Project Number 282910

ÉCLAIRE

Effects of Climate Change on Air Pollution Impacts and Response Strategies for European Ecosystems

Seventh Framework Programme

Theme: Environment

D15.1 The model PROPS (FKA EUMOVE)

Due date of deliverable: **3**
Start Date of Project: **01/10/2011**

Actual submission date: **01/10/2013**
Duration: **24 months**

Organisation name of lead contractor for this deliverable : Alterra

Project co-funded by the European Commission within the Seventh Framework Programme		
Dissemination Level		
PU	Public	☐
PP	Restricted to other programme participants (including the Commission Services)	V
RE	Restricted to a group specified by the consortium (including the Commission Services)	☐
CO	Confidential, only for members of the consortium (including the Commission Services)	☐

1. Executive Summary

This deliverable provides a model to assess the probability of plant species occurrence on a European scale. Results of the model can be used to assess biodiversity indices for forests, grasslands and heathlands that can be used in WP16 to compute climate dependent critical nitrogen thresholds, based on criteria for impacts on plant species diversity. Based on a large European data set with vegetation relevés (BioScore; about 800000 relevés), response curves where fitted that provide the occurrence probability of vascular plants as a function of soil pH, soil nitrate and temperature and precipitation at the site. A model, PROPS, was developed that uses these responses to compute (combined) probabilities for plant communities based on simulated soil pH and nitrate (computed by the VSD+ soil model) and ECLAIRE scenario data for temperature and precipitation.

1. Objectives:

This deliverable relates to: Objective 15.1. To develop a model for plant species diversity that can be used to assess climate dependent novel thresholds for nitrogen.

2. Activities:

A method was developed to derive occurrence probability functions for vascular plants as a function of abiotic conditions. Based on about 800000 relevés, soil pH and soil nitrate were estimated for the sites based on relationships between plant species and measured pH and nitrate from a Dutch data set. Climate data (temperature and precipitation) were derived from the ECLAIRE climate data sets using the 1970-2000 long term average yearly values. Next, an existing database (Karte der natürlichen Vegetation Europas) was used to assign typical plant species to vegetation types in Europe, needed for an European application of PROPS. A preliminary assessment of PROPS to Europe was conducted and reported.

3. Results:

Response curves were derived for about 2900 plant species (see Figure 1 for an example). A model, PROPS, was developed that simulates occurrence probabilities as a function of simulated pH and nitrate (based on the soil model VSD+ to which PROPS is linked) and climate scenarios for groups of species that are typical for a vegetation type in Europe (see Figure 2 for an example). A preliminary application to Europe of the combined VSD+PROPS model was conducted; in this application plant response was limited to pH, N deposition and climate and simulated occurrence of species was assumed to be linearly related to future abundance. Simulations were carried out for about 1.8M computational units in Europe with forests, grasslands and heathlands, using two scenarios for climate (constant climate and IPCC SRES A1) and two scenarios for N deposition (current legislation and maximum feasible reductions). Results show strong influences of both climate and N deposition on computed biodiversity indices, with strong climatic influences in Northern Europe and a decrease in diversity under changing climate and continued high N deposition. Reducing N deposition under climate change results in a reduced loss of diversity.

4. Milestones achieved:

PROPS model developed, linked to the VSD+ soil model and made available. Data base with species per vegetation type available for European applications of the model. First, preliminary assessment of the combined model to Europe conducted.

5. Deviations and reasons:

No deviations. The model is named PROPS and not EUMOVE to avoid confusion with a model called ‘EUROMOVE’.

6. Publications:

Reinds, G.J, , Bonten, L., Mol-Dijkstra, J.P., Wamelink, G.W.W., Goedhart, P., 2012. Combined effects of air pollution and climate change on species diversity in Europe: First assessments with VSD+ linked to vegetation models. In: Maximilian Posch, Jaap Slootweg, Jean-Paul Hettelingh (eds.), CCE Status Report 2012: Modelling and Mapping of Atmospherically-induced Ecosystem Impacts in Europe, Bilthoven, Netherlands, p 49-6.

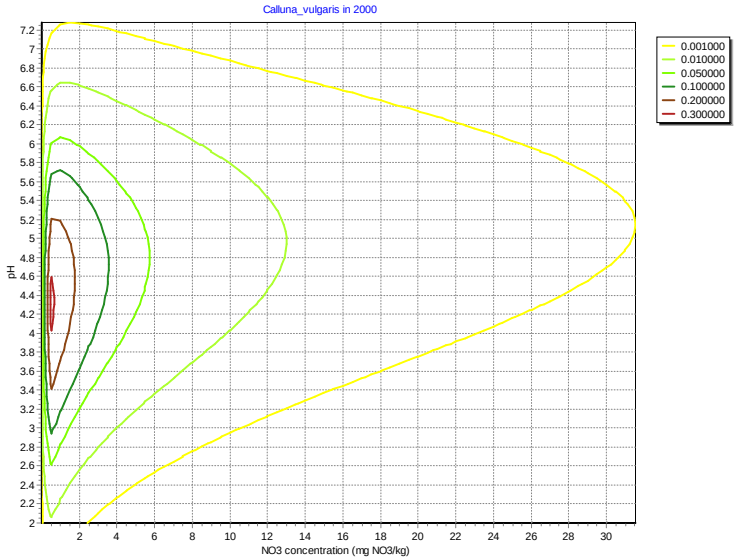
Bohn, U. et. al., 2000. 'Karte der natürlichen Vegetation Europas' (KNVE), Bundesamt für Naturschutz (http://www.floraweb.de/vegetation/dnld_eurovegmap.html)

7. Meetings:

Deliverable was discussed at the First annual Eclaire meeting in October 2012 in Edinburgh and presented at the UNECE LRTAP CCE workshop in Copenhagen 2013.

8. List of Documents/Annexes:

Figure 1. Response of Caluna Vulgaris to pH and nitrate at a temperatute of 8°C and 800 mm rainfall.
Figure 2. Species occurrence probability at a sandy site with 'Frisian Danish Coastal Heath' as the vegetation type.



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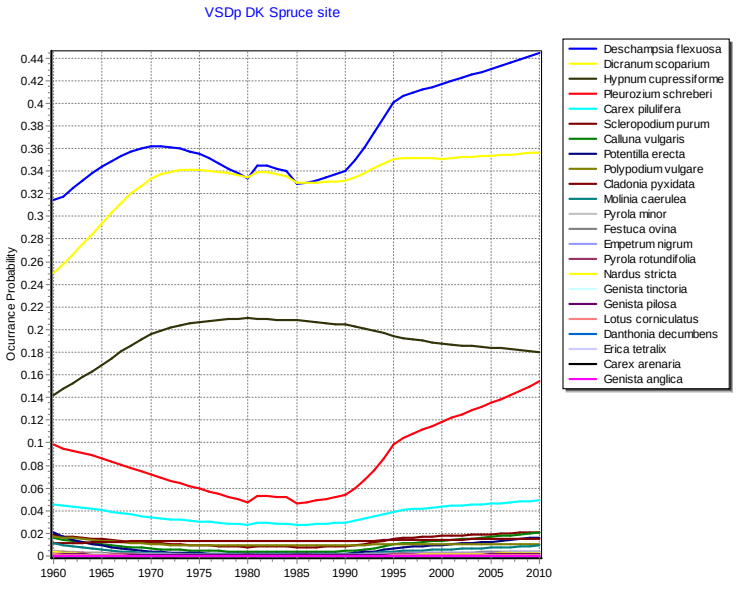

Figure 2. Species occurrence probability at a sandy site with 'Frisian Danish Coastal Heath' as the vegetation type.