Review

of the PhD Thesis “The use of functional traits as a tool in evaluating restorations of peatlands” prepared by MSc Petter Hedberg in the Institute for Plant Ecology and Environmental Conservation at University of Warsaw under the supervision of prof. dr. hab. Stanisław Kłosowski

1. Formal evaluation

The manuscript submitted for evaluation entitled “The use of functional traits as a tool in evaluating restorations of peatlands” is a doctoral thesis of Mr. Petter Hedberg. The dissertation consists of four scientific articles and the introductory text in Polish and English. All of the articles are the joint work of several authors. Three of the papers have already been published in the high-ranking scientific journals, and one article has been accepted for publication. The list of articles in concern includes the following publications:


Additional information, in form of signed declarations, included in the thesis, clarifies the scope and scale of individual participation of the particular author in each of the papers. In the light of these declarations Mr. Petter Hedberg is a leading author of the evaluated publications. His contribution to the papers has been evaluated to 80, 55, 65 and 65 %, respectively. This contribution concerned in particular: performing of the majority of field experimental work, collecting and processing of the data, a large part of advanced statistical analyses and the major part of editorial process of the articles.
Such a content of the submitted thesis is in agreement with the current regulations (Rozporządzenie Ministra Nauki i Szkolnictwa Wyższego z dn. 22 września 2011 r. w sprawie szczegółowego trybu i warunków przeprowadzania czynności w przewodach doktorskich, w postępowaniu habilitacyjnym oraz w postępowaniu o nadanie tytułu profesora, Dz.U. Nr 204, poz. 1200).

2. **Scope and scientific value of the thesis**

The main theme of the presented material concerns the methodological problems of measuring and evaluating the results of ecological restoration of degraded mires. The rehabilitation of these rapidly disappearing ecosystems is in focus of environmental protection at the global scale. Such activities, performed on a large scale in many countries, are extremely costly. It is obvious, that a successful restoration depends upon deep understanding of local ecological processes and constrains, as well as of the general rules governing the biotic/abiotic interactions.

As it has been demonstrated in the analysis of already performed studies and practical projects (presented in Chapter 1) the success of restoration works is mostly doubtful, and often depends on the liberal definition of restoration targets. Choosing the right criteria and application of the proper statistical methods may help to prove the real outcome of such restoration measures.

The ecosystem chosen as objects of the study are the degraded mesotrophic fens, which are relatively distant in geographical and ecological sense. The latter includes the degree and type of human-induced transformation, resulting from different local development history. The studies were performed on three partly degraded fens in Sweden (Chapters 2 and 3) and a highly degraded peatland in central Poland (Chapter 4). The good design of field experiments and measurements and intelligent, multi-level analysis of the problems have allowed drawing the general conclusions from the studies of these systems. This approach has enabled to encompass in a very limited number of areas, almost a complete set of more widely applied fen-restoration methods: improvement of water conditions, removal of trees, vegetation and soil stripping and supplementation of plant propagules. Even at international scale it is not easy to find areas fulfilling all the requirements, among which there is a good description of the original state of the studied mires and well documented history of human impact.

One of the most important achievements of the thesis is the application of the so called functional traits as generalized parameters allowing evaluation of the state of rehabilitated sites. Getting at this generalization level allows to overcome the problems arising from the individual properties of each particular fen. The selection of proper functional traits is based on good understanding of key factors responsible for the functioning of the natural ecological processes as well as the reaction to human-induced disturbances. This approach uses biological characteristics of plants to study the dynamics of ecological processes in reaction to changing abiotic conditions. The way this approach was implemented in the current research can generate some criticisms. The real values of biotic parameters, concerning particular plant species, have not been measured in the field, but were taken for calculations from the available databases. Besides the error that must have been induced through averaging of sometimes wide
ecological spectrum of certain species (as is a case of Ellenberg’s indices), there might be a variation in ecological behavior of supposedly the same taxa existing in distant geographical regions. This limitation has been recognized by the researchers, and the justification, based upon practicalities of the study, has been given in the appropriate publication.

The strong point of the study are advanced statistical analyses. Thanks to that, some obscure and subtle reactions of the system to restoration measures can be proven and clearly understood. The good expertise in this field has a great value for the further progress of the research. In my opinion however, from the practical point of view, such sophisticated and complex statistical methods have little chance for application in practical monitoring work and the evaluation of the results of concrete restoration works. For that reason there is still a need for simpler and more straight-forward indicators of the restoration success. Also, relatively little have been learned about the specific eco-hydrological processes controlling the development and influencing the success of restoration of the particular type of groundwater-fed fens. For example, a toxicity of certain metallic ions supplied with ground water may hamper the vegetation restoration process in such mires.

In general, there is a pity that the guidelines for further research, that have arisen from the research completed by mr. P. Hedberg, have not been formulated within the framework of this thesis. Even if there might be no space for it in the articles published according to strict editorial rules it could have been included in the Summary section of the PhD thesis.

3. Conclusions

The thesis presented by mr. Petter Hedberg contain valuable scientific material based on original research. The methodological approach and the obtained results are making an important contribution to science and can be used partly for solving practical problems in the field of ecological restoration of endangered peatland ecosystems. The thesis fulfill the formal requirements of the Polish law, in respect of scientific degrees and titles.

Therefore, it is recommended to the Council of the Faculty of Biology, Warsaw University to accept the dissertation of mr. Petter Hedberg, and allow him to participate in further stages of the procedure of granting the degree of Philosophy Doctor in Biology.