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Date: 7 September 2015

**Evaluation of the PhD thesis**
by Martin Kopecký on

**Vegetation changes in Czech lowland forests over the past decades**
2015

Most ecologists would agree that the vegetation in Central Europe and in many other parts of the world is currently changing with an almost unprecedented speed, caused by factors like climate change, eutrophication and altered land use. However, to demonstrate the direction and rate of change and especially to relate these changes to the various potential explanatory variables remains a challenge, because we are usually not able to re-localize old vegetation records and therefore often have to rely on spatial comparisons or experiments to assess changes in community composition. In addition, whereas hundreds of thousands of vegetation plots are available from Central Europe, few of these plots are accompanied by measurements of important environmental drivers. It is thus an important task of applied vegetation science to try to find old vegetation records for which the plots were permanently marked or where historical maps are sufficiently accurate to re-locate the plots. Although time series analyses often do not allow us to determine the underlying causes for vegetation changes, they are superior to experiments with respect to their realism and temporal extent.

Over the past 2-3 decades several papers (including some meta-analyses) were published on the vegetation changes in northern temporal forests. These publications have highlighted the strong effects of soil acidification and nitrogen deposition (less often also grazing and more recently climate change) on the species composition and richness especially in the herb layer of woodlands. Most of these studies were conducted in countries of northwestern Europe (Great Britain, Belgium, Germany) and eastern North America, whereas so far only few data is available from more continental parts of Europe. The PhD thesis of Martin Kopecký fills this gap in that it deals with the long-term vegetation changes in *Quercus*-dominated lowland forest vegetation in the Czech Republic. Another novel aspect of the thesis is connected to the management history of the studied woodlands: whereas most stands in northwestern Europe for already more than a century have been managed as 'high' forest, woodlands in many parts of eastern Europe have maintained a more traditional management (coppicing) until only a few decades ago. Therefore the data material of the thesis is highly suitable for assessing the impact of an altered forest management on vegetation and species richness.

The thesis by Martin Kopecký on **Vegetation changes in Czech lowland forests over the past decades** consists of a general introduction and four independent chapters, each of which being a separate research paper. The thesis is well written and prepared, and the text is pleasant to read. The structure of the thesis is excellent: the first chapter deals with methodological aspects being important for the plausibility and interpretation of the other parts, followed by the 'main' paper describing the general changes in species composition and the decline in species richness in eastern Central European oakwoods. The 3rd chapter presents a novel approach to analyze the randomness of species extinctions from these forests, and the last chapter finally highlights the (non-)effects of the invasion of an alien species on the forest vegetation. Together with the introduction the four chapters represent a very coherent piece of work! A strength of the papers and of the whole thesis is the way of presenting the results: while the statistical techniques used are advanced and appropriate, the results are not hidden in complicated tables, but shown in several easy-to-digest coloured graphs that facilitate the reading. There are several minor formal mistakes (e.g. misspellings) especially in the introduction and in the reference lists, but these are not significant considering the overall quality of the thesis which is also reflected in the fact that 3 of the 4 papers are already published in renowned international journals, with the fourth paper submitted to another excellent journal.

**Chapter 1** convincingly shows that vegetation surveys are rather robust against a certain uncertainty in plot location. This is an important finding, as few of the time series studies from forests and other vegetation types actually use truly permanent plots, but rely on semi-permanent plots with an approximate plot re-ocation. In order to be able to use these findings for assessing the general plausibility of past and future re-surveys, the following questions need to be answered: *In how far can these results be transferred to re-survey studies in other vegetation types being less structured than forests and offering fewer clues for plot re-location, such as grasslands? Is there a minimum plot size under which the main conclusion of the robustness of a semi-permanent plot approach no longer holds true?*

The main finding of **chapter 2** is that the thermophilous oakwoods over the past decades have been replaced by more mesic forests, mainly caused by the abandonment of coppicing. This change towards cooler, moister and more nutrient-rich conditions has been associated with a strong decline in species richness, especially of threatened species. The interpretation of the results is mainly based on the observed changes of average Ellenberg indicator values (EIV). A question is: *In how far is it problematic that the EIV for forest species are inter-correlated, i.e. that, for example, light-demanding woodland species (high EIV for light) tend to have lower EIV for soil nitrogen (nutrients) and lower EIV for soil moisture, resulting in a negative correlation also between the average EIV for light and nutrients, and for light and moisture? Can we then identify the main proximate environmental drivers for the changes in species composition and richness, or only describe parallel processes?*

**Chapter 3** underlines the results found in the previous chapter. The loss of many plant species from the forests is not a random extinction, but the consequence of the decline of light-demanding species that have earlier been favoured by the forest opening through coppicing. There is one paragraph in the discussion that is unclear to me: It is stated that the increasing frequency of nutrient-demanding species is not so much a consequence of N deposition, but of forest succession due to biomass accumulation. *However, is this not in contrast with the observation that the forests have become darker and therefore are expected to have a lower or at least not increased N mineralisation (see the 'N time bomb' hypothesized by Verheyen et al. 2012)?*

In **chapter 4** it is demonstrated that *Impatiens parviflora* does not pose a threat to the phytodiversity of forests, but is rather a passenger taking advantage of an empty niche. This coincides with other studies of the species (and also a paired study of invaded and uninvaded sites conducted in our own lab where we could not find detrimental effects of *Impatiens*). This might hold true also for other alien woodland species. *In how far stands this result in contrast to the main processes of ecosystem change depicted in Fig. 4 of*

*chapter 2 where it is stated the ungulates have a moderately negative effect due to their facilitation of the spread of aliens? Are alien woodland species not a positive contribution to biodiversity?*

In summary, Martin Kopecký has presented as very good and coherent PhD thesis that offers many new results in terms of both methodological aspects and insights into the current vegetation dynamics of lowland forests. The thesis is without doubt suitable for the defense and fulfills the criteria necessary for obtaining the PhD degree. I can without reservations recommend the thesis of Martin Kopecký to the Board of Examiners.