Alena Jírová – Vegetation succession in old fields at broad landscape scales

PhD Thesis – Review

This thesis consists of three related papers and a short preface, where the author comments vegetation succession and processes after land abandonment. All manuscript has 125 pages, two papers have broad appendices and few photographs. First paper has been published in Journal of Applied Science (2012), while location of other two remains me hidden. During a reading of the scientific stories I found many interesting questions and some problems, on which I would like to ask here:

- What is an average age of fields in an average landscape? How long were they abandoned in historically different times? What was the grain of the field mosaic? Was the succession same or different in different times? What happened in the time of Little Ice Age? Were crops and weeds changing during 'neolithic' period of field cultivation (till the end of 19th century)? These are very difficult, mostly virtual questions, which probably have no easy answer. However, I feel that the whole system is rather flexible not only in the present. These questions are related to others like 'Can be a direction of succession (the first stages) the same and comparable in old and newly abandoned fields? => Are these plots simply comparable?'

- Progressive and retrogressive succession vs. biomass production – can you explain it more in detail? There are differences between annual biomass production, total biomass production, above-ground biomass production and biomass production stored to perennial parts of plants. How does it work in the first successional stages, for example?

- What is a final (or "climax") state of today's species-poor woody vegetation of e.g. *Prunus spinosa*, *Acer platanoides* and *Fraxinus excelsior*? Can we find some analogy?

- Paper I, Fig. 4, page 36 – The vegetation is in progress and there is no hard data that environmental factors are changing. I would be careful in an interpretation, because successional stages start with generalist species and continues to more specialized part of species spectra. The species change may influence the change of Ellenberg indicator values, whilst pH may remain the same.

- Paper I, Page 50: How did you use five-point abundance scale? In CCA? And where did you use soil depth in the paper? In addition, I would like to see a metal stick 1 m long and 150 mm in diameter. Such "stick" from steel would weight about 140 kg!

- The size of fields fluctuated a lot. What was their average size? The size could be a source of problems like different number of species, different filtering area for aliens, dry grassland nor woody species, they have different length of borders with other habitats etc. Can you comment it, please?

Surrounding habitats are not independent.

- Where is a border between field and surrounding habitats? How is the seed pool on the border balanced (e.g. species A never grows in abandoned fields, but its population borders the former field)? Is there any buffer zone for clonal growth?

- Paper 3: I can see here several methodological problems. The time range between sampling of plots is rather high (36 years). Are you sure that the direction of succession remained the same? In addition, old data were probably excerpted from one source (Klaudisová 1975), which published data from one small area of the Czech Republic (probably with prevailing basic soils?). Data are not stratified. "...mostly in the western part of the country" – it is also an important information about data inconsistency. Eastern part belongs to the pannonian region, which is rather different (not only in flora and vegetation, but also in traditions, which may be also reflected here). There is no reason to expect that all succession processes will be the same as in western part of the CZ. I would expect spatial autocorrelation between many plots. Do you have some hard data that could reject this critique? Can you show us a geographical map with all plots?

- Discussion – "The country-scale analysis demonstrated a divergent successional pattern following in principle the same trajectories as previous analyses based on datasets taken in a particular landscape only (Prach et al. 2007a, Jírová et al. 2012)." Data from these papers were used in this paper = this is not an independent verification of this conclusion.

- Conditional inference trees in appendix: In my experience they are rather sensitive to a data structure (see my comments to unstratified data above). A nice example could be probably "Number of neophytes".

I can say that this PhD thesis has consistent topic and reading. I was happy to review it despite it is not directly my subject of direct interest. Generally I can conclude that the whole manuscript can be accepted as a nice scientific material.

Lubomír Tichý

Opponent evaluation on Mgr. Alena Jírová

" *Vegetation succession in old fields at broad landscape scales*"

Ph.D. Thesis

Submitted to School of Doctoral Studies in Biological Sciences
University of South Bohemia in České Budějovice
Faculty of Science 2012

Relevance of the topic:

Succession is a central topic in ecology. Vegetation succession on abandoned fields is a favorite research area since many decades. Related studies provided basic patterns and tested important principles in general ecology. Alena Jírová reanalyzed patterns of old field successions with new methods focusing on the variability of processes at extended spatial and temporal dimensions. There are hundreds of publications on oldfield succession, however, large-scale comparative studies are scarce. Therefore, the broad-scale approach applied here is relevant and original. It improves our knowledge on successional theory and supports landscape management.

Aims and major questions of the study:

By repeating earlier chronosequence studies and by collecting additional data at broader country scale Alena Jírová reconsidered basic community level successional patterns together with the analyses of explanatory factors. She also tested the idea whether spontaneous succession can be used as tool to restore seminatural vegetation.

Background and literature review:

References are well selected, and relevant. This selection was not easy considering the huge literature on old field succession. I was satisfied with the research background presented in particular papers and the brief overall introductory review.

Methods:

Sampling was well designed and adequate to represent robust large-scale patterns (but see my general note 1.1. below). Because of the extensive approach, the quadrat based local sampling (at field scale) was limited. Sampling was also constrained by the availability of data for repeated sampling. According to my experiences the design and the plot sizes used here were appropriate for representing robust patterns of compositional variability (of species, traits, and species groups). In case of analyses of the drivers of species richness (paper III) there is a potential bias due to the variable plots sizes (4x4m and 5x5m). Here I missed some methodological tests or references for estimating the related bias. The statistical methods used are up to date and adequate.

Scientific value, major novel results and related major comments:

Results are sound, novel, justified by the data and consistent with the objectives. I highlight the following results:

1, Spontaneous succession was divergent at regional scale (Bohemian Karst Landscape protected area) and at country scale. During succession (up to 91 years) the vegetation differentiated into four subseres toward shrubby grassland under dry and shallow soil conditions, two types of closed woodlands (oak-hornbeam woodland and others dominated by Fraxinus excelsior) and toward marshes occasionally dominated by willows under wet conditions.

Notes: 1.1., This is a nice synthesis (also confirms patterns described earlier). The overall divergent pattern is robust and convincing, relevant for theory, and it provides basic reference for local landscape management. Limitations: Results suggest that the broad-scale regeneration dynamics of vegetation is stationer. However, it is probably not true. Data used here are biased toward nice (often protected) landscapes dominated with traditional landuse and toward late successional stages. This sampling design is not appropriate detecting recent changes related to global change effects. I think that shifting observational window to areas with higher human impact and more young stages would modify this picture. 1.2., The broad-scale extent was set by natural geographic constraints, but the resolution at fine-scale was set artificially (4x4m or 5x5m plots). Each oldfields were represented by a single quadrat (papers I and III), i.e. the analyses were done at a single resolution. Using more replicates per fields (and more replicates of fields) and analyzing at several resolutions would result in more complex patterns of divergence and convergence. Also differentiation within the major branches of pathways is probably more complex (with subtypes).

2, Temporal trends of diversity (species richness) were different along the major successional pathways (no clear trend in the pathway to shrubby-grassland and decreasing trend in the series towards woodland). Field age and soil moisture were the most important explanatory variables for these patterns at broad scales.

Notes: 2.1., The decreasing trend found for the woodland series is probably a sampling artifact due to small sampling unit size. 2.2., A characteristic temporal diversity minimum in case of dense shrubland „jungle" (dominated by closed Crataegus stand) not mentioned. Probably because this stage was not represented in the data set. 2.3., Terminology: I would not interpret field age as a „driver" of succession („age" cannot be used here as surrogate for a particular mechanism).

3, It was demonstrated that simple species traits, target species groups and most Ellenberg indicator values show trends in oldfield succession and these results can be used for interpreting community level patterns.

Notes: 3.1., In case of very heterogeneous data set (contrasting stages in succession and variable environmental conditions) Ellenberg indicator values might give reliable results. However, from theoretical point of view, indicator values cannot be used (or can be used only very carefully) in transitional stages, especially in early and midsuccessional stages. According to my experiences strange artifacts can appear due to correlations with other (e.g. dispersal) traits. (However, I did not find potential artifacts in these particular analyses.) 3.2., It was demonstrated clearly that the presences of species from different target species groups are very good indicators of succession. However, I think there is a lot more potential here if the broad syntaxonomical groups would be divided into further smaller (functional) groups according to the role of target species in the organization and dynamics of natural communities.

4, The importance of surrounding vegetation on the direction and rate of succession was demonstrated investigating the surrounding landscape at two distance classes (100m and and 1 km).
Notes: 4.1., It is new and interesting results that different types of surrounding semi-natural communities have different influence on succession. 4.1., Previous studies were focused on the propagulum sources of target species. This Thesis presents here an interesting new aspect and a complementary result that old-fields was significantly related to the occurrence of synanthropic vegetation.

5, Results proved clearly that spontaneous oldfield succession is a real and successful alternative for the reestablishment of seminatural habitats in Czech Republic.

Interpretation and discussions:

I was generally satisfied with discussions within the particular papers. However, I missed a broader view about problems in restoration ecology. The present data show an optimistic view of successful and relatively fast regenerations in relatively undisturbed landscapes. It remained open how these patterns could serve as reference in more intensively used landscapes. I also suggest connecting the micro-scale regeneration dynamics of (semi)natural communities to coarse-scale patterns of old field succession and other types of succession. The results of multivariate analyses are convincing with reasonable patterns. However, the variability explained was usually very low (5-10%). It would be important to discuss how to understand and interpret the other 90% of compositional- and diversity variation. Is it trivial and reasonable to state that factors explaining only 5-10% of variability are the major drivers?

Evaluation of structure, style and the presentation of results:

The organization of the Thesis is satisfactory, the length is appropriate, the structure is clear and logical. The English is correct, clear and understandable. I enjoyed the style and the nice presentation of figures and tables. Many of them show up basic trends and demonstrate clearly basic principles so

they could be used directly in textbooks or comparative reviews. Figures and tables are necessary, complete, informative, with useful supplementary materials.

Publications:

The Thesis made of three research papers. One of them already published in Applied Vegetation Science, the other two are manuscripts submitted to leading international journals and are under reviews. Results were presented also in international meetings.

Summary (overall evaluation and declaration):

It is essential in science to be skeptic and open-minded. Therefore, revisiting basic principles and testing central concepts and facts with better data and with more powerful methods is always important. Laws in ecology are context dependent and even basic patterns might change with changing climate and landuse. Therefore, the studies presented here are valuable both from theoretic and applied aspects, especially they provide excellent materials for an evidence based modern conservation biology and restoration ecology.

According to my experience and opinion the Thesis of Mgr. Alena Jírová fulfils all formal requirements (respecting length, structure, style, publications, content and quality) of a PhD dissertation. It is a valuable study with her independent and creative contribution. It is based on excellent data, analyzed by appropriate methods producing relevant novel results. As an opponent, I strongly suggest to accept her Thesis and to give her the PhD degree in case of successful PhD. defense.

Question to the Candidate:

Theoretically, can you imagine that there are species (specialist) who never appear (not able to establish) in old field succession (in secondary habitats)? - or alternatively, all species from any target communities can establish (with varying probabilities that is just question of time).

Vácrátót, 18. October 2012.

Dr. Habil. Sándor Bartha