

Higher Education Quality Assessment Center of Estonia

# Joint Final Report

Institutes evaluated:

Institute of Botany and Ecology, Tartu University

Institute of Zoology and Botany, Estonian Agricultural  
University

Forest Research Institute, Estonian Agricultural University

Visit dates:

10-12 October, 2000

Expert team:

Chairperson:

Professor Marjatta Raudaskoski,

Department of Biosciences,

Division of Plant Physiology,

P. O. Box 56

FIN-00014 University of Helsinki

Tel.: 358-9-70859441

[Marjatta.Raudaskoski@Helsinki.Fi](mailto:Marjatta.Raudaskoski@Helsinki.Fi)

Members:

Professor emeritus Andreas Bresinsky,

Institute of Botany,

University of Regensburg

Private address:

Am Katzenbichel 22

D – 93161 Sinzing (Viehhausen)

Tel.: 49-9404-640185

Fax: 49-9404-640184

[abresinsky@t-online.de](mailto:abresinsky@t-online.de)

Professor H. Walter Lack,

Botanischer Garten und Botanisches Museum Berlin-Dahlem,

Freie Universität Berlin,

Königin-Luise-Str. 6-8,

D – 14195 Berlin

Tel.: 49-30-83850136

Fax: 49-30-83850186

[h.w.lack@mail.bgbm.fu-berlin.de](mailto:h.w.lack@mail.bgbm.fu-berlin.de)

## **JOINT FINAL REPORT - BOTANY AND MYCOLOGY**

RESEARCH INSTITUTES ASSESSED

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Forest Research Institute, Estonian Agricultural University

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## **1. Introduction**

The Estonian Higher Education Accreditation Centre (EHEAC) invited three experts from Finland and Germany to review and make recommendations for the following institutions or parts of them:

- Institute of Botany and Ecology (IBE), Tartu University (TU)
- Institute of Zoology and Botany (IZB), Estonian Agricultural University (EAU), but excluding the Department of Hydrobiology and the Department of Zoology
- Forest Research Institute(FRI), Estonian Agricultural University (EAU).

## **2. Bases of evaluation**

The members of the expert team (subsequently the Team) received well in advance:

1. a working schedule
2. the Principles and Criteria for Evaluations of Research and Development Institutions
3. the self-assessment reports of the three institutes involved.

The information provided in (3) was accepted *bona fide*, in particular concerning funds allocated, since for obvious reasons the Team felt unable to check the financial accounts.

By contrast, the publications listed in (3) were checked in an exemplary manner.

The members of the Team arrived on 9 October 2000 in Tartu, received short additional briefing and were transferred to Tartu the same evening.

The Team visited on 10-12 October 2000 the institutions listed above. It was received by the directors and senior staff members, met several junior staff members and had ample opportunity to discuss the ongoing research work and research facilities. In several cases meetings with graduate students and technicians were also made possible. On the other hand, it was impossible to meet and evaluate all and every member of the three institutes which results in certain gaps in this report, e. g. Malle Kurm, Toivo Meikar, Heldur Sander (all from FRI). However, it was felt that all the main projects are dealt with.

As a rule the recent research publications were on display, and additional reprints given to the Team. Access was possible to all laboratories, libraries and collections the Team wished to see as well as to the Baer Museum. In addition, an experimental field station of IBE in the surroundings of Tartu and the Botanical Garden of Tartu University were visited, the latter however not being a subject of this report. Academic teaching was expressly excluded from this evaluation by EHEAC.

On 12 October 2000 the Team was transferred to Tallinn to write the joint final report herewith presented.

Due to the considerable overlap and / or duplication of work done in IBE and IZB the Team feels unable to follow the institutional structure in this report. As a consequence the individual research groups are evaluated, not the institutes. Of course a mean total may be formed from the evaluation of the individual research groups involved, but this does not offer a guideline for further action.

### **3. Research facilities:**

SPACE is a serious problem mainly in the IBE, rooms are crowded and totally unacceptable.

The botanical COLLECTIONS are housed in two institutions, i. e. IBE and IZB, which is considered a serious impediment. The maintenance of the collections, the access to them, the percentage of unmounted and undetermined specimens is within international standards, with the exception of the vascular plants collection at IBE. No word is adequate for the neglect of this herbarium.

The value of the collections is very considerable: taken all together they form (1) the basis for the data base of the Estonian flora, (2) contain phanerogam collections of great value from all over the world, many from the 19<sup>th</sup> century, (3) comprise very valuable new cryptogam collections from all over the world, in particular many recent series of exsiccata, irreplaceable type material, collections

from ecosystems long destroyed, in particular of fungi and lichens. SECURITY is far below European standards only in IBE.

EQUIPEMENT for traditional routine work is available at low grade in all three institutes, but laboratory space is everywhere restricted.

The Mycological Laboratory of IZB has been recently redecorated and is moderately well equipped for molecular biology work and could also be used for the molecular biology work with endomycorrhiza done at IBE. An attempt to organize the sufficiently equipped laboratory was also obvious at the Department of Ecophysiology of FRI, but efficient laboratory use remained somewhat unclear to the Team. In contrast, the ecophysiological group dealing with photosynthetic capacity and water potential in forest trees and canopies at IBZ was equipped with updated instruments and possessed competence to use these equipments in a highly efficient way. Since modern taxonomic work needs biochemical analysis comparable to those in ecophysiology, plant physiology and molecular biology the equipment at IBE should be improved and refurbished.

The BAER MUSEUM is a conventional museum for a hero of science. Because of its position in the centre of Tartu its potentials should be further developed.

The BOTANICAL GARDEN of Tartu University is not included in this report. However, every attempt should be made to improve its facilities and use it fully in academic teaching.

A brief visit was paid to the EXPERIMENTAL PLOT, which seemed adequate for the ongoing studies.

The FIELD STATIONS of IZB were not visited and are not included in this report.

#### **4. Evaluation of research groups**

In accordance with the Principles and Criteria the following parameters were used for the evaluation:

- a. what was done
- b. strategy and perspective
- c. novelty
- d. national and international collaboration
- e. applicability to Estonian Society
- f. funds
- g. positive/ negative aspects; competence, capacity for further development
- h. grade

These parameter were either given individually or in prose.

#### **4. 1. Botany and taxonomy**

There are two research groups in botany/taxonomy, one at IBE of TU (research group Jaanus Paal), the other one at IZB of EAU (research group Tiiu Kull). They are evaluated separately.

##### **4. 1. 1. Estonian vegetation (Jaanus Paal, IBE, TU)**

- a) General survey of vegetation site types, general features of flora and vegetation, biodiversity of vascular plants and bryophytes in Estonia. Population dynamics and structure of taxonomic units on species level and below.
- b) Compilation of knowledge on the structure of vegetation based on own experience and field work.
- c) Scientific approach follows mainly traditional and classical guidelines.
- d) International collaboration in the sense of being involved into international programmes (United Nations, Danish-Estonian joint project)
- e) Conservation and management of Estonian vegetation; control of biodiversity in Estonia
- f) Several grants from ESF; no grant from international sources.

g) There is still a demand for descriptive studies on the vegetation of Estonia in order to fulfil national and international requirements. On the other hand research in this field may not be innovative enough to meet present time scientific standards. For future development it would be necessary to face the challenges of fast proceeding biological science without neglecting the value of research in traditional geobotany and systematics. Collections are to be regarded as scientific tools which should be used as much as possible. Even if conditions of housing are less than poor it is nevertheless of great importance to keep them safe and accessible. It was obvious to the Team, that – even under the conditions as they are – the present situation should have been avoided for the vascular plant herbarium of TU. It must be remembered that this collection is of enormous historical and scientific value. It is not only a national heritage but also a scientific tool to be used in a more proper way in future.

Finally it has to be questioned, whether two different groups with nearly identical scientific aims (see evaluation of IZB below) in two universities within one city can be further maintained. Under economical and organizational viewpoints the answer to such a question would be definitely “no”.

h) Satisfactory

#### 4. 1. 2. Estonian Flora (Tiiu Kull, IZB, EAU)

a) This research group is very clearly focused on (1) the composition of the Estonian flora past and present, and (2) the biological strategy (pollination, reproduction, dissemination) of selected species. Both fields are in the mainstream of current research. Spectacular findings of the first project are not to be expected, but the careful longterm monitoring of the national flora is today an obligation of each and every civilized country. In contrast, the biological strategy program will contribute in a modern way to our understanding of the actual flora and its distribution.

Other research fields within this group include (1) traditional isoenzyme work in crop species relevant for evolution, (2) biosemiotics. The results of both have attracted some international attention, but seem to play a minor role.

b) Collecting material and making observations in the field; determining specimens in the laboratory and comparing them in the herbarium; feeding the information into a data bank using grid squares. A solid body of information on the Estonian Flora and many answers on the actual distribution is the perspective of this working group.

c) In a well studied small country like Estonia no major floristic discoveries are expected among the vascular plants; however, this is not the case for the cryptogams. The concept of the biological strategy program is not new, but promising.

d) There is considerable national collaboration in floristic work; this is however hindered by the surprising fact, that two major Estonian herbarium collections exist side by side in Tartu. It is strongly recommended to unite these under one roof so that data can be collected more effectively.

In general, international collaboration in floristic work done on a national basis is rather limited. However, Tiiu Kull's project is nicely linked with Atlas Florae Europaeae, the Trondheim Bryophyte distribution program, the nascent European Aeroallergen Network, as well as the Flora of the Baltic Countries.

Collaboration in the biology strategy program seems to exist for orchids, on which more substantial work has been done than on other group. These should be developed.

e) The project on the Estonian flora past and present has a direct impact for the local society. It creates awareness of the native flora and its beauty, and forms the basic requirement for the monitoring of Estonian wildlife. National Parks, nature reserves of all categories can be monitored with the results of Tiiu Kull's team, of which several have been published.

f) The group has attracted a considerable amount of Estonian money. This has to remain so, since because of its in-depth approach national projects are and will be unable to attract international money.

g) The critical approach in both projects is most welcome. The aspect of monitoring nature reserves in Estonia and the collaboration with the conservation people has to be developed. Competence is high, the biology strategy program is expected to yield new insights of considerable interest, while the project on the Estonian flora is a basic necessity.

h. good

#### 4. 1. 3. Aspen Cultivation in Estonia (Ülo Tamm, FRI, EAU)

Ü. Tamm has had a long lasting interest in the different aspects of ecology, physiology, cytology and phytopathology of aspen (*Populus tremula*). Ü. Tamm's research will be compiled in near future in a monograph "Aspen and Aspen Stands in Estonia", which is a very appreciated approach, since aspen has become an interesting tree both for industry and a commonly used tool for basic molecular biology research in trees. Due to language problems it remains unclear to the Team whether Ü. Tamm or his students still perform experimental field or laboratory work. The approaching generation change in the leadership of the forest research should bring modern ideas, tools and laboratory facilities to the institute, not forgetting the data collected during the past years on aspen. The grade of the present research is satisfactory.

#### 4. 1. 4. Berry Cultivation in Estonia (Taimi Paal, FRI, EAU)

- a. The group is focused on cultivation of native and introduced berries in Estonia
- b. Field tests in collaboration with farms
- c. Traditional approach
- d. Being very applied and special in approach, limited international collaboration can be expected; however, collaboration has been found in Canada and Finland, where similar ecological situations lead to similar interests
- e. The project is directly applicable to Estonian Society, in particular to forest owners looking out for additional income. On a wider scale, the implementation of the results of the research group would strengthen Estonia's position on the European Berry Market, so far supplied mainly from Canada, Poland and Finland.
- f. Surprisingly ESF Grant Money has not been allocated abundantly to this research group; additional funds both from Estonian and European institutions should be used for a breeding program and a tissue-culture approach, which may attract students in forestry.
- g. Although conventional in approach, the work done is very promising. The project

leader is highly competent in her field-work and very practical minded.

h) good

#### 4.2. Ecology (Andres Koppel, Olevi Kull, Malle Mandre, Arne Sellin, Martin Zobel)

Ecological research projects were presented by several groups under several categories: Applied Ecology (O. Kull, A. Sellin) and Plant Ecology (M. Zobel), both at IBE of TU, Production Ecology of Trees (A. Koppel) at IZB of EAU and Pollution of Forest Ecosystem (M. Mandre) at the Department of Ecophysiology, Forest Research Institute of EAU. Some categories are not describing the research done by the group. The situation in ecological research is further complicated by the location of the groups either in different buildings far away from each other in Tartu or even in a different town, i. e. in Tallinn. This could also be the reason for the obvious lack of active cooperation between the groups.

According to his own report **Koppel's** research field is production ecology of trees. He and his coworkers (K.Heinsoo and E. Sild and two PhD students) are concentrating their research on the effect of soil and climatic factors on biomass production in a few clones of *Salix viminalis* and *S. dasyclados*. The know-how for the work comes from the Swedish Environmental University at Goteborg, where E.Slid has also been working. The

project appears to have two objects: (1) basic research which aims to resolve the unique properties in *Salix* physiology and (2) applied research which aims to develop the fast rotation forests of *Salix* for production of an alternative fuel and purification system for waste water in Estonia. The applied part of the research appears to proceed well and fits well into the applied research profile of EAU, while the basic research on *Salix* clones seems to lag somewhat behind. The reason might be the heavy administrative duties of the project leader as vice rector of the EAU. This could also be the reason for the low number of peer-reviewed publications (6) of Koppel. The grade of research is between satisfactory and good.

**Kull** 's main research area is the photosynthetic capacity of canopies in mixed deciduous Estonian forest. The strategy involves measurements of light gradients, fluorescence, evaporation etc. in different parts of whole trees with modern equipments and complicated experimental design in the forest. The results translated into photosynthetic parameters have been regularly published in well-known international journals in the field of ecophysiology. This strategy has given Kull an established international position in the field of ecophysiology. Although Kull calls his field applied ecology no application of the research results were presented. Kull's work must be graded between good and excellent.

In spite of the name of the Department **Mandre**'s investigations and those of her coworkers (two PhD senior researchers, three MSci researchers, three PhD students and several MSci students) concentrates on plants in areas polluted by industry. The special feature of Mandre's research is pollution caused by an alkalized environment, which triggers interest also outside Estonia . The group is trying to define a general bioindicator by measuring the relationship between inorganic ion and nitrogen content of control and polluted plants. Mandre has recently made a strong effort to build up contacts with researchers abroad and her effort include graduate students. However, the Department led by Mandre is located in Tallinn, while all other ecophysiological work is done in Tartu, which decreases the possibilities of cooperation. Mandre's research interest is very broad and would need some focusing,. Her research is graded satisfactory.

**Sellin** 's research area is waterpotential of forest trees, mainly in *Picea abies*. The research work is presented under category of applied ecology. Judging from the list of publications Sellin is very devoted and focused on his work, but does his research work mainly alone. The waterpotential of plants and especially of forest trees is not one of the most popular field although a very important area in plant ecophysiology. Therefore it would be good if Sellin could find PhD students or his competence would be consulted in the other research projects (for instance in the environmental pollution project). Out of 26 publications listed by Sellin at least 10 are in good international journals and in the nineties he has presented his work in Finland, Denmark, France and Austria which shows the significance of his research. The work is graded good.

**Zobel** professorship's matches well with his research interests. These concentrate on Estonian alvar plant communities (coworkers M.Moora and M.Pärtel) including analyses of succession of plant communities, effect of soil factors recently including endomycorrhizal associations. Zobel has also worked with salt marshes in Argentina. He has done research work abroad, published and functioned as a referee in international journals of his field. He has also been an opponent in Scandinavian countries and his students have done research work abroad. Zobel should use his internationally established scientific status to improve in very near future the facilities at the IBE at TU. If the present situation continues the scientific reputation of the group leader and the head of the institute will not be enough to attract students. The grade of Zobel's work is good.

It is very difficult to evaluate the funding of each research group discussed here, since the sums in the self assessment report were given mainly on institutional basis. It is obvious that each group evaluated here has been funded mainly by research grants from Estonia. Several groups also mentioned that personal grants had been of substantial help, together with the possibility to work free in laboratories abroad. The performance of all the groups in ecological research needs continuation of funding.

#### **4. 3. Mycology and Lichenology**

##### 4. 3. 1. Mycology (Urmas Kõljag in EAU, TU)

a) Taxonomy of selected groups of fungi (Basidiomycetes, Ascomycetes); including preparation of key books.- Phylogeny: morphological markers (including cladistical analysis) and molecular markers used to establish natural relationships and phylogenies in selected groups of fungi. Role of different DNA-contents of nuclei and polyploidy in micro-evolution.- Ecology: Molecular identification of fungi as ectomycorrhizal symbionts. Role of wood rotting fungi as ectomycorrhizal symbionts. Fungi as indicator organisms of special ecological conditions e.g. virginity of woodlands versus manipulated forests.- Chorology: Check-list of Estonian fungi. Mapping of fungi using data processing electronic devices.

b) Starting with the fundamentals, i. e. the often neglected classical taxonomy, the research group continues to overall morphological analyses of samples and species of a great variety of selected groups, and proceeds to data-processing devices and finally DNA-analysis. The group is open to use many modern methods.

c) Research with considerable degree of originality: matching the cladistical morphological with the molecular approach. Molecular identification of mycorrhizal symbionts is to be regarded as a promising new approach.

d) Connections to laboratories and working groups in different countries: USA, Finland, Germany, Sweden etc.

e) Fungi are an important component in Estonian ecosystems (forests, woodlands etc.). They contribute to food and may be used to answer Estonian demands as well as supply the markets in different other European countries. The role of fungi as pathogens should be kept in mind.

f) Funding from the the Estonian Science Foundation is remarkably high. Funds from the International Science Foundation have been given also.

g) One of the most important collections of Corticiaceous fungi in the world has been built up and is currently used as a basis to promote taxonomic research on these fungi. At no other place such a big resource of specimens from the European and Asiatic parts of the territory of the former Soviet Union has been brought together and is available for research. Great competence in taxonomic knowledge of fungi. Publication is achieved in international well known journals. One senior researcher is honorary member of the American Mycological Society which reflects great international reputation. Staff is composed properly. The head of department is young and energetic enough to ensure present high standards and to develop them further in future.

h) Excellent

#### 4. 3. 2. Phytopathology and Mycology (Märt Hanso at FRI, EAU)

a) Fungal diseases affecting forest trees

b) Established methods are applied in order to identify fungi and to study their life cycles as far as they are involved in forest damages

c) No remarkable novelty involved

d) International collaboration has been established with institutions in Sweden, Finland and Italy

e) It is important to keep a research group being capable to identify pathogenic fungi, to investigate the risks and the virulence of fungal species to forest trees in Estonia and to give special advices to foresters.

f) Funds of ESF support studies on natural antagonists of Root Rot and on the role of forest management in regard to distribution of *Heterobasidion*.

g) There is remarkable competence available to identify fungi causing diseases in forests. Such a competence is highly needed, should be developed and transmitted to students. The final scientific output of the research being done, e.g. in connection with the grants given to the group, is not totally convincing. However, some interesting phenomena have been discovered, and being important for disease control have to be investigated further.

h) satisfactory

#### 4. 3. 3. Lichenology (Tiina Randlane at IBE, TU)

a) Critical revision of Estonian lichen flora. Key books of Estonian lichens. Ecological aspects of lichen species occurring in different forest ecotypes of Estonia. The phylogeny and systematics of selected groups of lichens (Parmeliaceae: cetrarioid lichens).

b) Using a large collection of lichens, the strategy is (1) to provide a monographic treatment of a lichen group on a world-wide scale or (2) to deal with the biodiversity of lichens in Estonia. Monographs on a world-wide scale are needed in order to understand phylogeny of the investigated group. Lichens are extremely useful for monitoring environmental situations.

c) Novelty of research in terms of adopting modern methods is limited due to existing working conditions.

d) International collaboration is realized or on the way to be established more and more (foreign institutions, societies, working groups, organization of an international scientific conference).

e) Monitoring lichens could be an essential contribution to control environmental conditions in Estonia.

f) Work is supported by funds from the Estonian as well as from the International Science Foundation. Taking into account the small staff it is quite a considerable amount of money.

g) Very good competence and overall knowledge in lichens. Publication of results partially also in international journals. Maintaining and developing the collection of lichens as an important working facility has to be acknowledged. There would be a chance to step further and to use lichens (to a higher extend) in monitoring programmes of Estonian environment and/or as members of ecosystems.

h) Good

### **3. General Recommendations**

#### **5.1. Infrastructure**

The existing infrastructure is **TOTALLY INADEQUATE** for the Institute of Botany and Ecology of Tartu University. There is a very real danger of injury (fire, water, etc.) for staff and collections.

The space is totally **INSUFFICIENT** for the IBE of TU, the phanerogam collections are housed under conditions the Team has never ever seen anywhere else.

**IMMEDIATE ACTION IS MANDATORY.**

## **5. 2. Profile development**

It was felt by the Team that the profile of the individual research groups should be strengthened and overlap **MUST BE REDUCED**. In order to be able to better focus on research, it is proposed to incorporate all the scientific collections now kept at the IBE of TU and at the IZB of EAU into another organization. Ideally these materials should be kept in an Estonian Natural History Museum, preferably in Tartu, not in Tallinn. This needs not be a research museum, but rather a safe place to permanently preserve plant and animal specimens and make them available for the national and international scientific community. When this line is followed, it would create the necessary extension space for research facilities, in particular for laboratories. At the moment, however, the phanerogam collection at IBE is at a high risk of being damaged and / or destroyed. **IMMEDIATE DECISION AND ACTION IS NECESSARY.**

The research groups continue to need money. They are already able to compete for international grants. However, it was unanimously felt, that they would be more successful only after shapening their individual profiles.

In addition, it was felt, that **ALL** PhD students of ecology and forestry must be trained in plant physiology and molecular biology dealing with essential topics like photosynthesis, membrane transport etc. Although this information is given at the plant cell level, it forms the vital basis for understanding the function of the whole plant.

## **5. 3. Publishing policy**

In general, the printed output of the institutions evaluated by the Team is **VERY SATISFACTORY**. Every attempt should be made to encourage botanists/ecologist to

publish their results in English in order to make them better known to the scientific community. On the other hand, the publication of texts in popular science journals, textbooks for high schools etc. as done in an exemplary manner by members of a few research groups is very welcome and should be **STRONGLY SUPPORTED**.

#### **4. 4. Baer Museum**

The Baer Museum acts already as an ideal centre for the history of the natural sciences in Estonia. Although Baer is for Estonia a national monument on its own, the approach of the Baer Museum is far too parochial and should be broadened to include also materials from other important biologists like v. Bunge, Kusnetzow, Ledebour, Leppik, who have worked in Tartu University.

The policy of renting out parts of the building as a office for the popular Estonian journal 'Eesti Loodus' should be continued so that the Baer Museum can act as a centre for nature conservation and awareness in Estonia.

It should be noted, however, that the Baer Museum is totally unsuitable for storing natural history specimens in a modern way.