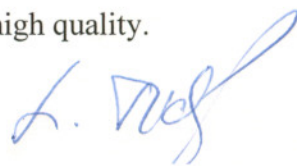# The review of PhD thesis of Mgr. Klára Řehounková

This PhD thesis is structured as a collection of 5 papers published or prepared for publication, where Klára tries to analyze two datasets from different points of view. I must say that it is relatively difficult to plan such theme as a PhD thesis, because of limited time for field work and finalization of papers. Therefore, I was happy to read this manuscript, which consists of literature review, large scale and small scale analyses, and which is focused on one narrow and consistent topic. Papers are well written and acceptable for publication. I have only several formal comments:

- Paper 1; When you mentioned the macroclimate as one from important environmental factors, also the mesoclimate and microclimate should be discussed. Air convection above large areas of bare ground ("warm island"), substratum color, slopes and orientations have important influence on the succession even through they are perhaps studied less frequently than other factors.
- The paper 2 and 5 showed the increased pH with age of succession. How do you interpret it? Do you think it is a common trend both on acidic and neutral(alkaline) substratum? May it be influenced by litter? Please, tell us more about values and trends of pH in your study. The paper 3 (fig. 1) shows the different trend of age and pH. Why?
- Paper 2; Can you estimate the total length of full succession series at disused gravel-sand pits with respect to different soils?
- Paper 2; **The time was responsible for only ca. 10 % of the vegetation variability...** Perhaps due to less and less spatial autocorrelation the time should play smaller and smaller role in comparison with the spatial heterogeneity among similar stands at broad scale. Were the studies compared in the paper done on smaller scale or not?
- Paper 3; Fig. 1. Could be interesting to know which environmental variables are autocorrelated and which correctly interpret the 1st, 2nd ... axis.
- Have gravel-sand pits higher potential for colonization of neophytes or native species? How many species tend to create meta-population dynamic? Are some species found there endangered according to the Red list of the Czech flora?
- Paper 4; Which is the final stage on dry stands? Can you interpret more in detail the Conclusion **4: The importance of scio- and nitrophilous species....** (when) and **6: Plant functional types can be useful tools in predicting colonisation success...** (How?) Do you able to present (virtually, of course) some prediction model for that?
- Paper 5; The plot size seems to be rather small. It can cover random distribution of earlier successional stages with annuals while later stages with higher concentration of clonal plants with successful strategy which can locally prevail when on higher scale they are still uncommon. How many clonal plants were determined in the dataset?
- Paper 5; The conclusion **...moisture gradient was the most important of all environmental factors.... Time explained only ca. 15 % of the vegetation variability...** is very relative - it depends on the length of time series and types of included biotopes. It could be interesting to test what will happen while e. g. only relevés from the 1st to 5th year (or from 1st to 4th year etc.) will be included or if dry or aquatic habitat will be excluded from the analysis.

Generally, the whole manuscript can be accepted as a scientific material of high quality.

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Review of a PhD thesis

Klára Řehounková: Variability of spontaneous vegetation succession in disused gravel-sand pits: importance of environmental factors and surrounding vegetation

This PhD thesis consists of three papers in impacted journals (Preslia, Journal of Vegetation Science, Restoration Ecology) and two manuscripts. These chapters are completed with clear and concise introduction and conclusions. The fact that main chapters have been published in journals and both introductory and concluding sections are brief and succinct makes the thesis free of any sign of protraction. The thesis is concise and the papers nicely work together, which is one of the main thesis assets. It is logically structured, each chapter deals with a particular problem and together they provide a consistent picture of succession in sand pits. The author obviously carefully thought about the topic, then collected data and attempted to answer the question she was asking. If my feeling about the development of the thesis is wrong, I am happy to be misguided.

The thesis is also very good formally, with pleasant format and layout (including cover), it is clearly written, with very few misprints (e.g., self-incompatibel instead of incompatible in table on p. 71, designation of the oldest successional stage as > 41 years instead > 40). The form accords with the contents.

The most important statement I would like to make is that I consider the PhD thesis of Klára Řehhounková to be a sort of unprecedented because of methodically excellent and consistent treatment of vegetation in the vicinity of study sites and evaluation of succession in the landscape context. I am convinced that reasons for such an extraordinarily successful outcome go back to the very beginning of her PhD study – choice of a very topical theme and most suitable habitat, and clear questions, which have been around in successional ecology for some time, but hardly ever rigorously tested, if at all. In this context, it is fair to emphasize the role of the supervisor Karel Prach, whose long term experience undoubtedly played an important role. A crucial aspect of the reviewed work is that the same, high quality data set was used to test various questions, ranging from purely scientific to applied. As far as the latter aspect is concerned, Klara repaid her supervisor by providing another convincing evidence to support his life-long (justified!)obsession with the application of spontaneous vegetation succession in restoration projects.

Chapter I. The introductory chapter, a review published in the journal Preslia, puts the topic of Klára's work into a broader perspective. Evaluation of published case studies on vegetation succession starting on bare ground, with emphasis on factors that proved to determine the course of succession, is a pioneering work, which clearly points to the importance of the landscape framework, in which a given successional sere is running. The review also shows that some studies only scratch the surface, since the results are strongly scale-dependent. In this introductory chapter, Klára Řehounková conveniently set the scene for what is to follow – she pointed to the gaps in successional literature and kept them in mind when working on other chapters (no matter that at the time the review was published, the work on dissertation was already in rather advanced stage).

Chapter II. This paper published in the Journal of Vegetation Science is, by general standards of studies on succession, very important because it evaluates effects of the number of factors, including landscape settings, on the course of succession. Data collation is standard, but the design of the study and data analysis are well above standard. I like the quantification of the relative effects of local and landscape factors – this is one of the first studies providing such an assessment. The finding that successional age accounts for only 10% of variation in species composition is very interesting.

p. 39 – Could the different conclusions on the relative importance of landscape and local factors (let alone the bias resulting from different authors chosing different variables and using different measures to quantify them) be also due to the relative heterogeneity of the study site and surrounding landscape? I can imagine that landscape factors in riparian forests studied by Holl & Crone 2004 could have been less important, because the landscape, the riparian forest, was relatively homogeneous. That is, a different situation from the system studied in the reviewed thesis where relatively homogeneous sites, in terms of substrate, were surrounded by fragmented and rather heterogeneous landscape?

Chapter III. This is the most "applied" chapter, in which succession is analysed with respect to the dynamics of target desirable species. This paper can become a model study of its kind, the figure on p. 55 is excellent and could serve as an example of scientifically based practical output for managers in restauration ecology.

p. 53 – Some landscape variables are correlated, for example, the proportion of vegetation types surrounding the sand pits sums up to 1. Was this taken into account in statistical analyses, or maybe more importantly, in their interpretation?

Chapter IV. The assets of this chapter are not that much in conclusions that are drawn here, as in a detailed description of the effect of particular species traits, evaluated by using regression trees. Answers to questions asked in this study can hardly be surprising – one can assume that anemochorous light demanding species capable of growing on acid and nutrient poor soils prevail at the beginning of succession in sand pits, or that opportunities for colonization decrease as succession proceeds. This by no means degrades the value of the paper. The opposite is true – by employing surrounding landscape once again, it was possible to express colonization success in relative terms. Using this measure is more convenient than is usually the case in similar studies that evaluate the successional role of species only on basis of their occurrence in study plots.

What proportion of variation was explained by regression trees for particular stages?

Chapter V. The last chapter is a standard case study of a single sand pit, value of which, however, is increased by being a part of the thesis. By using a different methodical approach (monitoring of succession on permanent plots) the study confirms the validity of trends revealed for the regional scale of the Czech Republic. In addition, it is a kind of a useful coda, pointing to the quality and importance of preceding chapters. The last chapter is how succession is being usually studied, while the rest of the thesis is how it should be done.

Conclusion

Klára Řehounková demonstrated that she is, without any doubt, capable of conducting independent scientific work of a high quality, meeting current international standards. It is my utmost pleasure to recommend her excellent thesis for defence.

Praha, 9. 9. 2007

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Klára Řehounková

Variability of spontaneous vegetation succession in disused grave-sand pits: importance of environmental factors and surrounding vegetation.

By

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This is a substantial piece of work described in a thesis that is well-focused, well-argued and has three chapters that have been published or accepted in refereed journals and a further two chapters that are of publishable quality. Thus, there is no doubt ion my mind that this thesis is of PhD standard.

The main thrust of the thesis is to test the use of spontaneous succession as a means to revegetate/restore sand and gravel pits in the Czech Republic at a lower cost that more technical solutions. The candidate has covered the following aspects:

1. The first paper reports a worldwide study of vegetation succession on a whole range of substrate types where restoration work is needed. This is a mini meta-analysis and provided a very good overview of the sorts of constraints that might hinder vegetation development and hence spontaneous succession.
2. The second paper considers the effects of local site and landscape factors in controlling vegetation succession. The main conclusion was perhaps surprising, in that the main factors associated with vegetation development were landscape ones rather than site variables such as soil. This implies that the species pool surrounding the site is crucial in determining the outcome of succession.
3. The third paper considers this further testing the ability to develop target communities. This is shown to be possible after about 20 years if appropriate vegetation is present in the local landscape. Attention is also drawn to the potential for an invasive species to be problematic in dry sites.
4. The fourth chapter considers the species that are successful in this successional process; this is done buy looking at the species traits and habitat preferences. Importantly this is linked through to success in assisting the process of spontaneous regeneration and its potential in land restoration.

5. The final chapter considers the effects of abiotic factors in controlling the success of species invading and persisting during the process of natural succession Water table (especially), pH and soil texture were identified as important constraints.

Taken together this thesis has clearly been well thought through, starting at the broad scales and working down testing various hypotheses in greater detail. The thesis is well-written and well produced and I am sure the conclusions will help better inform restoration practice in the Czech Republic. A model thesis in linking theory to practice.

Overall recommendation: Pass.

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14/09/2007