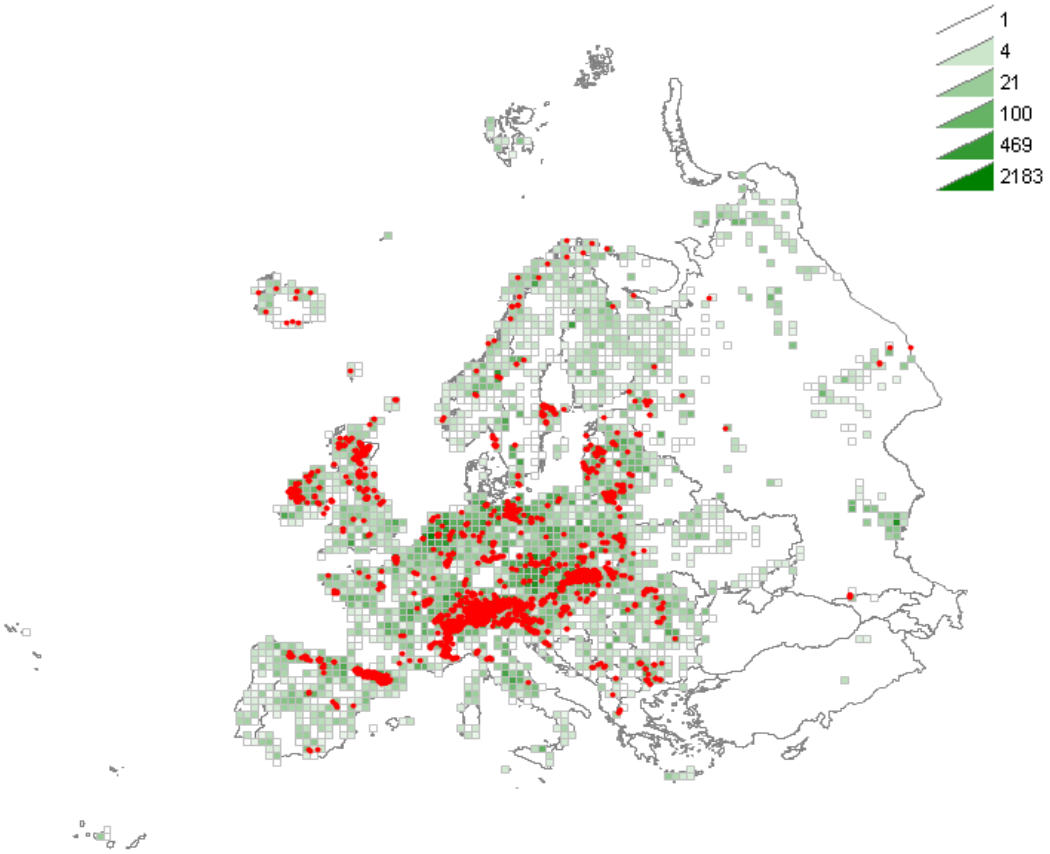
Q3132 Palsa and polygon mires - suitability



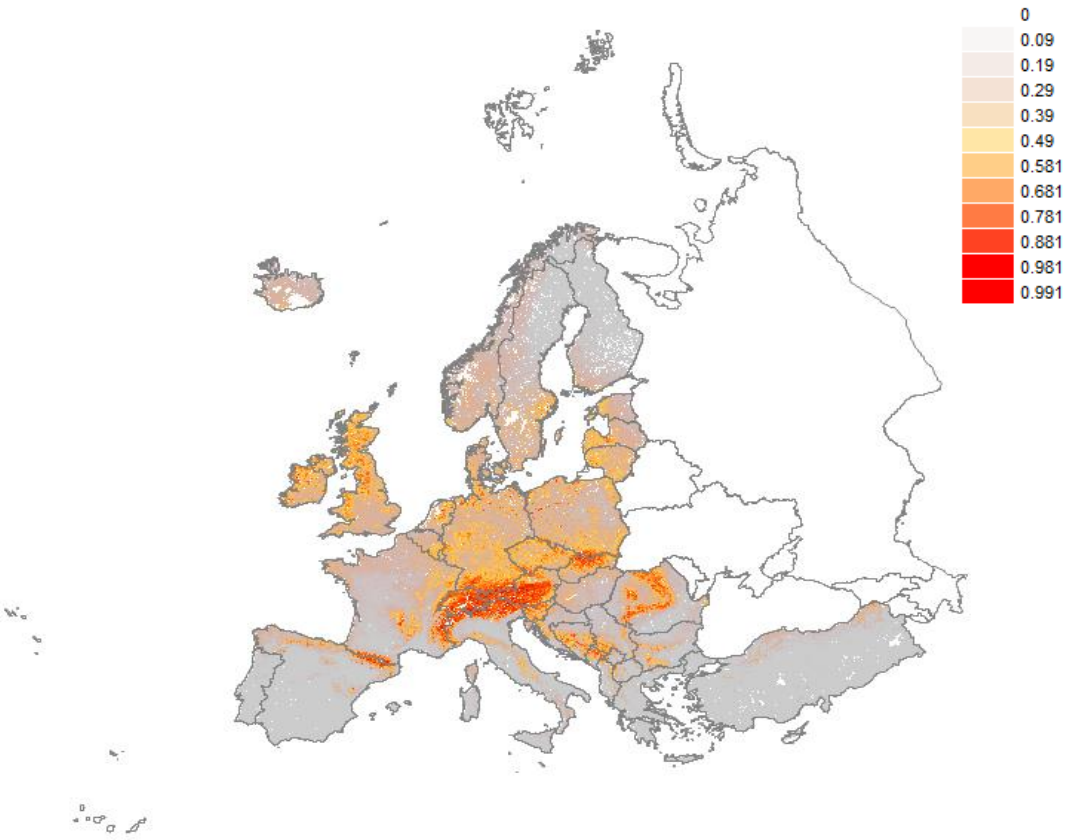
Statistics from Maxent modelling

AUC training (0-1)	0.9951
AUC test (0-1)	0.9946
Contribution variables to the Maxent model (%)	
Potential Evapotranspiration	66.3737
Vegetation height (m)	9.336
Digital Elevation Map (DEM)	6.1488
Distance to water (rivers, lakes, sea)	5.1198
Precipitation of warmest quarter	4.1471
Bulk density (kg/m³)	2.7567
Solar radiation	2.1585
Temperature seasonality (stdev * 100)	2.0807
Soil pH (water)	0.7558
Soil organic carbon content (‰)	0.3565
Inundation; occurrence	0.3535
Phenology; NDVI mean	0.1533
Phenology; Length of season (days)	0.1422
Weight in % of silt particles (0.0002-0.05 mm)	0.0707
Mean temperature of wettest quarter	0.0392
Cation Exchange Capacity of the soil	0.0075
Phenology; End of Season (day number)	0
Weight in % of sand particles (0.05-2 mm)	0
Weight in % of clay particles (<0.0002 mm)	0
Volume % of coarse fragments (> 2 mm)	0
Precipitation seasonality (coef. of var.)	0
Phenology; Low of season (day number)	0
Annual precipitation	0
Phenology; NDVI seasonality	0
Phenology; Peak of season (day number)	0
Phenology; Start of Season (day number)	0

Q41 Alkaline, calcareous, carbonate-rich small-sedge spring fen - distribution



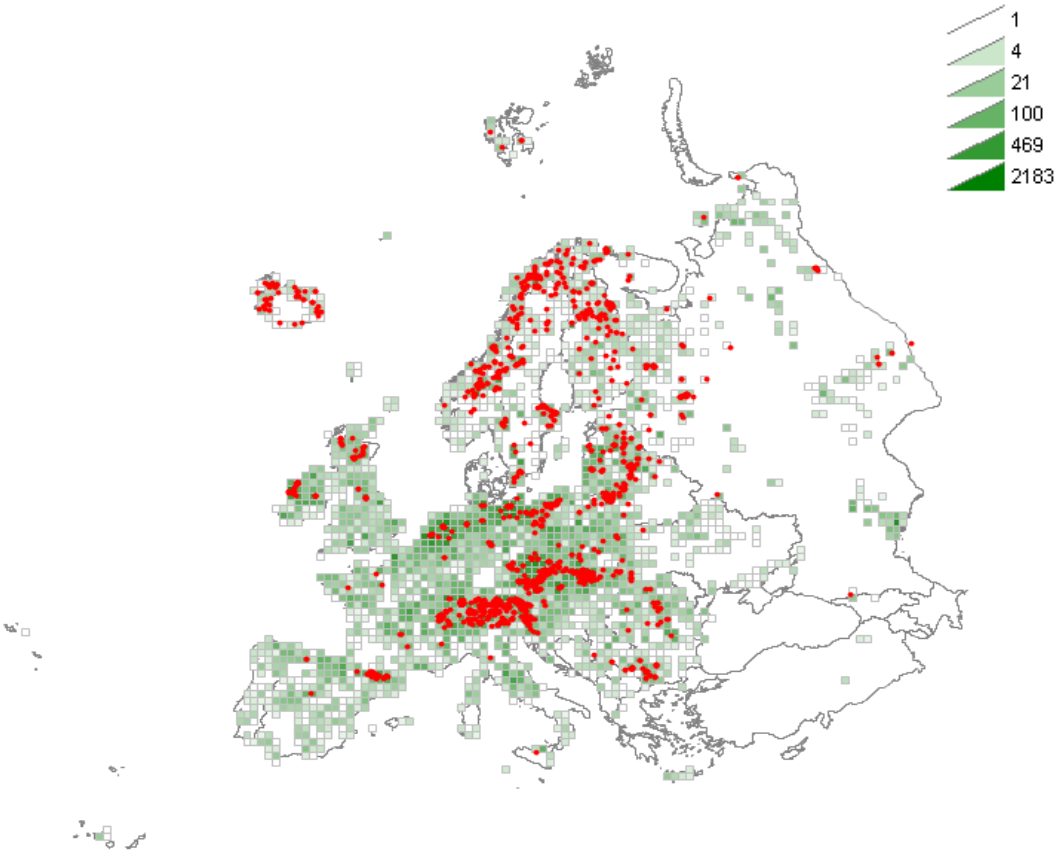
Q41 Alkaline, calcareous, carbonate-rich small-sedge spring fen - suitability



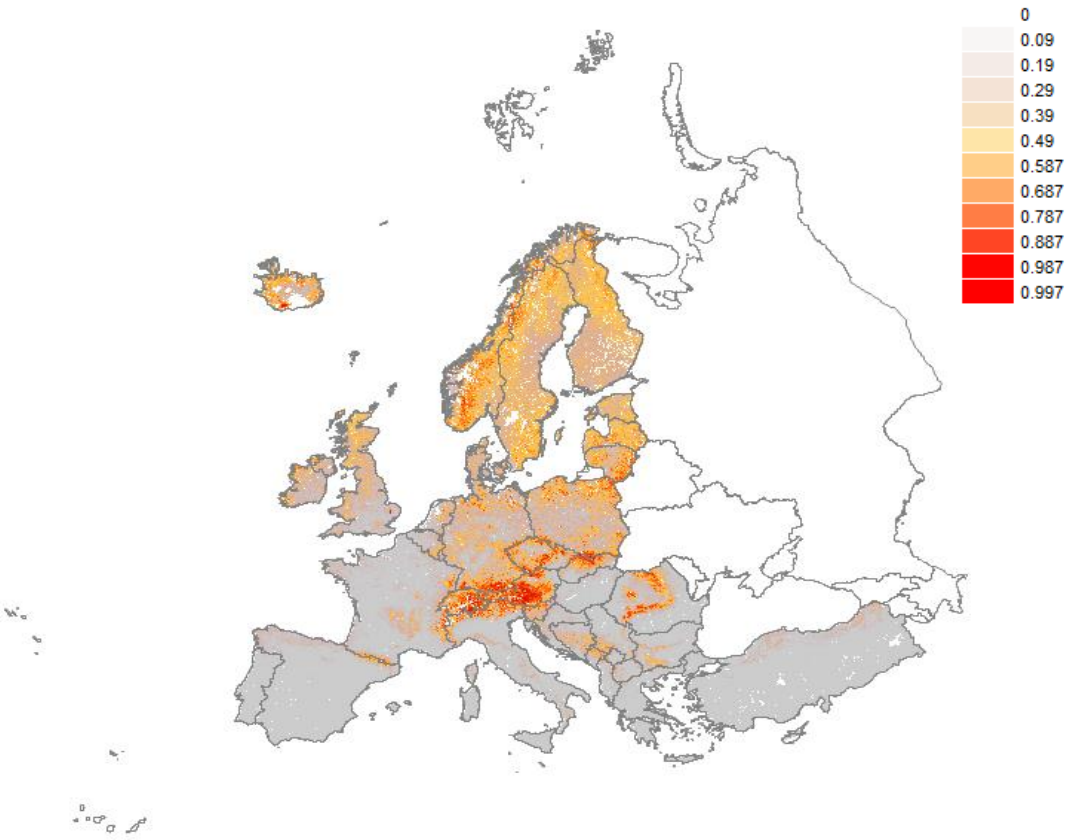
Statistics from Maxent modelling

AUC training (0-1)	0.815
AUC test (0-1)	0.813
Contribution variables to the Maxent model (%)	
Precipitation of warmest quarter	56.1096
Potential Evapotranspiration	7.9848
Bulk density (kg/m³)	6.83
Digital Elevation Map (DEM)	5.6775
Temperature seasonality (stdev * 100)	5.5387
Weight in % of clay particles (<0.0002 mm)	3.7219
Phenology; End of Season (day number)	3.05
Phenology; Length of season (days)	2.6167
Weight in % of silt particles (0.0002-0.05 mm)	1.7407
Cation Exchange Capacity of the soil	1.1884
Phenology; Low of season (day number)	1.1073
Solar radiation	1.0033
Soil pH (water)	0.6567
Vegetation height (m)	0.52
Annual precipitation	0.3959
Mean temperature of wettest quarter	0.3768
Volume % of coarse fragments (> 2 mm)	0.3619
Distance to water (rivers, lakes, sea)	0.3425
Phenology; NDVI mean	0.3415
Phenology; Peak of season (day number)	0.1873
Phenology; NDVI seasonality	0.074
Weight in % of sand particles (0.05-2 mm)	0.0666
Phenology; Start of Season (day number)	0.062
Inundation; occurrence	0.0404
Precipitation seasonality (coef. of var.)	0.0053
Soil organic carbon content (‰)	0

Q42 Extremely rich moss-sedge fen - distribution



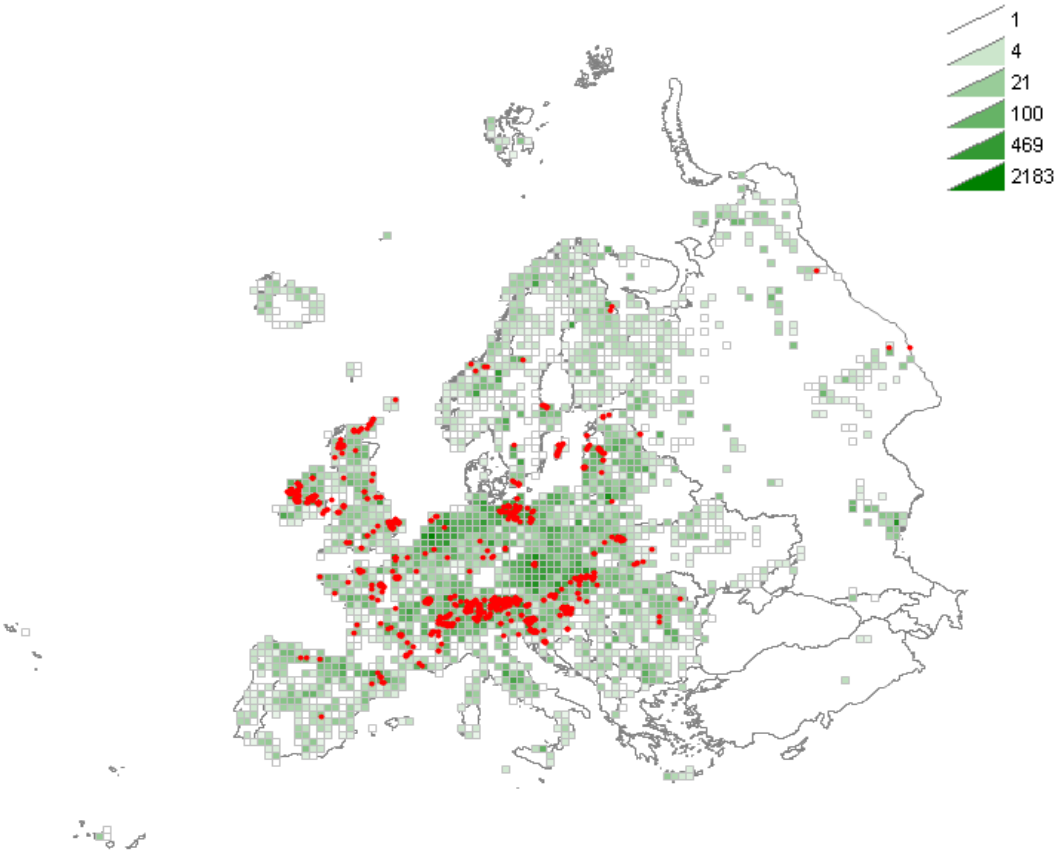
Q42 Extremely rich moss-sedge fen - suitability



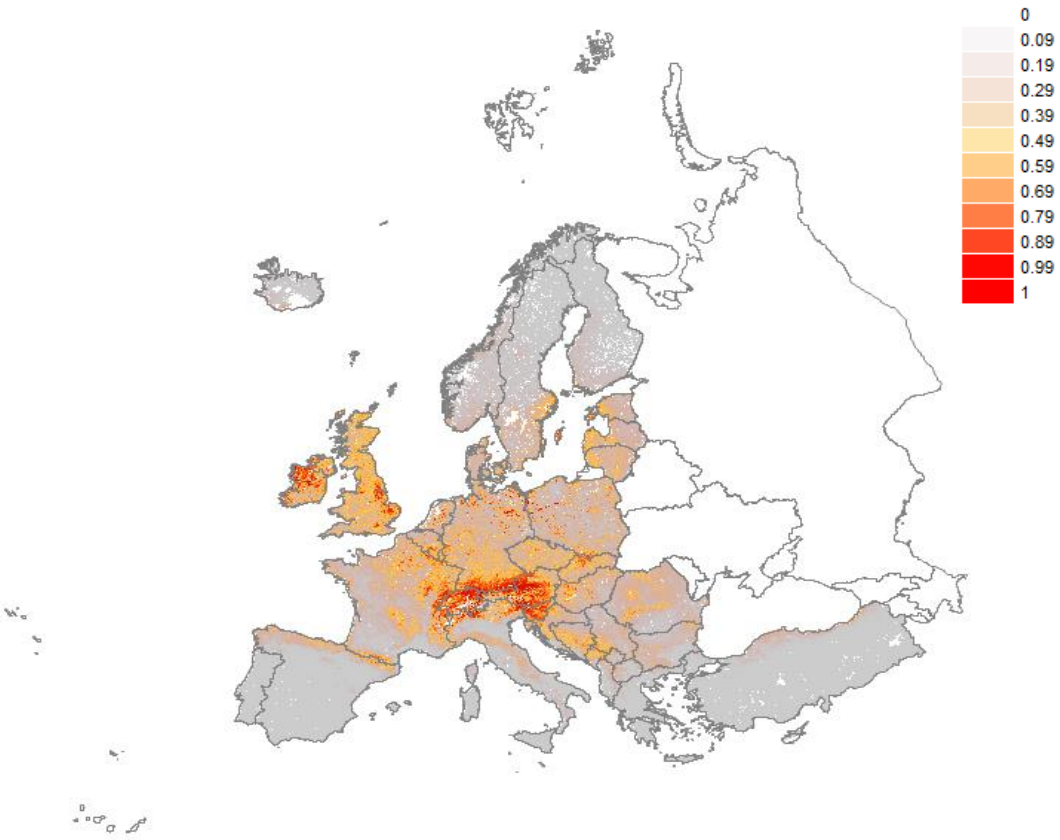
Statistics from Maxent modelling

AUC training (0-1)	0.8407
AUC test (0-1)	0.8135
Contribution variables to the Maxent model (%)	
Soil organic carbon content (‰)	28.5991
Precipitation of warmest quarter	22.8993
Soil pH (water)	21.1925
Potential Evapotranspiration	5.466
Annual precipitation	2.4061
Phenology; NDVI seasonality	2.1301
Precipitation seasonality (coef. of var.)	2.0837
Weight in % of clay particles (<0.0002 mm)	2.0213
Mean temperature of wettest quarter	1.8741
Phenology; Peak of season (day number)	1.8438
Volume % of coarse fragments (> 2 mm)	1.7443
Cation Exchange Capacity of the soil	1.6285
Temperature seasonality (stdev * 100)	1.3786
Phenology; End of Season (day number)	0.8288
Weight in % of sand particles (0.05-2 mm)	0.798
Phenology; NDVI mean	0.6018
Distance to water (rivers, lakes, sea)	0.5995
Vegetation height (m)	0.4234
Phenology; Length of season (days)	0.3117
Digital Elevation Map (DEM)	0.2558
Bulk density (kg/m^3)	0.2312
Weight in % of silt particles (0.0002-0.05 mm)	0.2232
Phenology; Low of season (day number)	0.2064
Phenology; Start of Season (day number)	0.1406
Inundation; occurrence	0.0798
Solar radiation	0.0323

Q43 Tall-sedge base-rich fen - distribution



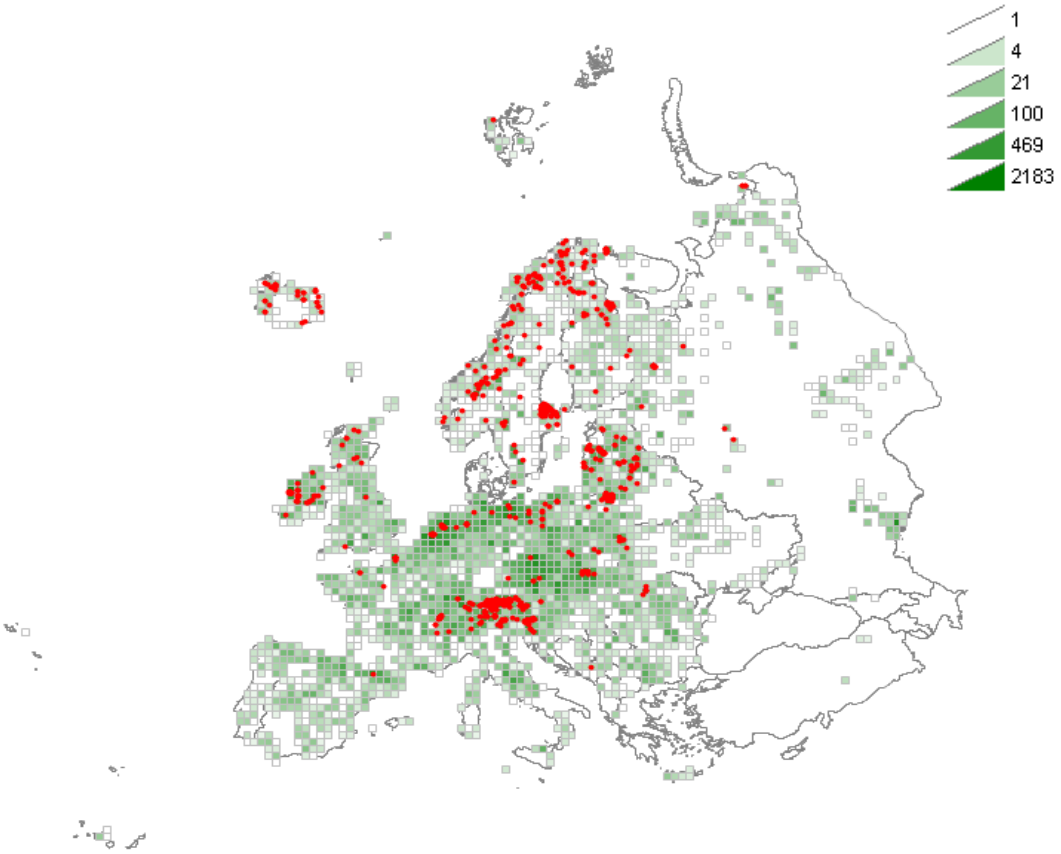
Q43 Tall-sedge base-rich fen - suitability



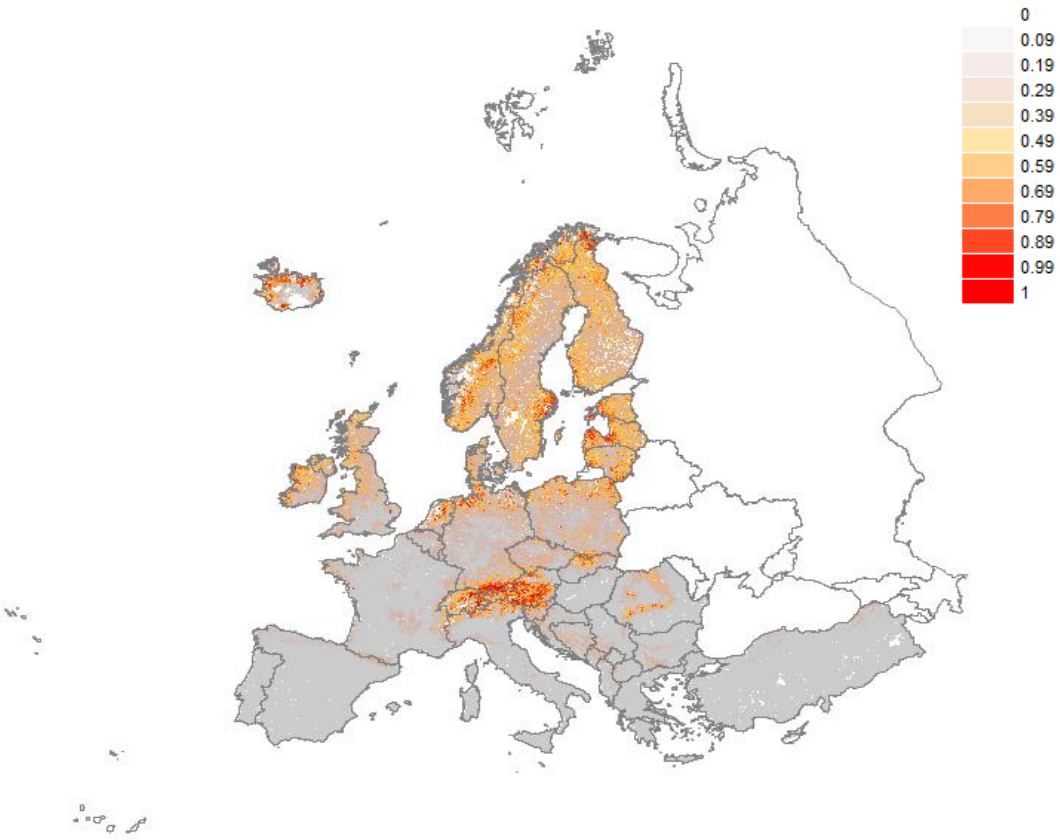
Statistics from Maxent modelling

AUC training (0-1)	0.8829
AUC test (0-1)	0.8466
Contribution variables to the Maxent model (%)	
Precipitation of warmest quarter	42.1551
Temperature seasonality (stdev * 100)	10.2404
Potential Evapotranspiration	10.0126
Bulk density (kg/m³)	6.9224
Digital Elevation Map (DEM)	4.704
Soil pH (water)	3.7682
Weight in % of clay particles (<0.0002 mm)	3.5495
Phenology; Length of season (days)	3.2694
Phenology; Start of Season (day number)	2.2373
Cation Exchange Capacity of the soil	2.0753
Annual precipitation	2.0345
Weight in % of silt particles (0.0002-0.05 mm)	1.6053
Precipitation seasonality (coef. of var.)	1.1227
Weight in % of sand particles (0.05-2 mm)	1.0536
Phenology; NDVI mean	0.8929
Vegetation height (m)	0.878
Phenology; Low of season (day number)	0.7918
Mean temperature of wettest quarter	0.7594
Phenology; NDVI seasonality	0.7341
Solar radiation	0.3885
Phenology; End of Season (day number)	0.2854
Volume % of coarse fragments (> 2 mm)	0.2612
Phenology; Peak of season (day number)	0.118
Soil organic carbon content (‰)	0.0714
Distance to water (rivers, lakes, sea)	0.0457
Inundation; occurrence	0.0233

Q44 Calcareous quaking mire - distribution



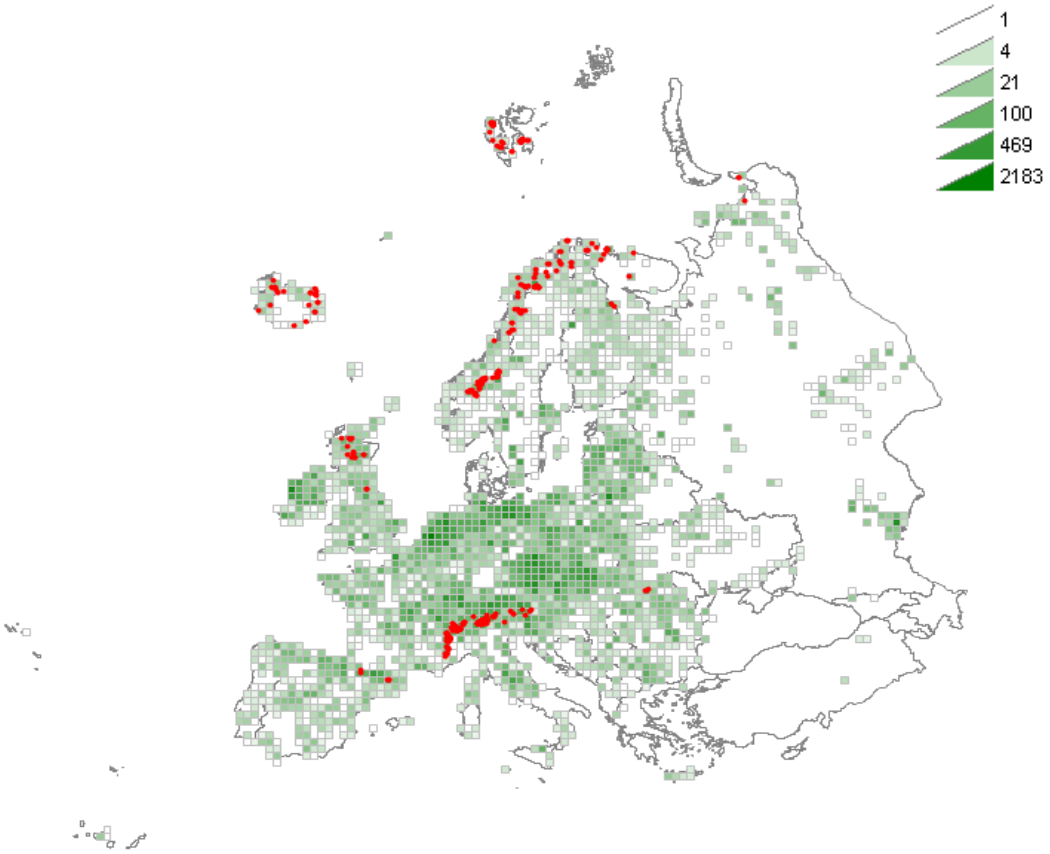
Q44 Calcareous quaking mire - suitability



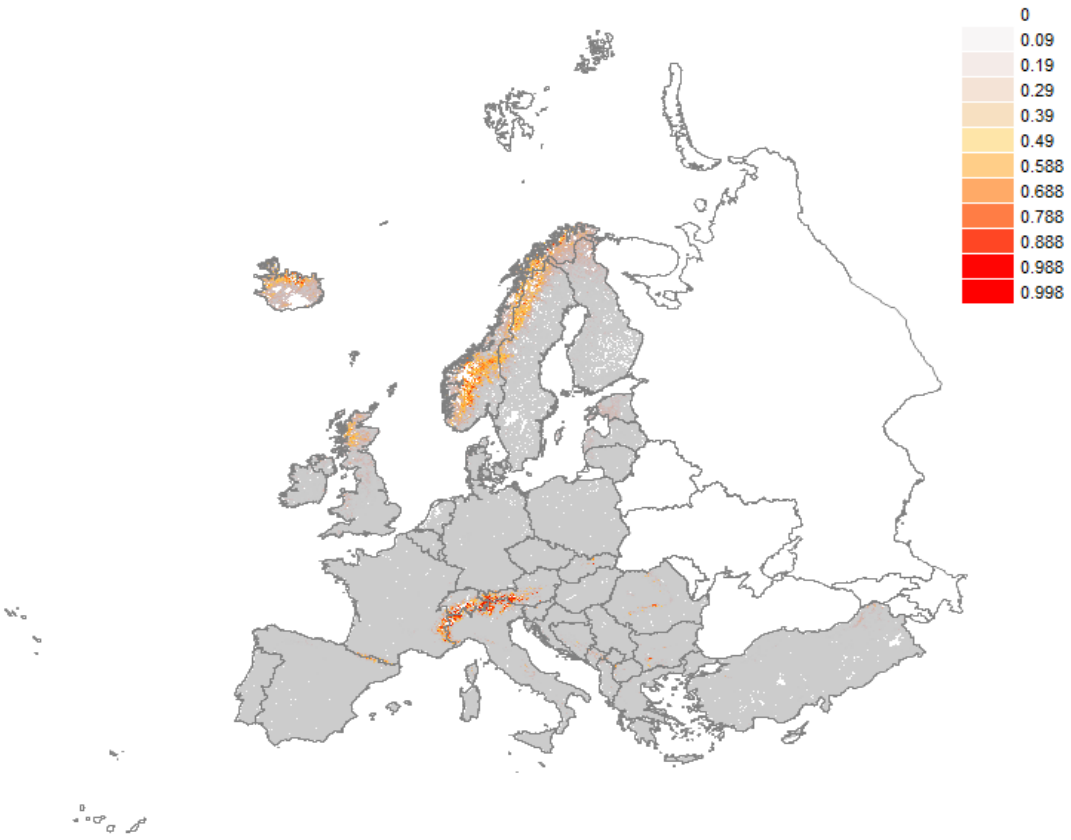
Statistics from Maxent modelling

AUC training (0-1)	0.894
AUC test (0-1)	0.887
Contribution variables to the Maxent model (%)	
Soil organic carbon content (‰)	25.9132
Soil pH (water)	18.8257
Precipitation of warmest quarter	16.7817
Digital Elevation Map (DEM)	6.6825
Phenology; Peak of season (day number)	4.6124
Potential Evapotranspiration	4.6057
Annual precipitation	3.0148
Volume % of coarse fragments (> 2 mm)	2.7505
Precipitation seasonality (coef. of var.)	2.2891
Bulk density (kg/m^3)	1.7113
Phenology; NDVI seasonality	1.6305
Weight in % of clay particles (<0.0002 mm)	1.5731
Weight in % of silt particles (0.0002-0.05 mm)	1.2859
Vegetation height (m)	1.1958
Phenology; End of Season (day number)	1.0994
Temperature seasonality (stdev * 100)	0.9993
Weight in % of sand particles (0.05-2 mm)	0.971
Mean temperature of wettest quarter	0.9061
Distance to water (rivers, lakes, sea)	0.8679
Cation Exchange Capacity of the soil	0.7223
Phenology; NDVI mean	0.5965
Phenology; Low of season (day number)	0.4135
Phenology; Start of Season (day number)	0.2204
Phenology; Length of season (days)	0.206
Inundation; occurrence	0.1254
Solar radiation	0

Q45 Arctic-alpine rich fen - distribution



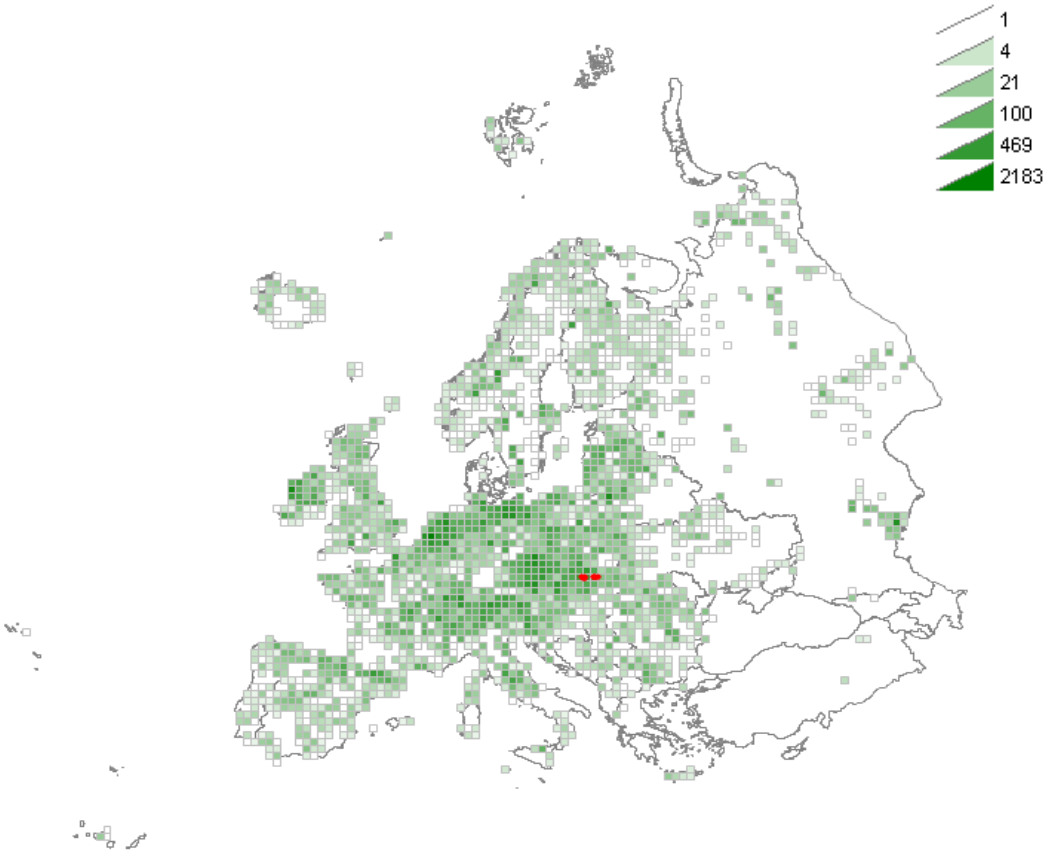
Q45 Arctic-alpine rich fen - suitability



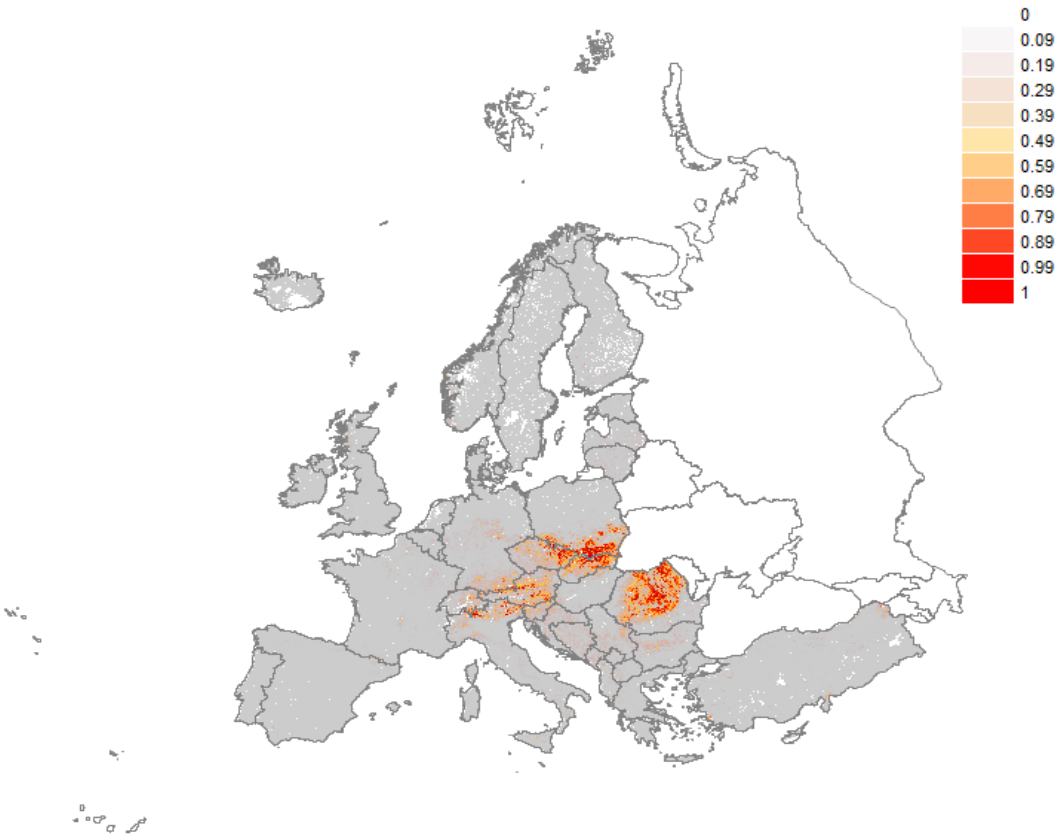
Statistics from Maxent modelling

AUC training (0-1)	0.968
AUC test (0-1)	0.9591
Contribution variables to the Maxent model (%)	
Digital Elevation Map (DEM)	21.6777
Potential Evapotranspiration	18.5827
Soil organic carbon content (‰)	15.6537
Precipitation of warmest quarter	13.8936
Phenology; NDVI mean	4.3667
Phenology; Low of season (day number)	4.3134
Mean temperature of wettest quarter	4.0762
Solar radiation	3.2607
Soil pH (water)	2.9745
Cation Exchange Capacity of the soil	2.9555
Bulk density (kg/m^3)	2.4993
Annual precipitation	1.4743
Weight in % of sand particles (0.05-2 mm)	0.9944
Distance to water (rivers, lakes, sea)	0.9404
Phenology; Length of season (days)	0.6046
Phenology; Start of Season (day number)	0.55
Volume % of coarse fragments (> 2 mm)	0.3025
Weight in % of silt particles (0.0002-0.05 mm)	0.2485
Vegetation height (m)	0.1318
Temperature seasonality (stdev * 100)	0.1164
Phenology; Peak of season (day number)	0.0932
Phenology; NDVI seasonality	0.091
Weight in % of clay particles (<0.0002 mm)	0.0777
Precipitation seasonality (coef. of var.)	0.0488
Inundation; occurrence	0.0367
Phenology; End of Season (day number)	0.0359

Q46 Carpathian travertine fen with halophytes - distribution



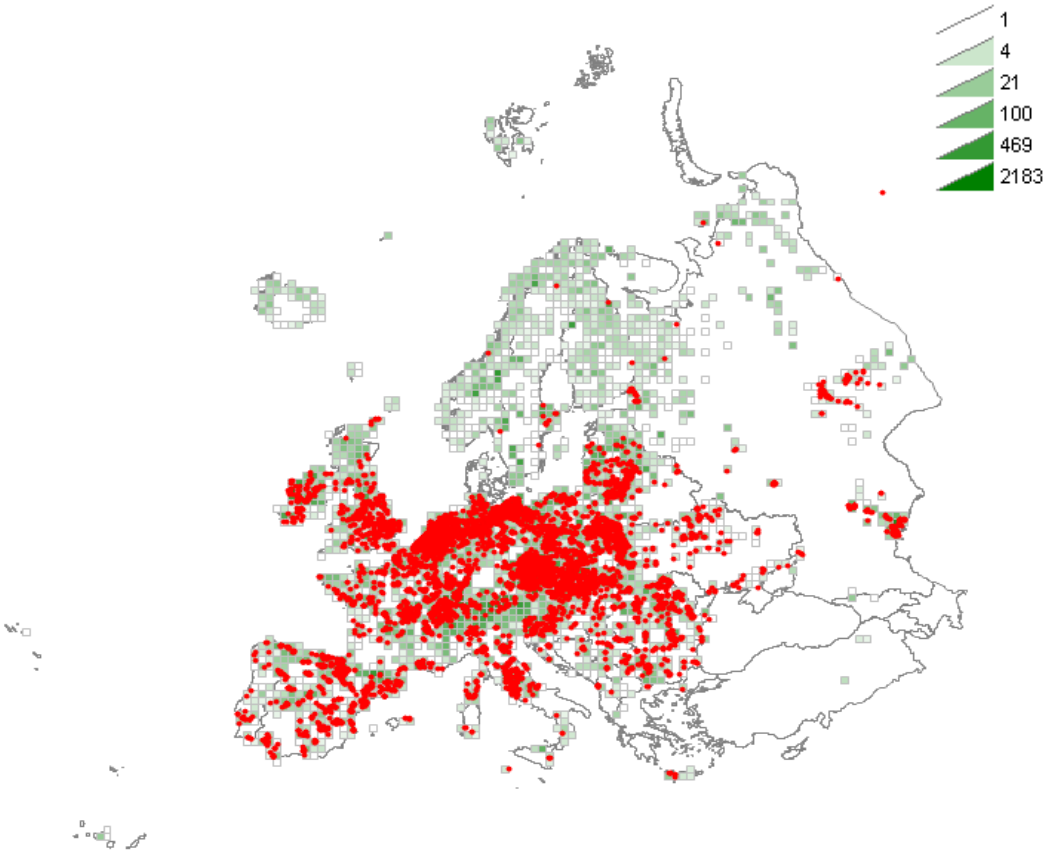
Q46 Carpathian travertine fen with halophytes - suitability



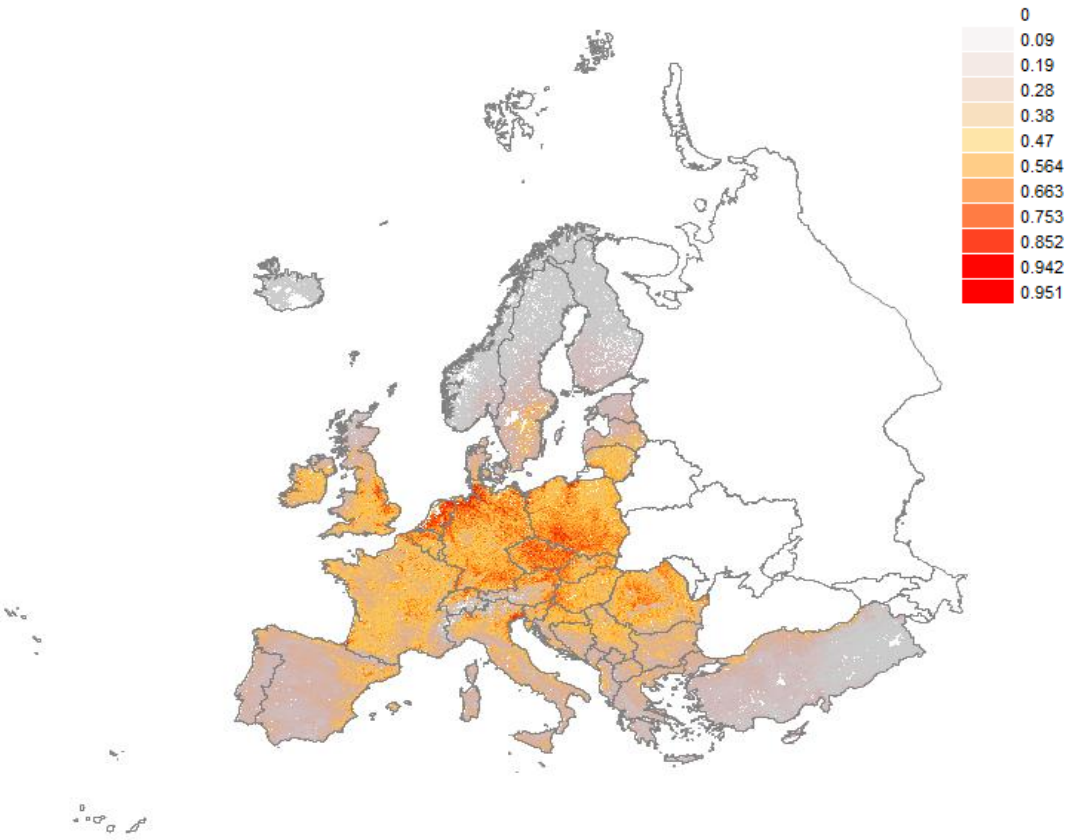
Statistics from Maxent modelling

AUC training (0-1)	0.9914
AUC test (0-1)	0.999
Contribution variables to the Maxent model (%)	
Precipitation of warmest quarter	26.4709
Weight in % of silt particles (0.0002-0.05 mm)	22.4379
Phenology; NDVI seasonality	16.3555
Precipitation seasonality (coef. of var.)	14.5006
Phenology; Low of season (day number)	9.5324
Mean temperature of wettest quarter	4.2209
Phenology; Length of season (days)	2.5347
Digital Elevation Map (DEM)	1.8302
Distance to water (rivers, lakes, sea)	1.4291
Phenology; Start of Season (day number)	0.5444
Potential Evapotranspiration	0.0795
Volume % of coarse fragments (> 2 mm)	0.0638
Soil pH (water)	0
Soil organic carbon content (‰)	0
Weight in % of sand particles (0.05-2 mm)	0
Weight in % of clay particles (<0.0002 mm)	0
Inundation; occurrence	0
Cation Exchange Capacity of the soil	0
Vegetation height (m)	0
Annual precipitation	0
Phenology; NDVI mean	0
Phenology; Peak of season (day number)	0
Temperature seasonality (stdev * 100)	0
Bulk density (kg/m^3)	0
Phenology; End of Season (day number)	0
Solar radiation	0

Q51 Tall-helophyte bed - distribution



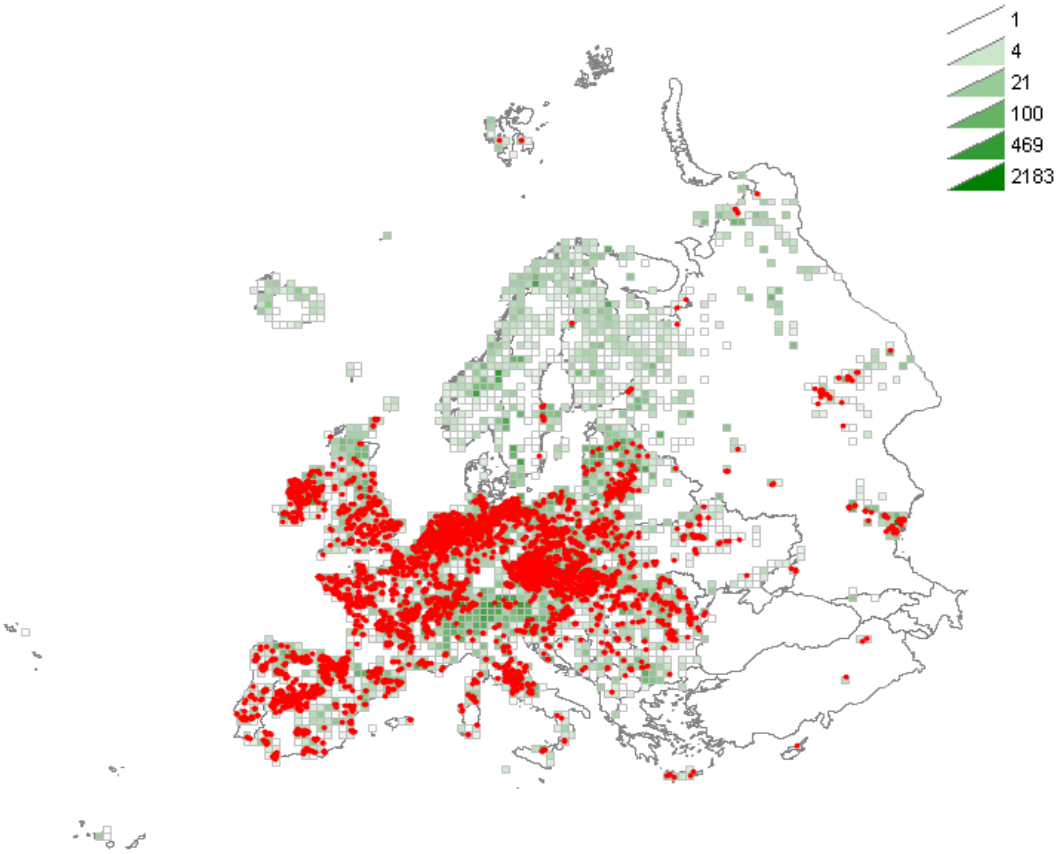
Q51 Tall-helophyte bed - suitability



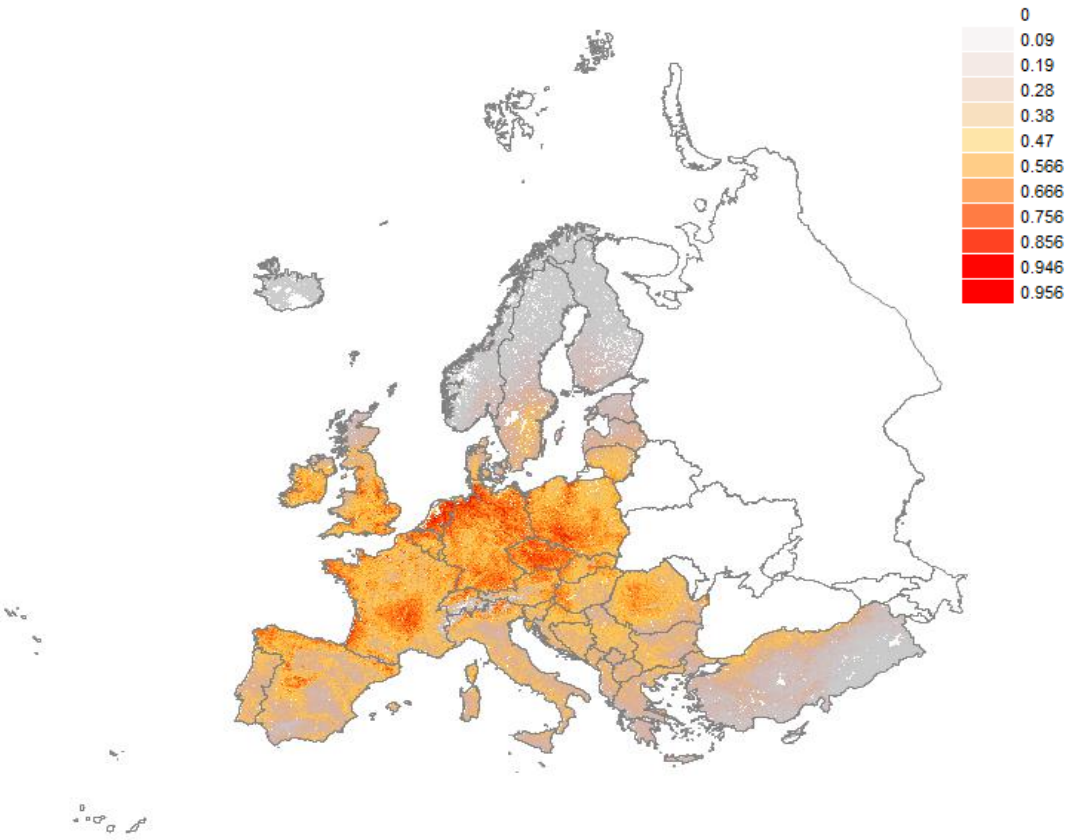
Statistics from Maxent modelling

AUC training (0-1)	0.7244
AUC test (0-1)	0.7124
Contribution variables to the Maxent model (%)	
Potential Evapotranspiration	27.6829
Digital Elevation Map (DEM)	20.8281
Precipitation of warmest quarter	19.4906
Bulk density (kg/m³)	6.8791
Distance to water (rivers, lakes, sea)	6.6361
Phenology; Low of season (day number)	5.0406
Temperature seasonality (stdev * 100)	3.0735
Cation Exchange Capacity of the soil	2.338
Volume % of coarse fragments (> 2 mm)	2.3109
Precipitation seasonality (coef. of var.)	1.4578
Mean temperature of wettest quarter	0.9513
Phenology; NDVI mean	0.8005
Vegetation height (m)	0.4619
Soil organic carbon content (‰)	0.4214
Annual precipitation	0.4083
Phenology; End of Season (day number)	0.3567
Weight in % of sand particles (0.05-2 mm)	0.2456
Weight in % of clay particles (<0.0002 mm)	0.1334
Soil pH (water)	0.1287
Inundation; occurrence	0.1233
Weight in % of silt particles (0.0002-0.05 mm)	0.1093
Phenology; Start of Season (day number)	0.0633
Phenology; Length of season (days)	0.0299
Phenology; Peak of season (day number)	0.0205
Phenology; NDVI seasonality	0.0084
Solar radiation	0

Q52 Small-helophyte bed - distribution



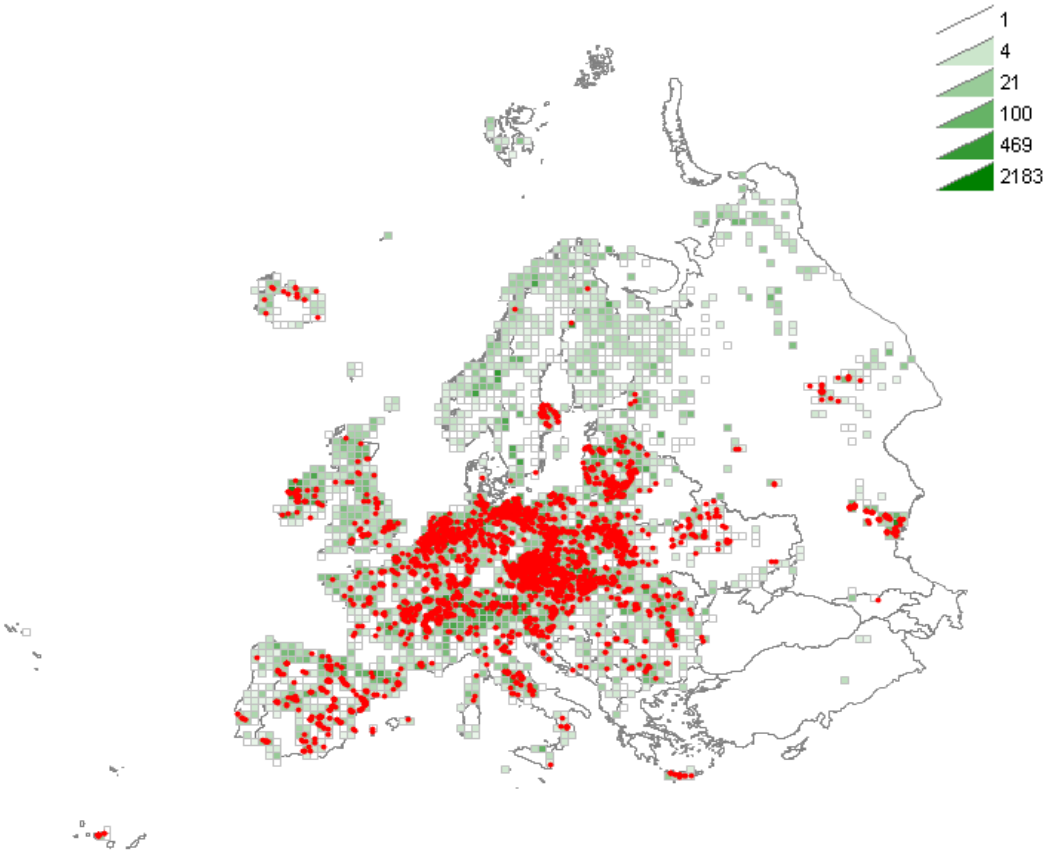
Q52 Small-helophyte bed - suitability



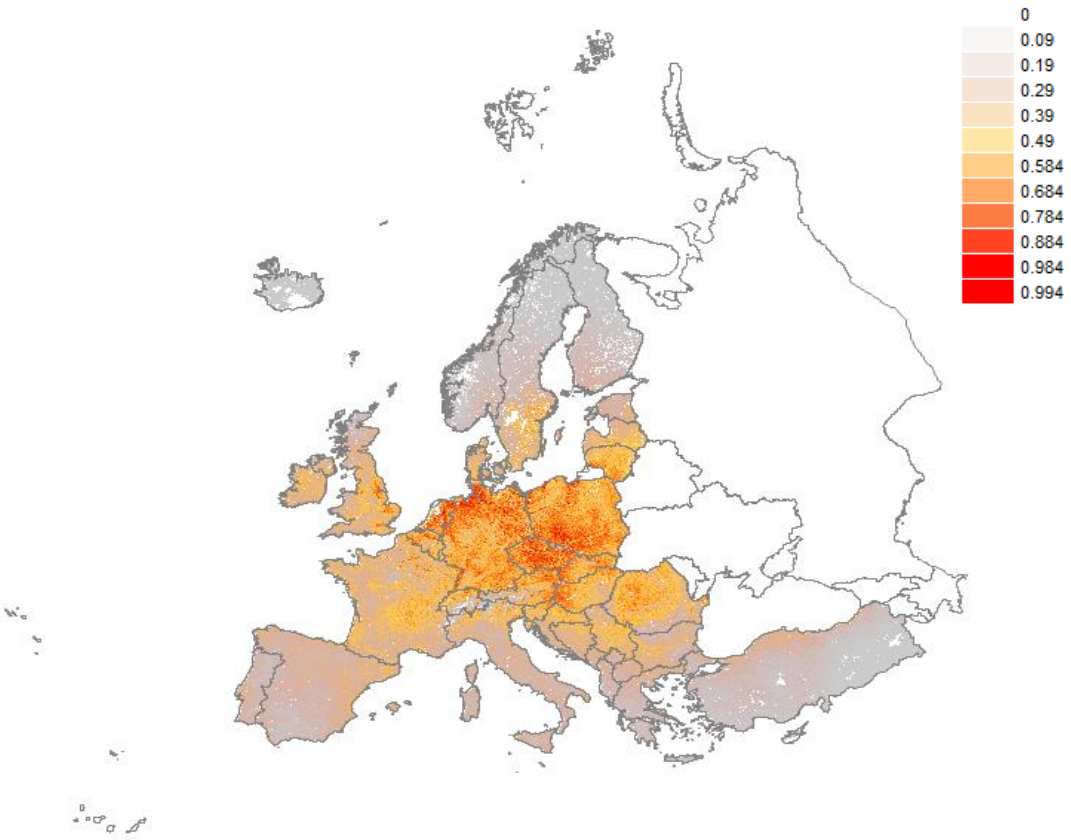
Statistics from Maxent modelling

AUC training (0-1)	0.7025
AUC test (0-1)	0.7035
Contribution variables to the Maxent model (%)	
Potential Evapotranspiration	39.341
Precipitation of warmest quarter	17.2352
Digital Elevation Map (DEM)	11.1104
Temperature seasonality (stdev * 100)	8.9226
Phenology; Low of season (day number)	6.6503
Distance to water (rivers, lakes, sea)	4.1655
Precipitation seasonality (coef. of var.)	2.748
Phenology; Start of Season (day number)	1.819
Soil pH (water)	1.7728
Cation Exchange Capacity of the soil	1.5312
Annual precipitation	1.4914
Bulk density (kg/m³)	0.821
Weight in % of sand particles (0.05-2 mm)	0.6433
Weight in % of clay particles (<0.0002 mm)	0.5938
Vegetation height (m)	0.4893
Inundation; occurrence	0.159
Phenology; NDVI mean	0.1327
Mean temperature of wettest quarter	0.1149
Phenology; End of Season (day number)	0.1132
Phenology; Length of season (days)	0.0561
Weight in % of silt particles (0.0002-0.05 mm)	0.03
Phenology; Peak of season (day number)	0.0266
Soil organic carbon content (‰)	0.0236
Volume % of coarse fragments (> 2 mm)	0.0064
Phenology; NDVI seasonality	0.0027
Solar radiation	0

Q53 Tall-sedge bed - distribution



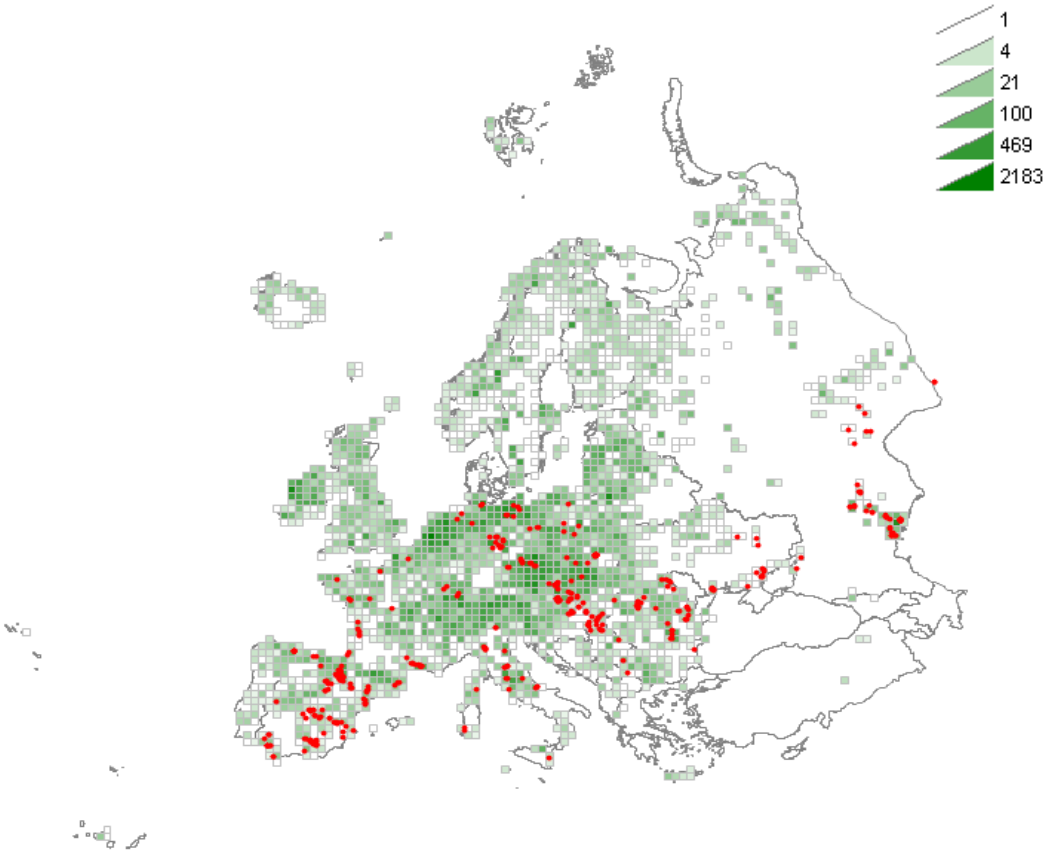
Q53 Tall-sedge bed - suitability



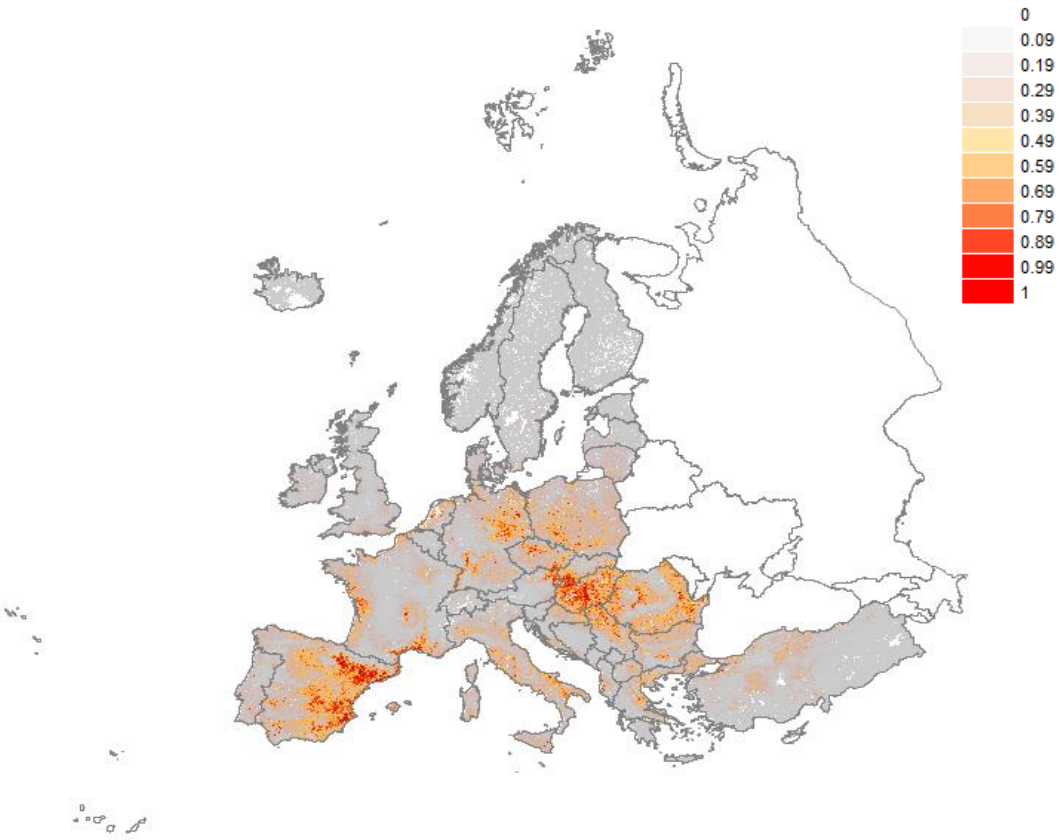
Statistics from Maxent modelling

AUC training (0-1)	0.7447
AUC test (0-1)	0.741
Contribution variables to the Maxent model (%)	
Precipitation of warmest quarter	27.2846
Potential Evapotranspiration	19.2828
Mean temperature of wettest quarter	10.9716
Distance to water (rivers, lakes, sea)	7.8347
Bulk density (kg/m³)	6.5793
Digital Elevation Map (DEM)	5.9613
Temperature seasonality (stdev * 100)	4.4115
Weight in % of sand particles (0.05-2 mm)	3.5242
Phenology; Low of season (day number)	2.3119
Phenology; Start of Season (day number)	2.2692
Precipitation seasonality (coef. of var.)	1.6418
Phenology; NDVI mean	1.3235
Phenology; NDVI seasonality	1.2608
Cation Exchange Capacity of the soil	1.205
Annual precipitation	0.9618
Weight in % of clay particles (<0.0002 mm)	0.5406
Phenology; Length of season (days)	0.4919
Volume % of coarse fragments (> 2 mm)	0.4477
Phenology; End of Season (day number)	0.395
Soil pH (water)	0.3294
Phenology; Peak of season (day number)	0.2937
Vegetation height (m)	0.2387
Inundation; occurrence	0.1633
Soil organic carbon content (‰)	0.1445
Weight in % of silt particles (0.0002-0.05 mm)	0.1313
Solar radiation	0

Q54 Inland saline or brackish helophyte bed - distribution



Q54 Inland saline or brackish helophyte bed - suitability



Statistics from Maxent modelling

AUC training (0-1)	0.9219
AUC test (0-1)	0.86
Contribution variables to the Maxent model (%)	
Soil pH (water)	21.089
Bulk density (kg/m³)	20.3409
Mean temperature of wettest quarter	15.6153
Precipitation seasonality (coef. of var.)	9.7314
Vegetation height (m)	5.3097
Temperature seasonality (stdev * 100)	5.1495
Phenology; Length of season (days)	3.6619
Digital Elevation Map (DEM)	2.5827
Distance to water (rivers, lakes, sea)	2.0545
Solar radiation	2.0392
Phenology; NDVI mean	1.9889
Annual precipitation	1.5251
Phenology; Low of season (day number)	1.4445
Potential Evapotranspiration	1.426
Precipitation of warmest quarter	1.1419
Weight in % of clay particles (<0.0002 mm)	1.1198
Volume % of coarse fragments (> 2 mm)	1.0881
Phenology; Start of Season (day number)	0.715
Weight in % of sand particles (0.05-2 mm)	0.4266
Phenology; Peak of season (day number)	0.4261
Weight in % of silt particles (0.0002-0.05 mm)	0.3907
Phenology; End of Season (day number)	0.2809
Phenology; NDVI seasonality	0.2239
Inundation; occurrence	0.1204
Soil organic carbon content (‰)	0.0967
Cation Exchange Capacity of the soil	0.0113