Estonian Higher Education Accreditation Centre

Evaluation of Research in Forestry (4.3) in Estonia

Institutes evaluated

Estonian Agricultural University
Faculty of Forestry

Evaluation dates

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Part I

General Overview

Introduction

At the request of the Estonian Higher Education Accreditation Centre, Tallinn (EHEAC), an evaluation team (hereafter named the "Evaluators") visited institutes in Estonia carrying out research activities in forestry (4.3). The evaluating team consisted of Prof. Hugh Miller (Aberdeen University), Prof. Sara von Arnold (SVA), and Prof. Henn Tuherm (Latvia University of Agriculture).

The institution to be evaluated was:

Faculty of Forestry, Estonian Agricultural University:

- Department of Forest Management Planning
- Department of Silviculture
- Department of Forest Industry

The evaluators were provided in advance with self-assessment report from the institution, prepared by the members of its groups.

After a brief orientation meeting at EHEAC, the evaluators visited the Estonian Agricultural University in Tartu over two days. At these meetings staff members of the various depatrments presented their work. During these presentations, as well as during the subsequent discussions, additional information about the research activities was provided. This included additional documents such as copies of published papers.

Approach to the evaluation

The evaluators were asked to:

1. Judge the activities of research and development in the units evaluated and the research topics implemented by them to ensure the governmental funding for internationally recognised research and development. The Team was asked to concentrate on research units (university departments, laboratories) with specific comments to sub-units, groups if necessary.
2. Identify deficiencies in the activities of research and development units.
3. Give recommendations on the development concerning research and development and research areas to the state of Estonia.

The Team received the following materials: A work schedule, principles and criteria for evaluation of the research units, evaluation guidelines for the ranking of research units, and self-evaluation reports created by the research units themselves.

On a first evaluation point, the ***quality of the research activities*** was considered. This assessment is largely based on the records of scientific publications.

Excellent	***The majority of the submitted works are at a high international level and virtually all others at a good international level***.
Excellent to good	*At least one third of the submitted works are at a high international level and many others at a good international level, these together comprise a clear majority.*
Good	***The majority of the submitted works are at least at a good international level and virtually all others at a fair international level***
Good to satisfactory	*At least one third of the submitted works are at a good international level and many others at a fair international level, these together comprise a clear majority*
Satisfactory	***The majority of the submitted works are at least at a fair international level***
Satisfactory to	*A minority of the submitted works are at a fair international level*

unsatisfactory	
Unsatisfactory	***None, or virtually none, of the submitted works are at a fair international level***

Regarding the grading of the research activities, the evaluation team was instructed by the EHEAC to reserve the term **excellent** for groups which were found to be among the best 10% of the European groups in the corresponding field. Similarly, the term **excellent to good** should be used if the evaluated group was found to be among the best 25 % of corresponding European groups. The full scale comprised 7 levels, in addition to the highest ones the grades are **good, good to satisfactory, satisfactory, satisfactory to unsatisfactory,** and **unsatisfactory.**

Secondly, the ***over-all capability*** of a research unit was evaluated based on a the combined assessment of the following criteria (each graded in three levels):

- The originality/novelity of past and ongoing research activities
- The strategy and perspective of the research
- Multidiciplinarity and relevance for other research areas
- The competence of the research groups and their capacity for development
- National and international co-operation
- Success in applying for grants

As the result of this assessment one of the four grades **excellent, good, satisfactory** or **unsatisfactory** was given for the group.

Thirdly, the ***implementation opportunities*** for the research results and their importance for the Estonian society were commented.

Finally, on a fourth evaluation point the critical comments and recommendations were asked to give by the expert team.

Part II

General Comments

Introduction

Academic forestry education in Estonia started within the University of Tartu in 1920 and a separate Faculty of Forestry was created in 1946. The faculties of Agriculture, Veterinary and Forestry were then combined into a separate Estonian Academy of Agriculture in 1951, now the Estonian Agricultural University, which also houses much of the Estonian Forest Research Institute. This combination of the Faculty with the Research Institute is a considerable strength and there is close collaboration between the staff of the two Institutions. However, as research at the Institute was assessed in 2000 the current review covers only that carried out within the University Faculty.

The Faculty comprises three departments, namely Silviculture, Forest Management and Forest Industry. For research purposes four groups are recognised, one of which, (Forest Management, Forest Policy and Economics) cuts across the departments whereas the other three are broadly synonymous with one or other of the departments. The staff as a whole were anxious to point out that research responded to perceived need irrespective of administrative boundaries (indeed the work of one member of staff was even presented under two research groups).

Without exception the staff and students were enthusiastic about their work and the evaluators gained a very positive impression of the Faculty as a whole. Some areas of work, such as that in the field of mensuration, were long established and proceeding well whereas others, for example policy research, were relatively new to the Faculty (indeed to the country) and the necessary skills are still being developed.

Part III

Evaluation of institute and research groups

3.1. Research group: Forest Growth Modelling and Remote Sensing *(Group leader Prof. Andres Kiviste, PhD)*

General Comments

As already mentioned, this area of research has a long history in the university and the continuing guiding input from Professor Emeritus Artur Nilson was very evident. There is an unusually high level of mathematical expertise among the staff that was being put to good purpose without apparently dictating the direction of research. While building on existing strengths, such as the theoretical aspects of forest growth modeling, a clear vision has been developed of future needs. To meet these a new network of permanent forest growth plots has been established between 1995 and 2002. Close collaboration has been developed with Tartu Observatory to explore the potential of remote sensing, mainly satellite remote sensing, in the survey and inventory of forest resources, and an assessment has been made of the likely impact of climate change on the forests of Estonia.

The research group comprises five scientists with doctoral degrees (4 PhD and 1 DSc), one with a Masters who is currently studying for a PhD and twelve MSc students. In addition one PhD and three MSc degrees have recently been completed. Research was presented for evaluation under the headings:

Climate Change Impacts and Adaptations Assessments in Estonian Forestry.

This four country review, lead by Professor Artur Nilson and commissioned by UNEP has produced a very significant report. Estonia was among the first countries to note the acceleration of tree growth that is now widely reported.

Theoretical Aspects of Forest Growth Modeling.

Professor Andres Kiviste has analysed some 75 different growth functions. There has been important and useful collaboration with researchers in Germany, Spain and Chile and the comparative work has been published widely, and a new method of site index developed. The mathematics involved in the use of non-linear transformations in forest biometrics has been rigorously analysed.

Network of Permanent Growth Plots.

Professor Andres Kiviste and six MSc students, with the assistance of some BSc students, has laid out a new series of 616 plots, each containing at least 100 trees, across the age ranges in the main forest types in Estonia. The evaluators regarded this as an important new development that should be pursued into the future.

Diameter Distribution Models and Height-Diameter Equations.

Professors Andres Kiviste and Artur Nilson, together with three MSc students, have tested more than 30 different height-diameter functions leading to the creation of a standardised height-diameter equation.

Individual Tree Growth Modeling in Mixed Stands.

Dr Kalev Jõgiste and two MSc students have been developing a simulation model, based on diameter growth equations, to enable the study of theoretical population dynamics in different mixtures of spruce and birch.

Database of Forest Models.

Professors Artur Nilson and Andres Kiviste, with three MSc students (one from Germany) have drawn up a database of some 80 models and this has been made available on the web in Estonian, English and German.

Remote Sensing.

This work is carried out in conjunction with Tartu Observatory where Drs Tiit Nilson and Urmas Peterson lead a group that presently comprises one PhD student and three masters students (one from Germany). The main task has been the elaboration of theoretical models for forest reflectance to enable interpretation of Landsat and SPOT images in relation to stand age, canopy closure, species composition and biochemical/biophysical variable such as leaf area index, chlorophyll, water etc. A map of the proportion of hardwoods to softwoods across Estonia has been compiled.

A considerable number of publications have resulted, many in refereed journals.

Evaluation of Research Activities

Overall work in this area this was judged as **Good** although the completed work on climate change was deemed to be Excellent and that on theoretical aspects of forest growth modelling as being Excellent to Good.

Evaluation of Overall Capability

The overall capability of the research group was scored as **Good** with again the work on climate change coming out as Excellent. That on both forest growth modelling and on individual tree growth modelling in mixed stands was both scored at the top end of good.

The implementation opportunities for the research results and their importance for Estonian society

The scientists involved were clearly well aware of the contribution they could make to forestry and society in general. This aspect was overall judged to be **Excellent to Good.**

Recommendations

1. The work on forest growth modelling based on data drawn from the new permanent sample plots is considered to be of prime importance. The theoretical basis has been well explored and the next step should be the production of the necessary management tools once adequate sample plot data has been accumulated (although the possibility in the interim of using data from earlier plots should perhaps be explored).

2. The future of the new series of plots provoked some concern. They represent an important long-term resource but their funding is currently dependent on obtaining new grants year on year. Some commitment to long-term support seems essential, something the forest service and the forest industry could reasonably be asked to provide.

3. The evaluators regard the development of predictive forest models as being at the core of the work of this research group. Other aspects, however, also impressed. It seems sensible to continue to pursue the work on the potential of remote sensing although the rather limited contribution this is likely to make to resource inventory in a country the size of Estonia must be recognised. However, its ability to identify temporal factors at a time of rapid in land use may prove to be of particular value.

4. The age distribution of this group, coupled with the departure of Dr Jõgiste to the Forest Research Institute does provoke some concern for its future. Appropriate new appointments should be considered.

3.2. Research group: Utilisation and Properties of Wood *(Group leader Prof. Peeter Muiste, PhD)*

General Comments

This group comprises seven scientists, two of whom have PhDs and the remainder MSc degrees, some of whom are now working on their doctoral thesis. In addition there are one PhD student, eight MSc students, a guest lecturer (MSc) and some sub-contracted researchers from other departments of the University and from Tallinn Technical University.

The Group is involved in studies on the properties of wood, the utilisation of wood by industy, energy from woody biomass and the structure and technology of the forest industry sector. The research, which is very practically orientated rather than of a fundamental nature, was presented for evaluation under the following headings:

Properties of Wood.

This is team is lead by Professors Jaak Pikk and Peeter Muiste and comprises eight researchers (including three MSc students). An investigation of the influence of site type on wood properties (such as hardness, bending, impact and compression strengths and density) is underway. A textbook has been produced providing guidance for the wood processing industry. A new initiative is a study of the production and properties of charcoal.

Measurement and Quality of Rroundwood and Use of wood in Traditional Houses.

The work on roundwood is lead by Jüri Jänes and aims to develop measures and regulations to specify quality in roundwood. This study has lead to proposals for changes in current forest law, to new timber measurement regulations and to improved forms of contract for private owners. The opportunity this work presents for implementation was evaluated as Excellent. An interesting and significant study of the traditional methods of use of roundwood in log houses is underway.

Analysis of the Forest Industry Sector.

This is lead by Professor Peeter Muiste and the team comprises eight researchers, including three MSc students. The results of these studies fed directly into the Forestry

Development Programme 2001-2010. This work, although descriptive, is very important for the Estonian forest industry

Utilisation of Energy Wood.

Lead by Professor Peeter Muiste and comprising seven researchers (including three sub-contracted researchers), this team this team has been modeling the supply-demand balance for wood fuel and determining the potential quantities from different sources.

Assessment of New Forest Technologies.

Again lead by Professor Peeter Muiste the three in this team, including one MSc student, are setting out to evaluate modern harvesting technologies.

The research under the first two headings above is very practically orientated while that under the third is more descriptive. None are of a fundamental nature.

Evaluation of Research Activities

On the basis of the publication record and on comparisons with other international groups the work of this group is judged to being **Good to Satisfactory.** Research on the utilisation of energy wood was considered Good.

Evaluation of Overall Capability

The overall capability was scored as **Good to Satisfactory,** this category being assigned to all the assessment units except Competence which was considered to be Good.

The implementation opportunities for the research results and their importance for Estonian society

This was evaluated as **Good to Excellent.** The Estonian national economy is very dependent on the success of its forest industry, with much of the produce going for export. The studies on the measurement and quality of roundwood and sawn wood are critical for this industry.

Recommendations

1. Research into the utilisation and properties of wood is of great practical importance and definitely should be continued. Efforts should be made to attract funding from the forest processing industry who are the first beneficiaries of such work.
2. The researchers making up this group are clearly competent and are committed to ensuring the implementation of their results. However, the techniques being used are largely descriptive and consideration should be given to investigating the underlying fundamentals.
3. Consideration should be given to developing improved methods for the analysis of the efficiency of timber conversion and the efficient utilisation of co-products such as bark and sawdust.
4. Greater international co-operation in forest technology research is recommended (including the manufactures and suppliers of forestry equipment), especially between the Nordic and Baltic countries (for example through the NSR – the Nordic Council of Forest Operation Research).
5. It is recommended that genetically defined trees and material from the tree improvement programme be included in the study of wood properties.
6. More of the work should be published in international journals.

3.3. Research group: The Regeneration and Cutting Systems of Estonian Forests
(Group leader Prof. Hardi Tullus, PhD)

General Comments

The research group includes eight researchers, three PhD students and four MSc students. The group leader, Professor Hardi Tullus, has built up a creative research group covering both applied and basic research. The group is a constituent member of the "Centre of Excellence for Basic and Applied Biology". Three research areas were presented for evaluation.

Forest Regeneration and Fellings.

This research is lead by Professor Hardi Tullus and comprises five members. The research is of an applied nature aiming to give recommendations to forest managers and to the Ministry of the Environment regarding reforestation and sustainable forest management. A handbook has been produced providing guidance for field managers and work has been carried out on methods of soil preparation prior to planting or natural regeneration. Studies have also been made of growth in mixed species stands.

Afforestation of Abandoned agricultural land and Nutrient Status of Fast growing Broadleaved Species.

This research is lead by Professor Hardi Tullus. The research covers several areas with the aim of establishing the limitations to, and consequences of, afforestation of ex-agricultural land and of man-made soils resulting from the reinstatement of shale mine spoil. Nutrient accumulations and fluxes are being assessed in stands of alder, hybrid aspen and silver birch. By the end of 2003 a full description of the flux of nitrogen through an alder stand should be available. Root ecology, especially the role of fine roots in the accumulation and decomposition of soil carbon, is being studied in different substrates. This research is being carried out in collaboration with scientists from the University of Tartu. The biomass production in stands of hybrid aspen is being studied in co-operation with Finnish scientists.

Tree Physiology, Water Balance

The project is the PhD project of Krõõt Aasamaa being carried out under the supervision of Dr. Anu Sõber from the University of Tartu. The overall aim is to study foliage biomass production and as a part of this the hydraulic conductance in different hardwood species. The next step is to study bioproduction in relation to water balance under stress conditions.

Evaluation of Research Activities

Both the applied and basic research is of high quality. The results have been published in national and international journals of high repute. Seven Masters theses and four Doctoral theses have resulted. In addition four Doctoral theses are in progress. Taken together the group has been very successful. The co-operation with other members of the Centre of Excellence, as well as with scientists elsewhere in the University of Tartu and the University of Helsinki, has had a positive impact. Although the number of researchers in each sub-project is small the co-operation with scientists outside the department has enabled advanced research.

The overall activity of the group is rated **Good.**

Evaluation of Overall Capability

The nature of the research varies from extension, e.g. the writing of a handbook, to work of considerable novelty, as in the study of internal water balance. However, an overall strategy is clear and the competence of the group is very good. The members of the group have established close collaboration with other scientists in Estonia and abroad. The integration of postgraduate students into the various projects is very positive and makes for future promise.

The overall capability of the group was scored **Excellent.**

The implementation opportunities for the research results and their importance

For Estonian Society

Results from the sub-project "Forest Regeneration and Fellings" has either been implemented or will soon be implemented, for example the production of a handbook for field staff and the provision of advice and recommendations to a number of organisations. The information gained is of importance for foresters and for future policy formulation in Estonia. The research within the framework of the two other sub-projects is more basic in nature and therefore will not be implemented for some time. However, the information will be of utmost importance for forest establishment and production.

The overall implementation opportunities for the research results are **Excellent.**

Recommendations

1. The Group should continue to conduct both applied and basic research. In order to continue with basic research it is important that new PhD students are involved and that the co-operation with scientists outside the department is strengthened.
2. The group should seek support to extend their work into more basic questions.
3. Research into nutrient accumulation and fluxes has been carried out for some time and the evaluators recommend that future development of these studies should be guided by a clearer strategy, with well-defined hypotheses.

3.4. Research group: Forest Management, Forest Policy and Economics *(Group leader: Assoc. prof. Paavo Kaimre, D.Sc)*

General Comments

In addition to the group leader, who is also currently the Acting Dean of the Faculty of Forestry, this group comprised four researchers, one with a PhD and three with MSc degrees, two PhD students and three MSc students.

The group is involved in studies of socio-economic aspects in the forest sector. The research was presented under the following headings:

Forest Management Planning.

Coordinated by Henn Korjus and aimed at developing, in conjunction with Eesti Metsakeskus, a method of assessing nature values on the basis of data collected by the Estonian Forest Conservation Area Network. The method is now widely used and aided in the inventory of NATURA 2000 forest habitats.

Economics of Forestry.

This is coordinated by Professor Paavo Kaimre and is aimed at developing suitable methodology for cost-benefit analysis in Estonian forestry. Such an analysis has been made of the economic benefits of afforestation of abandoned farm land and on aspects of timber processing.

Formulation and Implementation of Forest Policy.

Coordinated by Kalle Karoles this work has been directed at the harmonisation of Estonian forest policy with EU requirements and the development of Criteria and Indicators of Sustainable Forest Management suitable for Estonian conditions.

Forest Policy Analysis.

Under the direction of Professor Paavo Kaimre aspects of the financing of Estonian forestry, including the impact of environmental legislation, has been described and analysed.

The research in forest management planning by using the methods of nature value assessment in forests, forestry economics in free market relations, as well as research in forest policy formulation, implementation and analysis, are new areas of forestry research in Estonia. Research activities in these fields started only some 10 years ago, after the restoration of independence. Research in these fields at the national level is driven by the requirements for harmonisation of Estonian Forest policy with the policies of other European countries, with the EU Forestry Strategy and with international agreements, especially in relation to environmental protection and sustainable forest management.

Because of the relative lack of experience in this new field the work presented for evaluation can be described as being mainly descriptive, rather than being based on any analysis of the fundamentals of socio-economics. At the same time, the role of research group in formulation of Estonian Forest policy, of the Forestry Development plan and in working out the criteria and indicators of sustainable forest management, can not be over stated. A very positive feature must be the publication of an original textbook for the university students by Dr Paavo Kaimre, “Economics of Forestry”, the first monograph in this field in Estonia.

Evaluation of Research Activities

On the basis of the publication record, the content of submitted research works and on comparisons with other international groups the work of this group is judged to being **Satisfactory**. Although the completed work on Policy formulation was deemed to be Good on this basis.

Evaluation of Overall Capability

The overall capability was scored as **Satisfactory**, although the Strategy, Competence and Co-operation were regarded as Satisfactory to Good. The evaluators are firmly of the opinion that the enthusiasm and competence of the group is such that they form the nucleus of what could develop into a very effective research team into the new field of forest socio-economics as they gain the necessary experience and confidence.

The implementation opportunities for the research results and their importance for the Estonian society

Despite the Satisfactory rating of the quality of research, as well as the overall capability of a research group, the implementation opportunities and importance of the research were evaluated as **Good**, for the work that has been carried out has undoubtedly assisted in aspects of policy development in Estonia.

Recommendations

1. Forest management, forest policy and economics research is an important part of forestry research and must be developed if an understanding is to be gained of this area of human activity. We believe that the young staff of the group have the possibility to develop the necessary skills and to master the modern methodology of economic, policy and social research used in Nordic and other Western countries, so enabling them to carry out research at a high international level.
2. Co-operation with the academic units carrying out the economic, policy and social research elsewhere in academia within Estonia and neighbouring countries would help greatly in this process and we urge that this be developed.
3. The printed output of the group is satisfactory. Every attempt should be made to encourage the group members to publish their results in English in order to make them better known to the international scientific community. On the other hand, the publications of articles in popular science journals and textbooks for students are very welcome and are supported.

Part IV

Summary of evaluation

Forests and the forest industry are of great importance for Estonia. Therefore, it is of utmost importance that the country conducts research aimed at increasing the production and quality of wood as well as ensuring sustainable forest management and the conservation of important and reprersentative forest ecosystems. It is not realistic to expect a small country to undertake research in all areas, but it is important to develop strong and broad competence so making it possible for scientists to keep up to date with developments at an international level and partake in international research networks. The evaluators consider that the researchers they met in this exercise demonstrated high levels of competencies and showed that they are linked into, or are planning to become involved in, international co-operation. Such developments are highly supported.

The overall quality of the research at the faculty is **Good**. The scientists have been diligent in publishing their results, although the evaluators recommend more of the work should be published in international journals (see Recommendations). Much of the work that has been carried out has also been presented at international conferences, which is a matter for congratulations.

The overall capability of the research groups at the faculty is **Good**. The activities performed in different projects varies from analysis of existing information to the collecting of new data. However, both tasks have high relevance. The competence of the researchers is good. The interdisciplinary nature of the research makes the results highly accessible. The close co-operation with scientists at the Forest Reseach Institute and within the Centre of Ecellence is of great importance for the quality and the implementation of the results.

The practical implementation of the research performed at the faculty is **Good to Excellent**. The results have been reported in national and international journals and books. Much of the work has also served as background information for the formulation of forestry policy and forest practice.

An impressive number of master and doctoral thesis have been produced during the period under review. This is important for future research at the faculty.

Part V

Recommendations

International co-operation requires that researchers publish their results in international journals, so making them attractive to international teams seeking collaborators. The evaluators found that much scientifically new and important information gained from research is not available to the international scientific community because it has only been published in national journals. After disscussion with students we understood that there are some problems in obtaining international journals, both within the library of the University and the country as a whole. If the students are to be trained to publish in international journals, and to participate in international research, it is important to increase the availability of relevant journals.

In order to cover a broder research area, while still retaining the necessary competencies and focus, we suggest that new possibilities for co-operation within the Baltic countries in complementary research projects should be actively explored.

Some of the research groups are in urgent need for new young scientists. Efforts should be taken to recruit new PhD students as well as post doctoral scientists. It is also crucial to find new ways to finance researchers in order to make it possible for them to work full time with teaching and research. All opportunities to attract new financial support should be reviewed. In this context EU support is important. However, we would also encourage increased effort to obtain funding from the forest growing and timber processing industries who are often the first beneficiaries of the forest research being carried out at the University.

The evaluators have found that inevitably at this stage much of the work has been of a rather descriptive nature employing fairly standard methodology. This is sensible but for the future we would expect the research to become increasingly hypothesis driven.

Part VI

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