



# Biodiversity and climate change forum

## Report of the WP1 meeting on predictive approaches

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**Date:** 21 October 2008

**Place:** BelSPO

**Attendees:** Erika Baus, Etienne Branquart, Louis François, Sandrine Godefroid, Alain Hambuckers, Dirk Maes, Nicolas Titeux

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### Objective of the meeting

There are currently only few data available on the potential impacts of climate change on biodiversity at the Belgian level. The objective of the meeting is to identify the types of predictive approaches that could be developed at the Belgian level.

Three approaches have been proposed:

#### 1. Dynamic modelling of plant distribution (A. Hambuckers et L. François)

The property of dynamic models is to take the processes into account, for example the interactions between species (competition, predation,...), the cycle of nutrients, the impact of CO<sub>2</sub> on the hydric balance,... Moreover, new processes can easily be included into the model.

The objective of the proposal is to improve the existing models by :

- Improving the resolutions of climatic scenarios in Belgium,
- Inserting additional processes in models to increase their accuracy such as the response of species to soil properties (C/N, pH,...) and demography (dispersal rate, germination,...),
- Attempting computation of plant communities (species and abundance)

Note : abundance is considered as a good indicator of species adaptation to local conditions  
→ This type of study is really promising but must be envisaged on the long term and with an appropriate budget

## **2. Bioclimatic envelope modelling (D. Maes et N. Titeux)**

This project is based on the following approach :

- based on the current species distribution and climate variables, a bioclimatic envelope is described for each species
- the projection of bioclimatic envelopes in future climatic conditions provides insights into the potential future range of the species

Variables related to land cover and soil type improve the performance of the model (performance assessed by the ability of the model to predict current distribution).

Note : This model is based on the assumption that ecosystems are in equilibrium with climate conditions and doesn't take species dispersal capacity into account.

Results have already been obtained that predict the locations where future conditions are likely to be favourable to specific animal species/groups of species (butterflies, grasshoppers, dragonflies) according to different climate scenarios.

→ Interesting applications of this modelling technique would be :

- using this approach on plant and bird data to identify the most vulnerable habitats to climate change,
- identify which regions in Belgium could act as climatic refugia for vulnerable species,
- using this approach to make a coupled analysis on animal species (ex butterflies) and host plant species

## **3. Identification of life-history traits that confer higher susceptibility to climate change (S. Godefroid)**

This approach consists in identifying plants that are more likely to be susceptible to climate change based on specific life-history traits.

A list of susceptible life history traits have been proposed by other initiatives (Gran Canaria declaration, IUCN)

A first preliminary analysis has been made on Belgian flora based on the « habitat susceptibility » criteria and gives encouraging results. Climate susceptibility has then been tested against the Red List status.

Other criteria could be included in this analysis but they are often difficult to evaluate. Dispersal mode (barochorie, zoochorie,...) could be used to evaluate the « dispersal range » criterion. However, it is difficult to take into account the frequency/probability of long distance events.

This approach is qualitative. A ranking could be obtained by taking into account criteria such as plant optimum summer/winter temperatures (available in PLANTATT)

The major drawback of this approach is that the evaluation of criteria is relatively subjective : how to define a susceptible habitat ?

→ An interesting idea could be to combine the bioclimatic envelope modelling and the life-history traits analysis approaches and compare climate responses of species according to their life-history traits.

## Conclusion

In the context of the global project, the idea is :

1/ To produce preliminary results :

- To make use of the bioclimatic envelope modelling approach on plant data (IFBL atlas, 1979) to predict their future distribution and to identify the most vulnerable habitats in Belgium and Luxemburg (Dirk Maes + Nicolas Titeux),
- To complement this information with data from the scientific literature in Europe (Sandrine Godefroid),
- To combine predicted distribution data with red list status, life-history traits and Natura 2000 (Sandrine Godefroid + Etienne Branquart),
- To test the dynamic model (in its current state of development) on a few species (example : host plant of an insect) (Alain Hambuckers et Louis François).

2/ To use these preliminary results to identify gaps and convince policy makers of the need of further research in this field. Notably provide specific recommendations for more advanced modelling techniques (dynamic modelling) that also enables simulation of management strategies.