Review on the PhD thesis „Interactions between plants and soil biota and effect of energetic crops on these interactions“ of Petr Heděnec, Department of Ecology, Faculty of Science, Charles University of Prague

The thesis deals with several aspects of plant and soil ecosystem interactions. It consists of five papers from which one is already published. Other manuscripts are submitted to various journals. Introduction to the thesis is quite comprehensive and widely focused. The presented work seems not to be relevant only for ecologists but also as a scientific base for managers and possibly for policy-makers. The candidate used several methods to measure a plethora of relevant metrics to understand the interactions between the planted crops and soil ecosystems. I like that the author used variety of different methods to deal with the problem under analysis. Here comes visible the mutual benefit of the cooperation in a wider team.

I have to say in the beginning that I am neither soil biologist nor energetic plant manager and my experience is based mostly on work with negative effects of invasive plants and studying their population biology. Therefore I am primarily against any further human assisted spread of non-native plants. From the focus of invasion ecologist, using the invasive plants as energetic crops is something that should be banned. On the other side the thesis (and financial support towards this direction) provides great set of studies for analysing the impact of alien species on soil ecosystem. As this issue is mostly neglected or reduced to simple measurements of soil chemicals or litter decomposition in ecological studies, I highly welcome the width of assessed types of studied factors in presented thesis. The thesis offers multiple comparisons that are valuable due to several reasons, and standardized methodology on top of it.

The topic of the presented thesis is hot, especially in these days when various policymakers push for wider use of energetic crops. Based on such studies as presented in the thesis we should be able to better consider the advantages as well as potential risks for the environment and than to better choose between different species which are deliberately imported.

Here I have to point out the biggest weak issue of the thesis. Surprisingly the thesis is not closed by any conclusions or synthesis. I would expect that candidate will summarize the new findings acquired from the presented papers in the thesis. It would be great to see all the studied species in one table with their pros and cons. In an ideal case I can imagine a connection of the results of this study with another thesis looking at other environmental impacts e.g. on insects or other plants by using the same set of crop species. Such complex evaluation would be unique and would move the results much higher.

Absence of conclusion part that summarize the results of the papers leave the thesis open. Apart from the summarized results of the presented manuscripts, I would also like to see authors view on e.g. using alien plants as energetic crops and their comparison with native species.

The complete thesis is clearly structured, well balanced in recognizing different aspects of the covered topics, easily understandable and adds new knowledge for a better understanding of the ecology of soil interaction between the crop plants and the soil ecosystem. The data gathered by Petr Heděnec during his field work and experiments is invaluable and will definitely be a good base for many more analyses. By my opinion the used methods were appropriate and thoroughly applied. Sometimes the results presented in individual papers would benefit from a multivariate method that would combine more response variables in one analysis. In some papers, the sampling design is not clearly described. In most of the papers I miss the overall conclusion and take-home message. Several printing errors occur in the text, a careful reading before printing would be welcomed. Petr Heděnec is first author of all presented papers, so I assume he was the key person in

preparation and realisation of the study, as well as writing the papers. To make it clear, it would be useful to state a contribution of each involved person for each paper.
I have a few comments and questions listed below.

At page 38 you state that hybrid sorrel is the most important introduced energy crop. Are you sure? At page 81 you write the same about oilseed rape.
At page 39 in the description of question you say that plot for oilseed rape was more than ten years old. Is this situation comparable to nature conditions? I expect that in most fields the crops change year after year. Can this non-rotated field affect your results?
What do you mean by "split-plot field experiment" (page 56). If you have split plot, you should analyse data by block design. How old were the fields used in this study? Can different age affect/bias your results?
In the last study presented in the thesis, you used the hybrid of *Populus*. Does it refer to some certified clone? If yes, please give its code. Why did you select *Fallopia sachalinensis* for the study? From the perspective of energetic species, is it the most promising species from the genus *Fallopia*?

The whole thesis is nicely rounded around the soil ecosystems, and with exception of the first paper it relates to the energetic crops. Petr Heděnec and his collaborators have gathered huge information about this ecosystem.

My questions are thus:

Based on your knowledge, are you able to conclude what are the pros and cons of planting such species?

Are newly introduced or planted species better or worse than "older" species (oilseed, wheat)?

As agroecosystems are usually taken separately from (semi)natural habitats, can you compare these systems from the view of impact of aliens?

Is there any evidence that success of the invasive alien species/yield of energetic crop plants is linked to soil ecosystem of invaded sites/fields?

What might be possible mechanisms of the changes in the soil?

Conclusion
By my opinion, the thesis of Petr Heděnec fully satisfies the criteria necessary for obtaining the Ph.D. degree at the Charles University. I consider it suitable for defense.

In Průhonice, September 2, 2013

Jan Pergl