

Evaluation Report

**Faculty of Forest Sciences
University of Joensuu, Finland**

Reporting Period 2000–2006

Review Panel

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29. 2. 2008

Evaluation Report of the Faculty of Forest Sciences, University of Joensuu, Finland

Opening Statement

This report assesses the quality of research within the Faculty of Forest Sciences, University of Joensuu, Finland, for the period 2000-2006. The assessment was required by the University of Joensuu and in the context of the overall evaluation of the education and research it may serve as a basis for the “negotiations” during the merging process of the Universities of Joensuu and the University of Kuopio to the University of Eastern Finland, effective January 1st, 2010.

In the fall of 2007, the panel members were approached by Prof. Seppo Kellomäki, the Dean of the Faculty of Forest Sciences, University of Joensuu. Upon acceptance of the invitation, we were provided with background material on the reporting period, including: (i) a general overview of the faculty (ii) publication lists, (iii) budget related issues, (iv) four selected PhD theses by major, (v) the ten most relevant publications by major, and (vi) self-evaluation reports from each faculty member.

The panel members visited Joensuu on February 5th through 8th, 2008, in which introductions to faculty and staff members were made, laboratories were visited and information regarding the three major programs was presented. Finally, all other information required for this assessment was obtained through individual discussions.

None of the panel members had or has any conflict of interest or is related to any of the faculty members, ensuring that this is an independent expert panel assessment. The following report gives the consensus view of all four panel members.

1. Introduction

The Faculty of Forest Sciences was founded in 1984 (teaching started already in 1982) with the goal of establishing a research and educational program in boreal forest ecosystem management. Today research and training is done in three major areas:

- 1. Forest Engineering and Forest Products Technology***
- 2. Forest Planning and Economics***
- 3. Management of Forest Ecosystems***

The Faculty is led by a Faculty Council, which consists of two professors, two students and two members representing the other groups (senior assistants and other researchers). The Dean is the chair in the Council and leads the Faculty with the principles agreed by the Council and the University Board. The next organizational level is the individual professors and senior assistants, whom are considered to be independent scientists. In addition, loose research related groups exist, but have no resources and hold no formal power. The Dean of the faculty is responsible for all of the resources and their distribution within the faculty.

Table 1. Number of person-years among various personnel groups in 2000–2006 in the unit.

Position	2000	2001	2002	2003	2004	2005	2006
Research personnel	50	44	44	48	46	44	38
Professors	9	9	11	11	11	11	11
Teaching personnel*	9	8	8	10	10	10	10
Auxiliary personnel	17	18	16	15	16	16	12
Administrative personnel	12	10	9	11	9	8	9
Post graduate students**	63	82	77	76	86	78	71
Total personnel	97	89	88	95	92	89	80

* Teaching includes lecturers, full time teachers, assistant and senior assistants

** The numbers indicate the number of post graduate students.

List of Professors and Senior Assistants currently working at the Faculty:

1. **Pertti Harstela**, Professor in Forest Cultivation Technology (shared with Finnish Forest Research Institute, 20%, Faculty of Forest Sciences), Doctor of Science in Forestry (D.Sc. in Forestry)
2. **Timo Karjalainen**, Professor in International Forestry (shared with Finnish Forest Research Institute, 20%, Faculty of Forest Sciences), D.Sc. in Forestry
3. **Seppo Kellomäki**, Professor in Silviculture, D.Sc. in Forestry
4. **Atte Komonen**, Senior Assistant in Forest Ecology (currently on leave), D.Sc. in Forestry
5. **Jari Kouki**, Professor in Forest Ecology, PhD
6. **Mikko Kurttila**, Professor in Forest Planning (deputy), D.Sc. in Forestry
7. **Petri Kärenlampi**, Professor in Forest Products Technology, Ph.D.
8. **Matti Kärkkäinen**, Professor in Wood Utilization and Industry, D.Sc. in Forestry
9. **Tarja Lehto**, Senior Assistant in Forest Soil Science, Ph.D.
10. **Katri Luostarinen**, Senior Assistant in Wood Science, D.Sc. in Forestry
11. **Matti Maltamo**, Professor in Forest Mensuration, D.Sc. in Forestry
12. **Hannu Mannerkoski**, Professor in Forest Soil Science, D.Sc. in Forestry
13. **Jukka Matero**, Senior Assistant in Forest Economics, D.Sc. in Forestry
14. **Lauri Mehtätalo**, Senior Assistant in Forest Planning, D.Sc. in Forestry
15. **Pekka Niemelä**, Professor in Forest Protection, Ph.D.
16. **Heikki Ovaskainen**, Senior Assistant in Forest Technology, M.Sc. in Forestry
17. **Petteri Packalén**, Senior Assistant in Forest Mensuration, Lic. in Forestry

18. **Teijo Palander**, Professor in Forest Technology, D.Sc. in Forestry
19. **Paavo Pelkonen**, Professor in Forest Production Science, D.Sc. in Forestry
20. **Heli Peltola**, Senior Assistant in Silviculture, D.Sc. in Forestry
21. **Timo Pukkala**, Professor in Forest Planning, D.Sc. in Forestry (currently on leave)
22. **Olli Saastamoinen**, Professor in Forest Economics, D.Sc. in Forest Sciences
23. **Olli-Pekka Tikkanen**, Senior Assistant in Forest Ecology (deputy), Ph.D.
24. **Timo Tokola**, Professor in Forest Information Systems, D.Sc. in Forestry

Table 2 outlines the funding sources in the previous 6 years. Approximately 40% of the funding is derived from external sources (see External Financing).

Table 2. Sources of funding and spending in the period 2002-2006.

Item	2002	2003	2004	2005	2006
Budgetary funding	3552000	3464000	3511000	3483000	4349000
External financing	2152000	2535000	2367000	2999000	2770000
Academy of Finland	930000	1135000	1145000	1333000	870000
Tekes	209000	199000	186000	171000	68000
Domestic company	19000	57000	31000	40000	18000
Other domestic funds	473000	656000	770000	934000	780000
EU	513000	483000	217000	520000	1032000
Foreign companies	-	-	-	-	-
Other foreign funds	8000	5000	18000	1000	1000

Major facilities are located in the Borealis Building. These include various offices and a university-connected network of over 200 computers. The Faculty has good laboratory facilities with several pieces of special equipment (e.g. ICP, GC/MSD-laboratories and laboratory for freezing tolerance tests) and permanent laboratory personnel. The Faculty has both internal collaboration within the university (laboratory network) and external collaboration with the Finnish Forest Research Institute (FFRI), Joensuu Research Unit. The laboratory network within the university expands the range of available analyses and increases human resources available for laboratory and field work and the FFRI Joensuu Research Unit and the Faculty share special laboratories (growth chambers, root laboratories/phytotrons). There are also laboratory facilities and experimental fields in the Mekrijärvi Research Station at the University of Joensuu, which the Faculty can use.

The Finnish Forest Research Institute, Joensuu Research Unit, is located just across the street from the Borealis Building and the headquarters of the European Forest Institute is located close to the university. The location of the Faculty is ideal for a close collaboration with the "Joensuu Forestry Cluster" - (i) the Faculty of Forest Sciences, (ii) the Forest Research facilities of Metla in Joensuu, and (iii) the European Forest Institute (EFI).

The following main research topics were identified by the Faculty for the period 2000–2006.

- Effects of climate change on forests and adaptation to climate change
- Forest ecology and biodiversity
- Multi-objective and participatory forest planning
- Wood science
- Wood procurement
- Forest resource inventory and GIS (laser scanning remote sensing)
- Economic evaluation of forest benefits
- Forest energy biomass and its procurement

Table 3 outlines the number and types of publications for the reporting period 2000–2006. Annually, there were 60–70 articles in refereed publications.

Table 3. Number of publications in 2000–2006.

Category	2000	2001	2002	2003	2004	2005	2006	Total
Articles (refereed)	56	33	77	68	65	62	73	434
Published in Finland	3	4	19	17	9	11	17	80
Published abroad	53	29	58	51	56	51	56	354
Articles in compiled works or in printed conf. public.	54	7	45	37	58	38	54	293
Published in Finland	27	3	40	23	46	24	36	199
Published abroad	27	4	5	14	12	14	18	94
Monographs	3	1	2	1	4	4	3	18
Published in Finland	1			1	4	4	3	13
Published abroad	2	1	2					5
University's own publication in series	5	0	0	0	0	1	0	6
Published in Finland	4					1		5
Published abroad	1							1

2. Conclusions and recommendations

1. The research activities at the Faculty are organized along 3 majors:

(1) Forest Engineering and Forest Products Technology

(2) Forest Planning and Economics

(3) Management of Forest Ecosystems

The human and financial resources are not evenly distributed between the 3 majors. Management of Forest Ecosystems dominates the resource allocation and achievements, followed by Forest Planning and Economics, and, undoubtedly, Forest Engineering and Forest Products Technology is the least developed.

2. Overall, the quality of the research of the Faculty of Forest Science of the University of Joensuu is very good to outstanding, depending on the major.

The Management of Forest Ecosystems program has delivered outstanding research achievements in several areas. The status of a National Centre of Excellence in Forest Ecology and Management is a clear indicator of the quality of work of this group.

The quality of the research in Forest Planning and Economics is, in general, very good. Contributions of excellent quality are found in areas such as airborne laser scanning and remote sensing as well as multi-objective forest planning methods.

Forest Engineering and Forest Products Technology is clearly the smallest area, and thus, only a very select range of research topics are feasibly covered. Results and achievements are good to very good in these selected topics (e.g. fiber and drying technology - wood technology; harvester operations and transport logistics - forest technology), whereas, other topics have some room for improvement.

3. The Faculty of Forest Science identified a number of research topics, which were of priority status during the evaluation period, among which are and will continue to be “Technology and Harvesting Operations”, “Production of Forest Biomass in Timber for Wood Processing and Energy Industry”, and “Wood Technology”. This will require a strengthening of the Forest Technology and Wood Science area to achieve the ambitious targets.
4. The organization underneath the Dean and the Faculty Council is not formally structured and seems to be too flexible. The different professors work, more or less, independently and cooperate in teams or research groups according first and foremost to their own preferences and secondarily to actual research needs and research programs. The allocation of the Faculty’s budget and other resources is flexible and is re-allocated on a year-to-year basis. This flexible structure has its advantages, namely, it allows for adaptability in the face of evolving research needs and programs. On the other hand, complex research needs at the national and international (EU) level require structure and leadership from the university programs and it could be difficult in an unstructured environment for a single professor to fulfill such institutional demands. Furthermore, such flexibility may prevent the human capacity building and the development of the main faculty programs and could eventually limit the institution’s longevity. The panel suggests a possible solution of 3 to 5 groups (e.g. according to the three majors) below the Dean, each one headed by a lead position and involving separate budgets.
5. The scientific output in terms of internationally recognized and peer-reviewed publications is very good to excellent, a statement based on the average number of publications per scientist. Nevertheless, there are clear differences between the three

majors and the professors, which may not only reflect differing scientific productivities, but also a problem of applied research and scientific transfer.

6. The laboratories and equipment are of good to very good quality, reflecting the fact that the faculty was founded in the early 1980's. The near future will bring an increasing need to renovate or replace parts of the (expensive) equipment and it is not clear if or how such a major re-investment program would be financially supported by the university. It is recommended that a plan be developed for the renovation and/or replacement of outdated equipment within the next ten years in a systematic, stepwise process. This will require funding resources internal and external to the university.
7. Technical staff seems to be a limiting factor for maximal use and good maintenance of the existing laboratories. Master students may be useful to bridge this gap, but cannot replace a sufficient number of well trained permanent technical supports personnel.
8. The Faculty of Forest Sciences in Joensuu belongs to the Forest Science Cluster in the area including the Forest Research Institute and the European Forestry Institute. There are close links to both institutions and some facilities as well as personal are shared. These liaisons should be strengthened. The upcoming necessity to replace a great number of scientists in both institutions gives the opportunity to look for excellent researchers.
9. The fact that five out of 11 professors will retire in the next five years creates chances, but also risks for the recruitment process. The Faculty should start immediately and develop a plan to redefine, if necessary, the direction and specialization of the respective retiring professors. One option would be to apply for funding to finance additional positions just for this transition phase.
10. The Faculty was very successful in establishing one of the few national PhD programs of Finland (the only one in Forest Science). This has led to a significant improvement of both quantity and quality of the PhD students and is an excellent instrument to develop young scientists and future researchers. The program is coordinated in Joensuu and is well organized, effective and efficient.
11. The Faculty has very good international cooperation. A good example is the leading role of the European Master of Forestry program, an Erasmus mundus activity supported by the European Union. This brings in young, sharp students and provides additional funding to the Faculty. Although the exchange of senior researchers to countries outside Scandinavia has some room for improvement, a very positive element of international cooperation is the focus of research activities towards Russia. Taking into account the strong future developments in Russia, Joensuu could further elaborate its role as one of the "windows" of EU forestry towards Russia.

3. Scientific quality of the research

The overall impression given from the evaluated research was very good to outstanding. We recognize this faculty as one of the best forest faculties in Europe, in a very competitive university environment and supported by surrounding facilities (EFI and METLA). The high percentage of funding originating from external sources is commendable, considering the fact that one of the main tasks of university professors apart from research is teaching. Our impression is that, given the large number of PhD students and the fact that this is the only Graduate School for Forest Sciences in Finland, this faculty is strongly committed to

education for the next generation of researchers, thereby ensuring the quality of the next generation of scientists.

The Panel was introduced to the research activities of the faculty according to major, three areas which may also be considered key elements within forest sciences, and thus, we will follow this structure in our analysis of the research areas.

3.1. Forest Engineering and Forest Products Technology (EPT)

At the Faculty of Joensuu, the research area EPT consists of two different scientific disciplines: a) Forest Engineering with Forest Operations, Forest Technology, Logistics and Work Science and b) Forest Product Technology with Wood Science and Wood Technology. In other national and international forest faculties and research organizations, this wide range of topics is usually covered by several professors and senior scientists.

In Joensuu, EPT today is by far the smallest of the three research areas of the Faculty with only 2 full-time professors:

- Forest Cultivation Technology, Prof. Pertti Harstela, 20% shared with the Finnish Forest Research Institute
- Forest Products and Technology, Prof. Petri Kärenlampi (with Senior Ass. Heikki Ovaskainen)
- Wood Utilization and Industry, Prof. Matti Kärkkäinen
- Wood Science, Senior Ass. Katri Luostarinen
- Forest Technology, Prof. Teijo Palander

Some subjects under the category of EPT are dealt with in the two other research areas, for example:

- important wood quality research is also carried out within Management of Forest Ecosystems, namely by D.Sc. Heli Peltola.

- specific Forest Product related research is (or could be) included in the context of Forest Biomass Production by Prof. Paavo Peltonen, who is working in Management of Forest Ecosystems, and

- Forest Technology and Forest Operation related issues (e.g. GIS - support of forest operations) are (or could be) part of the scientific work of Prof. Timo Tokola (Prof. for Forest Information Systems), who has been involved in Forest Planning and Economics since 2006.

In contrast to the other two research areas, there is no clearly visible internal structure (e.g. working groups or teams) within EPT, but this may be the result of the small number of personnel. Each professor directly supervises one or two PhD students and may have several external PhD supervisions.

The wood science area involves two laboratories that seem to be only partly used at present - a very specific, ingenious mechanical pulping laboratory and a mechanical wood testing laboratory. There is also a wood fibre laboratory and an x-ray/tree-ring laboratory, both of which are used primarily by Heli Peltola. There are no specific forest technology laboratories. Most of the studies in this area are carried out in field experiments in cooperation with forest research stations and/or industry.

The significance and productivity of the research during this period are reflected in the number of publications and the range of topics covered by the Master's and PhD theses. In this six year period, the ETP area completed a total of 78 publications and 7 dissertations (from approximately 750 publications and 67 dissertations in the whole faculty).

The Forest Products/Wood Science area had 45 publications and 6 dissertations, which covered the following topics: wood colour and quality, drying, defibration related to mechanical pulping (mainly related to Birch), steam treatment, microstructure of wood (basic research). These themes are quite specialized and could be supported with more cooperation with the silviculture-related wood quality research scientist within the Ecology and Management area. The majority of the publications are in English and target internationally refereed journals; however, some publications are in Finnish and cater more specifically to national needs.

Forest Technology produced 33 publications and 1 dissertation. Among other topics, they dealt with computer-supported decision making in the context of harvesting, logistic issues and harvester operations (including bucking optimization). These are quite specific, but very relevant and up-to-date issues, which are often discussed in the context of industry needs and practice. Further collaboration with the Forest Information Systems research could support even more advanced methodological approaches and research topics. Again, the majority of the publications are in English and target internationally refereed journals with fewer published for national and industry needs.

Finally, the growing interest in biomass/bioenergy production and procurement is not yet reflected in the research themes in any of these sub-areas. Also, there are relatively few master and PhD students actively participating in EPT as a whole, despite it having been named as a priority area by the faculty.

3.2. Forest Planning and Economics (FP&E)

This research area covers several subjects:

- Forest Economics and Policy (Prof. Olli Saastamoinen, Prof. Timo Karjalainen, 20%, and senior assistant Jukka Matero, altogether 5 researchers)
- Forest Inventory and Mensuration (Prof. Matti Maltamo and senior assistant Petteri Packalén, altogether 10 researchers)
- Forest Planning (Prof. Timo Pukkala, acting professor Mikko Kurttila and senior assistant Lauri Mehtätalo, altogether 3 researchers)
- Forest Information Systems, started in 2006 (Prof. Timo Tokola, altogether 3 researchers)

A large proportion of the researchers are post-graduate students.

The research area has two main objectives: 1) management of forest resources for timber and other ecosystem services, and planning for multi-objective management of forest ecosystems and forest resources and 2) remote sensing and inventory techniques, including laser scanning and applications of GIS technology in forestry and environmental management. These objectives are clearly reflected in the main research achievements that are related to airborne laser scanning (ALS) applications to forest inventory and to multi-objective forest planning tools (MONSU system). Growth and yield modeling has also been an important research topic during the evaluation period as well as the consideration of risk and risk effects on forest planning. The results obtained so far in ALS applications to forest inventory are on the forefront of the subject and have produced several refereed publications, and therefore, are

very relevant at an international level. In an international context, the MONSU system is one of the most complete forests planning tools and involves both detailed objectives and optimization methods (which can account for spatial restrictions). The number of publications related to the MONSU system was noteworthy.

The research within the Forest Economics and Policy area has been concentrated on total value of forests, socio-economics of non-wood forest products, forests in everyday-life of people, Russian forest policy and forest ethics. The research area as a whole has been highly productive. During the evaluation period, a total of 160 scientific publications were produced (slightly more than 1 publication per researcher per year), 65 of which were in Forest Mensuration, 70 in Forest Planning and 30 in Forest Economics and Policy. Most of the publications were in ISI journals and all of them were refereed.

This research area is highly strategic for the Faculty, as many of the topics fall under the socially relevant and internationally recognized umbrella phrase “Forests and the Environment” (mentioned in the Faculty research strategy). The area of Forest Economics and Policy belongs to the Centre for Forests, Environment and Society, funded by the University of Joensuu and there is collaboration with other Faculties within the University of Joensuu, including the Faculty of Science, the Department of Computer Science and Statistics and the Department of Law and Commerce (for forest ethics).

In terms of scientific quality and productivity, there are observable differences between sub-areas, with some thriving (Forest Mensuration and Forest Planning) and others lacking in strength (Forest Economics). Given its start in 2006, Forest Information Systems is not considered in this evaluation.

3.3. Management of Forest Ecosystems

The researchers within the Management of Forest Ecosystems area generally work in groups. Research covers different management topics, including forest ecology, forest entomology, forest pathology, forest soil science, silviculture, forest biomass production and production ecology. The staff is made up of 5 professors, 3 senior assistants, 25 additional docents funded by external sources and 33 doctoral students, giving a total of 33 researchers and 33 doctoral students.

This major provides several permanent positions at the Faculty:

- Forest Ecology Prof. Jari Kouki, Senior Ass. Atte Komonen (on Leave) Senior Ass. Olli-Pekka Tikkanen (acting)
- Forest Soil Prof. Hannu Mannerkoski, Senior ass. Tarja Lehto
- Forest Production Prof. Paavo Pelkonen
- Forest Protection Prof. Pekka Niemelä
- Silviculture Prof. Seppo Kellomäki, Senior Ass. Heli Peltola

The research facilities and infrastructure of special relevance for this major include growth chambers, laboratories for testing freezing tolerance, laboratories for chemical and physical analyses, a greenhouse and the Mekrijärvi Research Station (including its field sites).

Several groups have a multidisciplinary approach with collaboration between the natural and social sciences, especially for projects related to biodiversity and bioenergy. There are several research projects that will help in the development of adaptive strategies for managing forest ecosystems in a future characterized by climate change. Many of the findings have helped shape the national adaptation policy to climate change (in regards to adaptations

specific to forestry) and have also been used for the updating of the National Forest Programme. The research within this major also includes model development of strategic importance for forest planning and economics and for the understanding of forest ecosystem behavior.

The quality of the research in this area is excellent. In particular, we found several examples of world-leading groups and one of the groups was appointed to the Centre of Excellence for Forest Ecology and Management of the University of Joensuu during the evaluation period. The existing and on-going collaboration in the Centre can continue under exit-funding and the groups have been reorganized into a working group called “The Centre of Excellence in Boreal Forest Ecosystem Management Research”, which will be funded by the University of Joensuu and the Centre of Excellence Programme from 2007 to 2009. The Centre has wide-ranging domestic and international research collaboration.

Similarly, the researchers have strong domestic and international collaborations, which are demonstrated by the list of publications for 2000-2006. During this period, 256 refereed scientific papers were published in international journals. Several researchers within this major have strong international reputations and this provides the fundamental basis for earning a good academic reputation.

It is a difficult task to intensify forestry production for more timber, paper and energy while at the same time ensuring ecosystem integrity, biodiversity and recreation, and difficult decisions lie ahead in order to find a balance between these. One issue will be identifying strategies to reduce threats such as climatic and market changes while taking advantage of potential benefits from global warming and technological development. The Faculty has a number of strong research teams with the capacity to develop knowledge and tools that will enable us to find a balance between social, economic and environmental interests.

4. Relevance of the research

In Forest Technology, the important and relevant issues for practical forestry were covered, namely wood procurement, harvesting operations and transport logistics. These issues are necessary to understand the overall economy related to societal needs for biomass. Much of this research is directly linked to company needs and many of these results are not included in the publication list.

In Wood Product Technology, research has been focused on a few selected issues, namely mechanical pulping technology for round-wood, principles of wood drying and properties and utilisation of birch timber. The topics are scientifically interesting; however, they are of limited relevance for the pulp industry given that TMP-technology dominates mechanical pulping in current technological practices. This was also reflected by the fact that most of the research activities in this topic were not carried out throughout the evaluation period. Interesting theoretical considerations regarding material behaviour have not yet been transformed into experimental activities. The work related to birch timber is highly relevant for only a narrow part of the forest industry sector.

In Forest Economy and Planning, much of the work has been directed towards landscape planning and this has been a relevant consideration for a number of forest policy issues. A number of models describing non-timber values have been developed and incorporated into an existing forest planning tool, MONSU; however, the economic aspects of the individual land owner have been ignored so far. Remote sensing and airborne laser techniques are strong areas and many of the research activities are leading edge. This will be of utmost importance for the future development of decision support tools for the whole forest sector.

During this period, the Management of Forest Ecosystems field has been active in many highly relevant areas, especially in questions related to climate change and ecosystem functioning and much of this research has been internationally recognized. The Centre of Excellence for Forest Ecology and Management supports much of the ongoing research, which is suggestive of the quality and relevance of the work done in this major. In addition to the promising research focused on ecosystem functioning, other cross-topic projects were active (e.g. effects of silviculture on tree growth and wood properties), which will be important for future development of new forest management strategies.

5. Role of research in education and training

One of the outstanding achievements of the Faculty of Forest Science is the establishment and successful coordination of the Finish Graduate School in Forest Sciences (GSForest) in 1995. The other partner facilities are the University of Helsinki and Kuopio, Oulu and the Finnish Forest Research Institute.

The main goals of GSForest are:

- (i) educating international experts in forest science,
- (ii) increasing the quality, efficiency and interdisciplinary of the doctoral students,
- (iii) initiating the collaboration between universities, research institution and enterprises.

The program is funded by the Ministry of Education and the Academy of Finland to promote high quality doctoral degrees. The support includes funding for the enrolled candidates, travel grants for incoming professors and teachers, and support for administration costs. The current funding is 645,000 Euro and allows the support of 19 twelve month doctoral students with a salary of 1,800 Euro/month. The following table gives a list of graduates for the reporting period.

Year	Funded person months	Number of Doctoral students supported	Funded students of the faculty	Foreign students of the faculty
2002	312	38	16	0
2003	264	27	12	0
2004	264	29	13	1
2005	264	24	11	1
2006	264	32	12	4
2007	228	33	15	3
2008	228	28	13	3

The panel was very pleased with the success of this program. The professional management and the excellent link between research and education were unique. This was well documented by the fact that graduates did not have problems in finding jobs. It is strongly suggested that this program is continued and that all PhD students should be part of the GSForest. The panel would like to stress that this program addresses three important issues:

- (i) it combines research activities with education and clearly addresses the goal of a research driven education of high potential
- (ii) it addresses quality assurance issues since the guidelines for enrolling and monitoring the success of the PhD candidates is clearly stated
- (iii) it induces a competition and monitoring of the supervising Professors, and, the money provided to the PhD student acts as an incentive for the professor to have students enter this program.

A second important activity is the coordinating role of the Faculty within the European Master of Forestry, an ERASMUS mundus activity funded by the European Union. Although this program is less oriented towards research, it provides an excellent source of students from around the globe and leads to strengthened networks with the participating universities and additional international networks.

6. International and national networking in research activities

The Faculty of Forest Sciences has established an excellent network with other universities and research organizations within Europe and across the world. This is very well demonstrated by the large number of national and international research projects as well as the educational and teaching activities of the faculty members. The large number and wide variety of master and PhD students are an additional indication that the faculty is well known and provides a very attractive and well respected research and education environment. To maintain this national and international focus, it is important that this Faculty remains in the coordinating role for both this Graduate program and for the European Master of Forestry program.

In addition to these existing collaborations, the following partners are of specific interest for the Faculty of Forest Sciences:

- (i) The cooperation with Metla sharing resources and Professors. This is a vital part for the success and efficiency of the research. It also gives access to experimental data and the co-supervision of PhD students.
- (ii) The cooperation with the European Forest Institute (EFI). EFI headquarter is located in Joensuu and attracts a lot of young researches around the world. The opportunity for PhD students to combine working at the EFI and academics at the Faculty is important for both organizations.
- (iii) The cooperation with the University of Kuopio. Members of the Faculty of Forestry together with colleagues from Kuopio were very successful in launching joint research activities in the field of **Bioenergy and its impact on the carbon balance** (Prof. Kellomäki) as well as **Harvesting and transportation issue related to bioenergy** (Prof. Tokala). Considering the fact that the two universities will merge in 2010, these two activities are a clear indication that the forest community is taking advantage of the win-win situation of the planned merge.

7. Outreach and communication

The Faculty has a strong relationship with practical forestry through the application of research results or, in some cases, by defining research objectives directly related to industry and/or local managers needs. Most of the relationships can be seen on technology, such as:

- wood flow models and systems that can be used as support tools for every day logistics work by local managers of wood procurement organizations,
- several techniques that implied the modification of forest machinery as well as the methods used to organize wood harvesting or to train harvester operators,
- the forest planning tool is being used in several countries and applied to different planning cases and case studies,
- remote sensing and GIS methods developed at the Faculty allow the precise mapping and characterization of forest areas in an accurate and cost-efficient way, and
- four practical scale demonstration energy farms have been established.

There are also important applications on culture and society, for instance, by increasing awareness of the effects of climate change on forests or of the role of bioenergy in energy production. Similarly, there are important applications for politics and administration, such as participating in the preparation of the Finnish National Strategy for Climate Change and on the IPCC 4th assessment on the climate change regarding adaptation and mitigation.

8. Lessons learnt and future development of research in the Faculty

Based on the documents, hearings and discussions, we have identified some suggestions, concerns and perspectives for future development.

Suggestions and concerns

A major concern is the lack of balance between the three research areas. Management of Forest Ecosystems is very strong and includes forest ecology, forest entomology, forest pathology, forest soil science, silviculture, forest biomass production and production ecology. This research area covers subjects which are important for the other areas and collaboration could be initiated (e.g. wood quality or biomass production related issues). It is not necessarily a problem; however, the current structure seems to not utilize the potential benefit of collaboration within the faculty.

The research area Forest Engineering and Forest Products Technology is by far the smallest with only two full professors working mainly on their own. Another weakness is related to the lack of research focused on Forest Economics at the enterprise level. Forest economy is included in the forest planning tool MONSU, but mainly as an input to the system and a strong forest economy group may also be needed.

Several groups expressed concern about the long-term ability to maintain key facilities for their research, such as equipment, field sites and technical support. Such facilities are necessary for research and teaching and should be part of the long-term strategy for the University of Joensuu. In many cases, graduate students are actively involved in operating and maintaining laboratory facilities and there seems to be a lack of permanent technical staff to use and maintain the existing infrastructure. The university should make every effort to provide the long-term infrastructure

Perspectives for the future

The Faculty provides expertise in important areas and has an important strategic location and an excellent working environment.

An important future role of traditional forest research areas such as sustainable forest management and optimization of timber production (e.g. forestry wood chain) will be to provide the expert know-how to the forest enterprises and industries.

A preliminary future research priority identified was biomass and bioenergy, and included not only short-rotation forestry in former agricultural land but also bioenergy products of one of the possible assortments of traditional forestry. Special emphasis should be given to support multi-disciplinary research within the Faculty in this area. Areas of potential cooperation are suggested between researchers covering the fields of production ecology, nutrient and carbon cycles, forest ecology, forest planning, harvesting and procurement, economics, silvicultural management, risk management, ecosystem services. These integrations are particularly relevant for newly emerging fields. We anticipate the need for a new Professorship position that will head this development.

Another area of interest is climate change impacts and the adaptation options and/or potentials of boreal forest ecosystem dynamics. Studies must include both ecological and economic analyses and planning in order to demonstrate conflicting interests and introduce the findings into the practical management. The goal of this research should be to produce guidelines for so-called adaptive forest management in a very broad sense.

The expansion of timber and biomass production within the limits of sustainability must be pursued as a priority objective of research. Certainly, biodiversity issues, non-timber products and other services must also be taken into account; however, this must be done within the context of multiple-use forestry in which timber production is a key driver.

A strategic field of research is Forest Engineering and Forest Products Technology including wood technology. This research field has some substantial room for improvement and needs to be strengthened. The international collaboration needs to be enhanced and specific task should be selected so that Faculty expertise is evident.

An interesting strategic issue for the Faculty is the collaboration with Russian universities. Due to the proximity of the countries, some pre-existing collaboration exists. A promising connection is the shared professorship position with the Research Institute on Forest Economics in Russia and it is suggested that this partnership be further developed in order for the University of Joensuu to be able to act as a focal player in European-Russian relations.

Closing statement

The Panel Members thank the Dean of the Faculty, Prof. Seppo Kellomäki, and his team for the technical support, the open sharing of information and the kind hospitality. We also thank the professors and senior assistants for their presentations and the discussions during our 3 day visit in Joensuu. We do hope that our comments and suggestions will help to maintain the strength and development of this faculty as one of the leading institutions for forestry research and education in Europe.

Appendix. Numerical grading of the activities in the Faculty of Forest Sciences over the period 2000–2006 regarding majors and the summary grading over the majors

Major and criterion	Grade (1–7)
Forest Engineering and Forest Products Technology	
1. Research infrastructure	5
2a. Standard of research at national level	5
2b. Standard of research at international level	5
3. Research strategy	4
4. International activities	5
5a. National co-operation	5
5b. International co-operation	4
General estimation	5
Forest Planning and Economics	
1. Research infrastructure	5
2a. Standard of research at national level	6
2b. Standard of research at international level	5
3. Research strategy	4
4. International activities	6
5a. National co-operation	6
5b. International co-operation	6
General estimation	6
Management of Forest Ecosystems	
1. Research infrastructure	6
2a. Standard of research at national level	7
2b. Standard of research at international level	7
3. Research strategy	5
4. International activities	7
5a. National co-operation	7
5b. International co-operation	7
General estimation	7

7 = excellent, 6 = very good, 5 = good, 4 = average,

3 = somewhat below average, 2 = fair, 1 = poor