SLU

Department of Forest Resource Management

Annual Report 2008

CERTIFIED ISO 14001 SEMKO CERTIFICATION

Johan Fransson,
Head of department

Contents

Cover: Picture taken by Ola Borin
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Dear reader,

Please feel welcome to read and learn about our activities at the department during 2008. These include education, research, environmental monitoring and the spreading of information to a wide cross-section of society. This annual report is the first of its kind at the department. The layout has been chosen to give you a good overview of what we are doing in an easily accesible format.

The idea of producing an annual report is threefold. Firstly, it encourages us to reflect on the accomplishments that we have achieved during the year. Secondly, by reporting some of the most important events of the year, we are actually contributing to a future historical archive both for ourselves and others. Finally, it gives us an excellent opportunity to share information about our activities to the general public and other interested parties.

The department activities include undergraduate, master´s and doctoral studies, research in six competence areas (research groups); Remote sensing, Forest inventory and empirical ecosystem modeling, Forest planning, Forest technology, Forest in rural studies and International forestry and, last but not least, Environmental monitoring and assessment which is organized in three major programs; National forest inventory, National inventory of landscapes in Sweden and Terrestrial habitat monitoring. In this annual report you will find some of the highlights from these activities. For further reading I recommend you to dig into the bachelor's and master's thesis reports as well as the publications listed at the end of this annual report. I would also encourage you to visit our homepage at www.srh.slu.se.

The achievements of the department are based on individual efforts and contributions that all definitely deserve to be mentioned. This is unfortunately an impossible task. Nevertheless, I would like to highlight a few important occurrences with respect to the staff during 2008:

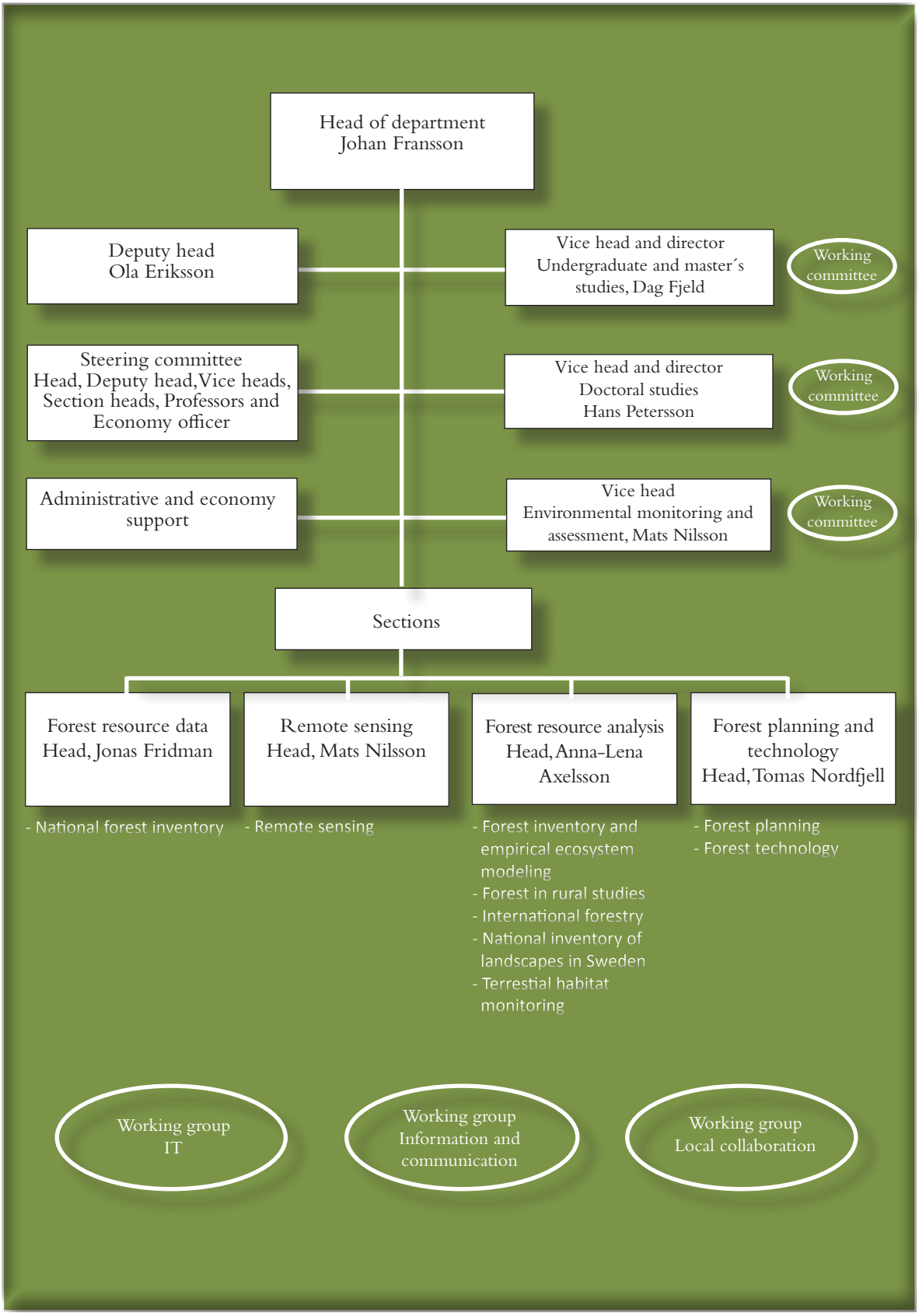
- Ola Eriksson was appointed as Deputy head
- Johan Svensson was employed as Program manager of the National inventory of landscapes in Sweden
- Hans Petersson earned the competence of Associate professor (docent) in Forest management with focus on Forest inventory and was appointed as Vice head and director of doctoral studies
- Dag Fjeld earned the competence of Associate professor (docent) in Forest technology with focus on Forest logistics and was appointed as Vice head and director of undergraduate and master´s studies
- Jonas Fridman was appointed as Head of the section Forest resource management and Program manager of the National forest inventory
- Göran Ståhl was appointed as Assistant vice-chancellor for Environmental monitoring and assessment at SLU
- Mats Nilsson was appointed as Vice head of Environmental monitoring and assessment
- Tomas Nordfjell was formally installed as Professor in Forest operational efficiency at a special ceremony at SLU in Umeå
- Jonas Bohlin was employed as University adjunct in Geographical information system
- Sofia Hansson was contracted to work part time with information and communication
- Dianne Staal Wästerlund was promoted to University lecturer in Forest technology
- Hans Toet retired from the National forest inventory after 31 years of employment at SLU
- Anne-Maj Jonsson and Erik Wilhelmsson were honoured in a special celebration for employees that have served the government (SLU) for 30 years

I hope you enjoy reading this annual report and do not hesitate to contact us if you would like to find out more about our activities touched upon here. We would be more than pleased to share our knowledge and experiences with you!

Yours sincerely,
Johan Fransson
Head of department

Organization

Schematic view of the department



Department steering committee

From the left:
Jonas Fridman
Anders Lundström
Mats Nilsson
Anna-Lena Axelsson
Dag Fjeld
Johan Fransson
Hans Petersson
Håkan Olsson
Iwan Wästerlund
Maud Andersson

Missing from the picture:
Ola Eriksson
Tomas Nordfjell
Göran Ståhl

The duties of the department steering committee are to identify key issues and define the department´s position on strategic and comprehensive questions. The responsibilities also include supporting the management of the department. The committee convened on a weekly basis and also had six more indepth meetings during 2008.

Administrative and economy support

From the left:
Carina Westerlund, Administrator
Ylva Jonsson, Economy administrator
Anne-Maj Jonsson, Economy officer
Barbro Gunnarsson, Administrator
Maud Andersson, Economy officer
Sofia Hansson, Information officer

The administrative staff are involved in most of the activities within the department including bookkeeping, employment issues, student course registration, information issues and layout of reports.

Press clippings

"Strong growth in Sweden's forests"
The Swedish forests are growing at an impressive rate. Standing volume is getting larger and larger despite the fact that we are also felling at a record rate.
– It's true that the forests are growing well, but at the same time there is a high demand for timber and wood resources. Especially now that the energy sector are also demanding more and more, explains Per Nilsson at the Swedish University of Agricultural Sciences in Umeå.
NT 26th September

"ESA leads the way to map boreal forest"
How to best map boreal forest with spaceborne radar is the focus of an ESA campaign currently conducted in northern Sweden at the test site Krycklan outside Vindeln.
ESA News 16th December

Tomas Nordfjell was formally installed as Professor in Forest operational efficiency at a special ceremony at SLU in Umeå on 15-16th May 2008.

"A record year for blueberries in the north"
Berry pickers in Norrland rub their hands with glee. According to SLU's berry forecast it is going to be the best year since observation began in 2003. However, in Götaland and Svealand the berry harvest is predicted to be poor.
Jordbruksaktuellt 9th July

"Forest waste can be good business"
Logging residue, compared with timber and pulp wood, has long been considered a waste product, explains Iwan Wästerlund, professor in Forest technology at SLU in Umeå. He heads a pioneering project in logging residue processing, which has raised the value of this underestimated resource.
Västerbottningen 24th April

"High-tech reindeer lead to better co-operation with forestry"
Satellite images, GPS senders and laptop computers are all new additions to a reindeer herder's toolbox. This new technology is part of a project in reindeer husbandry planning, which has been developed by the reindeer herders, the Swedish Forest Agency and researchers from both SLU and Umeå University.
Miljöforskning 5-6th December

"Forest management must change"
Professor is worried about the dramatic increase in track and wheel damage from forest machines.
Värnamo News October

"A new method of forest management"
Forest owners will soon be able to plan their forest management in a whole new way thanks to Heureka. Forestry researchers are now working instensively on creating a detailed computer system, which will be able to test different future forest management scenarios.
Västerbottens Kuriren

"Göran Ståhl – new Assistant vice-chancellor at SLU"
From the first of March, Professor Göran Ståhl will begin his new post as Assistant vice-chancellor at SLU. He will be responsible for SLU's work with Environmental monitoring and assessment.
Miljötrender January

"World class technology research"
A new multi-million crown investment in forestry technology is to help catch up 20 years of lost research. Next year sees the start of FIRST, a broad Swedish-Finish venture.
Skogsland 28th November

"SLU tests belt commercial felling"
The Swedish University of Agricultural Sciences is currently testing mechanized felling in belt patterns using a modified harvester head attachment, which cuts the thinner stems.
Skogsaktuellt 21st May

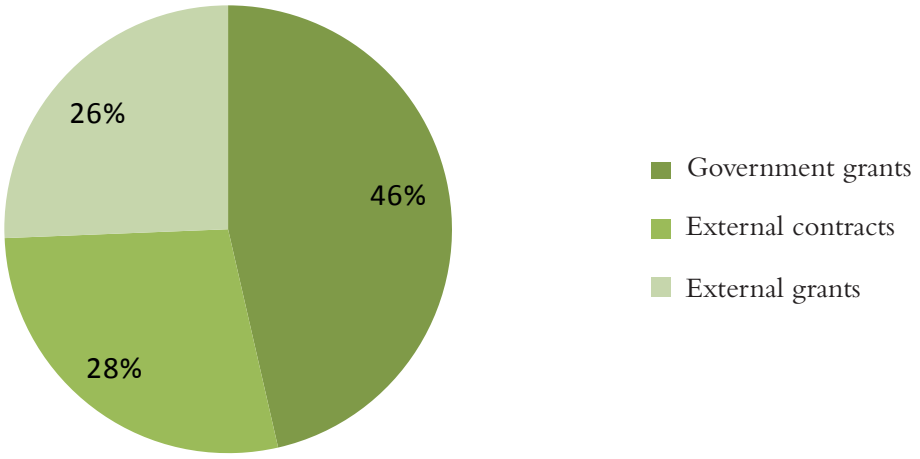
"Sweden's largest net contributing sector"
The forestry sector is the largest contributor to Swedish net trade and commerce, accounting for 11-12 percent of employment, turnover and gross domestic product. "The potential is even greater, the forestry sector is in this respect a sleeping giant" implies Tomas Nordfjell at SLU in Umeå.
Dagens Industri, 5th May

Facts and figures

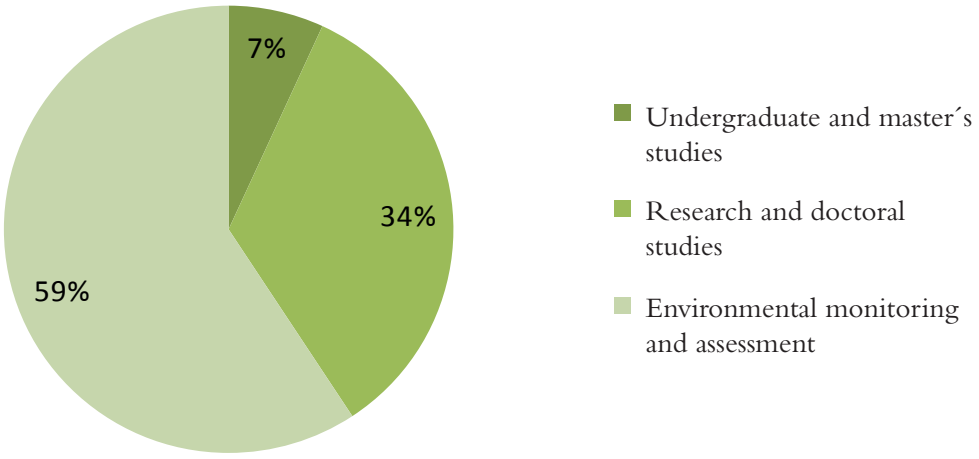
Revenues (1000 SEK)	Undergraduate and master´s studies	Research and doctoral studies	Environmental monitoring and assessment	Support function	Total
Government grants	7375	14007	33061		54443
External contracts	289	6705	25571	240	32805
External grants	387	18457	11213		30057
Other revenues	17	23	35		48
Total	**8068**	**39192**	**69880**	**240**	**117380**

Costs (1000 SEK)					
Staff	4790	20339	38178	3956	67263
Premises	902	2014	1810	108	4834
Other operative expenses	705	10197	17778	1553	30232
Depreciation	30	96	378	35	539
Overheads	1501	6262	10136	-6129	11770
Total	**7928**	**38909**	**68280**	**-477**	**114639**

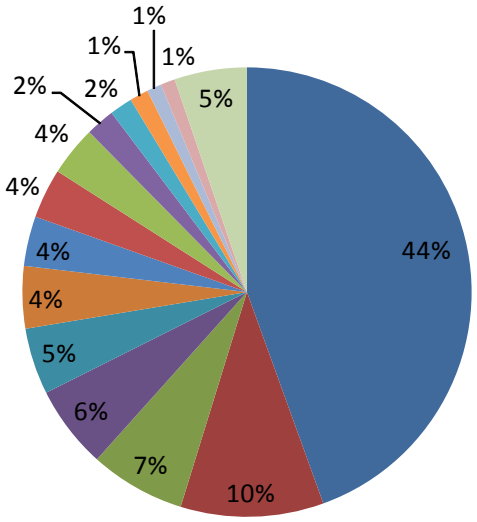
Revenues



Costs



External contracts and grants



	Financier	Incomings (million SEK)
1	Environmental Protection Agency	29.8
2	Mistra	6.9
3	Formas	4.6
4	SIDA	4.0
5	Swedish National Space Agency	3.2
6	Swedish Board of Agriculture	3.0
7	Kempe Foundations	2.4
8	Swedish Forest Industries Federation	2.4
9	Swedish Forest Agency	2.4
10	Swedish Energy Agency	1.4
11	Forest Society of Sweden	1.1
12	EU	0.9
13	Swedish Forest Research Institute	0.7
14	Brattås Foundation	0.7
15	Other	3.5

Personnel categories	Number of work-years
Professors	5.0
Associate professors/University lecturers	9.0
Assistent professor	1.0
Researchers	19.7
Post doctoral students	2.5
Doctoral students	20.0
Other teachers	2.6
Administrative staff	6.0
Technical staff	52.6
Total staff	118.4

These figures show the number of work-years at the department, and is not a true reflection of the number of employees.

Undergraduate and master´s studies

Dag Fjeld
Vice head and director
Undergraduate and
master´s studies

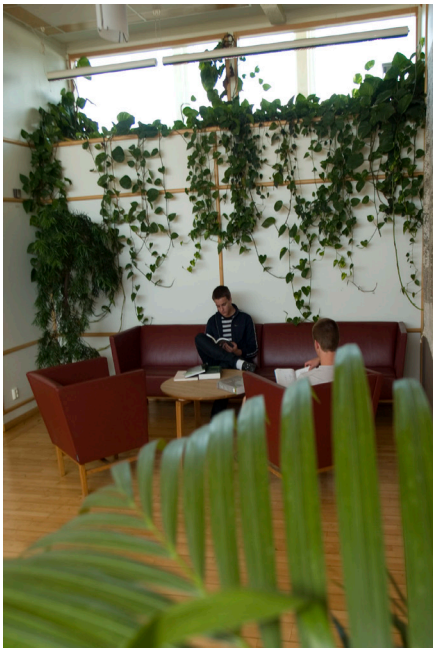
The department is a major contributor to SLU's Master of forestry education (in swedish called Jägmästarutbildningen). The department is also active in contract education for forest companies and international cooperation with other universities. Our course selection in the Master of forestry program amounts to over 40 ECTS credits at the undergraduate level and 80 ECTS credits at the master´s level. The courses are given within six subjects: Remote sensing and Geographic information technology (GIT), Forest inventory, Forest planning, Forest technology, Wood supply and Organization and leadership. Integrated courses with a wider thematic focus are also given within a master´s-level specialization in Industrial wood supply.

Subject coordinators. Curriculum development is handled by subject coordinators: Jonas Bohlin (Remote sensing and GIT), Sören Holm (Forest inventory), Ola Eriksson (Foret planning), Dag Fjeld (Forest technology and Wood supply), Dianne Staal Wästerlund (Organization and leadership).

Undergraduate and master´s studies. The individual courses per subject are shown in the table below. Courses at the undergraduate level have 40 to 80 students per course. Courses at the master´s level generally have 10 to 30 students per course.

The development of the thematic courses in Industrial wood supply has been of particular interest. From an industry-sponsored initiative in 2004 the specialization has grown to attract the highest student participation in SLU, Umeå, 25 to 30 students per course in 2008. An important factor for this has been a high degree of sector participation in course concept development as well as actual teaching.

During 2008 the total volume of teaching done at the department was 118 full-time equivalent, corresponding to 121 annual performance equivalent. Approximated 15% of the total volume comes from master´s thesis (supervision of about 25 thesis per year).



Picture: Julio Gonzales, SLU

Strategic goals. The long term goals for educational activities at the department are to deliver relevant competence to the forest sector through courses of high quality with excellent student evaluations. Current efforts are also focused on launching a new European Master of environmental monitoring and assessment at the Faculty of Forest Sciences, SLU, by the fall of 2010 (coordinator Torgny Lind).

Courses given at the department in 2008

Subject	**Undergraduate level** (year 1-3) 40-80 students per course	**Master´s level** (years 4-5) 10-30 studens per course
Remote sensing/GIT	GIT and forest planning	GIT II Remote sensing
Forest inventory	Silviculture and forest inventory	
Forest planning	GIT and forest planning Forest planning	Company-level planning Multi-use planning
Forest technology	Forest production and processing Forest technology	Advancing forest technology
Wood supply	Market-oriented wood supply	Forest industry supply strategy Operational planning and control Business processes and information systems
Organization and leadership	Individual and group leadership	Organizational development in the forest sector

Bachelor´s thesis reports

Henriksson, Gunnar. Combustion of pellets produced from refined Norway spruce wood. (Supervisor: Rolf Gref)

Stadling, Per. Qualification support of forest machine contractors. (Supervisor: Dianne Staal Wästerlund)

Master´s thesis reports

Andersson, Lars. The market for silvicultural services. A study among non-industrial private forest owners within a region in Värmland. (Supervisor: Tomas Lämås)

Andersson, Lars. Utvärdering av flygbildstolkning för uppskattning av beståndsvariabler och åtgärdsförslag i ungskogar - en studie på Korsnäs Skog och Bergvik Skog AB i västra Dalarna. (Supervisor: Tomas Lämås)

Bäck, Martin. Transport path selection in roundwood trucking – a test of current calibration parameters. (Supervisor: Dag Fjeld)

Bergquist, Lina. Important qualities of successful school forests in Sweden. (Supervisor: Gun Lidestav)

Dahlin, Andreas. Productivity and quality in first thinnings with strip roads and intermediate passages. (Supervisors: Ola Lindroos, Iwan Wästerlund)

Engdahl, Madeleine. Two new trailer concepts for roundwood transport at Stora Enso - an analysis of performance and flexibility. (Supervisor: Dag Fjeld)

Eriksson, Andreas. Evaluation of a method for subjective assessment of tree biomass quantities in road right-of-ways. (Supervisor: Ola Lindroos)

Eriksson, Jonatan. Identifying deviations in forest databases, by using data from satellite images. (Supervisor: Mats Nilsson)

Eriksson, Malin. Strategic and tactical planning and the link between - analysis of implementation of the planning process at SCA Forest. (Supervisor: Peder Wikström)

Erlandsson, Emanuel. Success factors for roundwood truck transport companies in mid-Sweden. (Supervisor: Dag Fjeld)

Hägg, Karin. Measurement of tree parts and forest wood chips at Dåvamyran, Umeå Energi. (Supervisor: Iwan Wästerlund)

Halvarsson, Joakim. Prioritizing thinning operations using airborne laser scanning. (Supervisor: Johan Holmgren)

Hedman, Linnea. Productivity at stump harvest. (Supervisor: Tomas Nordfjell)

Johansson, Henrik. Updating information on young forest stands using digital aerial photos. (Supervisor: Björn Nilsson)

Jonsson, Arvid. Motives and profitability in purchases of forest estates – an interview study. (Supervisor: Erik Wilhelmsson)

Larsson, Mattias. GIS and realtime-GPS on reindeer. Habitat use of reindeers in areas affected by forestry activities - two winter seasons in Vilhelmina Norra Sami reindeer herding community. (Supervisor: Per Sandström)

Lindberg, David. Stump transport and fuel quality in stump wood. (Supervisor: Iwan Wästerlund)

Nilsson, Simon. A mill stock model for bio fuel. (Supervisor: Dag Fjeld)

Önneholm, Kristoffer. Digital photogrammetric workstations for aerial photo interpretation in forestry. (Supervisor: Björn Nilsson)

Orgum, Jonas. Plant inventory with digital aerial photographs from helicopter. (Supervisor: Sören Holm)

Renström, Johan. Seasonal harvest – how the operational choice of stands effect the seasonal sustainability of the stand bank within a forest company district. (Supervisor: Ola Lindroos)

Sallin, Simon. Economy when utilizing long tree tops for forest fuel in final felling. (Supervisor: Iwan Wästerlund)

Sjödin, Fredrik. A field instruction for forest management planning of native forests in Andean Patagonia. (Supervisor: Ulf Söderberg)

Stoor, Martin. Updating of forest road cost estimations. (Supervisor: Iwan Wästerlund)

Ström, Pelle. Harwarder productivity at unloading. (Supervisor: Iwan Wästerlund)

Thunell, Anna. Quality and economy in first thinning based on different thinning and preclearance programs. (Supervisor: Ola Lindroos)

Doctoral studies

Hans Petersson,
Vice head and director
Doctoral studies

Picture: Jenny Svennås-Gillner, SLU

The doctoral education aims to provide a university education of higher quality, providing the doctoral students both broad knowledge in their field and expert skills in their competence area. During 2008 around twenty students were enrolled, with an even number of men and women. One doctoral student concluded the studies this year, and three new students were recruited.

The doctoral students have made great progress this year and an direct result of this progress is co-authorship of eight scientific publications. They have also presented their results at several national and international conferences, meetings and workshops.

The majority of the doctoral students have actively participated in seminars and doctoral-days organized by the department. Representatives of the doctoral students have taken part in: the conference for doctoral students (university level), the working committee of doctoral studies (department level) and the council of doctoral students (organization by doctoral students) .

Supervision. Eight different senior researchers currently act as supervisors. Only one of these is female. The doctoral students are supported by more than thirty co-supervisors of which four are women. Four people, two men and two women, have passed the course for supervisors at SLU during 2008.

The role of the department and faculty. The department undertakes an annual review of all doctoral students individual study plans. The director of doctoral studies at the department is then reporting the outcome of this review to the faculty. The director of doctoral studies at the faculty organizes meetings for the directors at the departments on an annual basis. The aim of the meetings is to inform about new regulations and facilitate harmonization of the doctoral studies programs.

During 2008, the department gave the doctoral courses: Advanced natural resource sampling (7.5 ECTS), Basic inventory methodology (4.5 ECTS), Markov decision processes (5.0 ECTS) and Forest governance (7.5 ECTS). In total fifteen doctoral students were examined.

Remote sensing - Wood-wisdom IRIS

The research programme Wood-wisdom IRIS is developing new ways to obtain information about forest resources, in order to enable better utilization of the forests' raw materials. Leading research groups from Norway, Sweden, Finland, Germany and Ireland are participating in the project. The Remote sensing section at SLU, together with the Swedish Forest Research Institute, participates in two work packages with the aim of developing methods for using airborne laser scanner data to obtain improved information about wood quality.

Estimation of tree lists by combining image analysis of single trees and statistical analysis at sample plot level

Airborne laser scanning is rapidly becoming an established method for forest inventory. Primarily, it is the so-called "area-based method" that has been used in practice so far. The method is based on the statistical relationships between the laser point cloud and forest inventory data at the sample plot level. The method performs very well in coniferous-dominated managed boreal forests, and accurate and unbiased estimates for stem volume, basal area, tree height and mean stem diameter can generally be derived. When laser scanning is carried out with a pulse density of several laser pulses per square meter, it is also possible to use image analysis methods to identify and measure most of the individual trees in the forest. However, it is not possible to identify all trees as single objects from the laser data. This work package aims to develop methods to estimate a tree list by combining the area-based and single-tree-based methods for analyzing laser scanner data of forests. The method is based on first identifying and measuring the single trees that are visible in the images. The distribution of stems is then adjusted to fit the total stem volume and stem size distribution as measured using the area-based method. In an early test, the number of stems was underestimated by 35% when using the single-tree-based method alone. This underestimation was reduced to 3% when calibration was done using estimates from the area-based method. In addition, the underestimation of stem volume was reduced from -14% to +2% when calibrating single tree estimates with the area-based method.

Use of data from harvesters and laser scanning for improving pre-harvest inventories

The large forest companies in Sweden use a database with stands that are candidates for final felling in their planning of forest operations. The aim is that this database should provide information indicating which stands have the properties the industry is in need of at a given point in time, in order to enable a timely delivery of that assortment to the industry. The manual routines for stand-wise forest inventories that are accurate enough for this purpose are, however, costly and time consuming. In the research programs Wood-wisdom IRIS and Heureka, SLU and the Swedish Forest Research Institute are developing a new method that utilizes the information about stem dimensions and timber assortments collected by the harvester's computer during the bucking operation (Fig. 1) and compares this information with laser scanner data from the same trees as the harvester computer has registered. In this way, a database is built containing tree measurements, associated quality parameters and the associated laser scanner data. This database can be used to transfer tree parameters to other stands that have been laser scanned at the same time point, but have not yet been subject to final felling. Fig. 2 shows the promising results from earlier tests of this technique, conducted as part of a master´s thesis by Henrik Larsson with Johan Holmgren at SLU as the supervisor. The method requires that the position of a tree harvested at a certain moment is known. This is technically possibly to achieve by equipping harvesters with positioning devices, but this practice is not yet standard.

Figure 1. Ongoing research has shown the possibility of using stem data collected by a harvester's computer in order to estimate timber assortments in similar stands that have not yet been harvested.

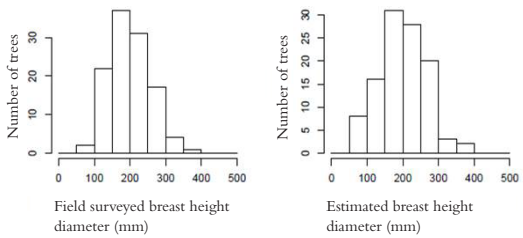


Figure 2. Histogram showing the number of trees in 50 mm diameter classes for field surveyed validation data (left diagram) and estimates obtained using laser scanner data trained with harvester data from other stands (right diagram). The results are for clusters of four 10 m radius sample plots. From the master´s thesis of Henrik Larsson, Estimation of timber assortments by integration of harvester measurements and airborne laser scanner data, Report 260, 2009.

Håkan Olsson
Competence area manager

Staff
Axensten Peder
Bohlin Jonas
Cronvall Erik
Egberth Mikael
Fransson Johan
Granqvist Pahlén Tina
Holmgren Johan
Högström Mats
Jonsson Sofia
Lindblad Anders
Magnusson Mattias
Mäki Ann-Helen
Nilsson Björn
Nilsson Mats
Olofsson Kenneth
Sandström Per
Sjöberg Maud
Terä Karin
Wallerman Jörgen

Post doctoral students
Gilichinsky Michael
Heiskanen Janne

Doctoral students
Hagner Olle
Joyce Steve
Lindberg Eva
Reese Heather

Forest inventory and empirical ecosystem modeling - Climate report

Göran Ståhl
Competence area manager

Staff
Axelsson Anna-Lena
Feychting Henrik
Holm Sören
Lind Torgny
Nyström Kenneth
Petersson Hans
Ringvall Anna
Wikberg Per-Erik

Post doctoral students
Tarekeng Abebe

Doctoral students
Melin Ylva
Ramezani Habib
Roberge Cornelia
Suty Nicole
Wulff Sören

Reporting under the Convention on Climate Change. On an annual basis, the department reports changes in carbon stocks matched to land use to the secretariat of the United Nations Framework Convention on Climate Change (UNFCCC). This includes carbon in living biomass and dead wood, as well as emissions linked to land use and land use transfers within the sector Land Use, Land-Use Change and Forestry (LULUCF). During 2008, new methodologies were developed for the Kyoto Protocol reporting. These will be implemented for the first time in 2010. Data from the National forest inventory (NFI) are transformed so that they fit the requirements of the good practice guidance by the Intergovernmental Panel on Climate Change (IPCC). The results are published by the Environmental Protection Agency.

The department also conducts research in order to enhance the future reporting and to make information comparable across countries. On a national level, we are involved in several areas linked to this reporting. According to decision no. 280/2004/EC, member states shall, every second year, report national projections of greenhouse gas emissions by sources and removals by sinks to the European Union. For evaluating commitments, similar projections are reported to the UNFCCC (national reports). The department is contributing to these projections through simulations using the Hugin- and Heureka models – based on data from the NFI.

Future climate agreement and next steps. A new climate agreement is under negotiation and the department provides data for decisions to stakeholders on European, Nordic and National level. Researchers also act as experts in the negotiations. New reporting guidelines are suggested by the IPCC and the department has participated in this work. We have evaluated the probable influence of the suggested new guidelines on European, Nordic and National level.
A report about enhancing the incentives for mitigation efforts, focusing on suggested accounting rules, will be published in 2009. Scientific papers about estimating uncertainty for estimates of carbon, decomposition of carbon, the carbon pool in stump systems and substitution fossil fuels by bio fuels from stump systems, are under preparation.

Land use, UNFCCC

Managed land

Unmanaged land

According to the United Nations Framework Convention on Climate Change, annual changes in carbon pools should be reported on managed land. Sweden defines Forest land, Cropland, Grassland and Settlements as managed, while most Wetlands and all Other land are assumed unmanaged. Pictures: Ola Borin, SLU

Projects 2008

1. International reporting under the UNFCCC and the LULUCF-sector (Environmental Protection Agency 235-2406-04Md)
2. Updating a database for reporting greenhouse gases under the LULUCF-sector (Environmental Protection Agency 235-3299-07Md)
3. Consequences on the Swedish carbon reporting by introducing IPCC 2006 good practice guidance (Environmental Protection Agency 237-1558-08Md)
4. LULUCF-adapting to the reporting requirements of the Kyoto Protocol (Environmental Protection Agency 237-1445-08Md)
5. EEC 2152/2003 Forest Focus regulation on developing harmonized methods for assessing carbon sequestration in European forests.
6. Enhanced incentives for mitigation efforts in the Land Use, Land-Use Change and Forestry sector (AFOLU sector) in the next global climate change agreement (COP 15 group of the Nordic Council of Ministers)
7. New perspectives on the role of forestry in climate change policy (Swedish Energy Agency 30248-1)
8. The carbon budget of stumps today and the influence of an increased demand of stumps for forest fuels (Swedish Energy Agency 30424-1)
9. Projections of greenhouse gas fluxes of the LULUCF-sector (Swedish Government JO2008/3958)

Networking 2008

1. International Energy Agency, Joint IEA Bioenergy, Task 29, Task 38: Greenhouse gas balances of biomass and bioenergy systems, and Task 40 (expert consultation): Woodfuel supply chain – sharing experience, UK, 14-19 September, 2008
2. COST action E43, Harmonisation of national inventories in Europe: techniques for common reporting, UK, 2004-2008, Slovenia, 2008
3. European Commission DG – Joint Research Centre, Italy, MASCAREF working meeting, 21-22 January, 2008, Technical workshop on LULUCF reporting issues under the Kyoto Protocol, 13-14 November, 2008
4. Intergovernmental Panel on Climate Change, Expert meeting: IPCC Guidance on estimating emissions and removals of greenhouse gases from land uses such as agriculture and forestry, Finland, 13-15 May, 2008
5. Climate Group (COP 15 Group) under the Nordic Council of Ministers, Nordic workshop on LULUCF in a post-2012 regime, Norway, 6-7 March, 2008
6. Swedish Government/Environmental Protection Agency, Harmonisering av rapportering enligt UNFCCC, Finland, 10 November, 2008
7. Kungliga Skogs och Lantbruksakademin, Skogens roll i ett framtida globalt klimatavtal, Sweden, 8 October, 2008

Forest planning - Heureka
– a forest analyses and planning system takes shape

Ola Eriksson
Competence area manager

Staff
Erfan Saeid Hansson Per
Lämås Tomas
Sjöberg Susanne
Wikström Peder
Wilhelmsson Erik
Åström Joakim
Öhman Karin

Doctoral students
Backéus Sofia
Forsell Nicklas
Hankala Anu
Nilsson Malin
Nordström Eva-Maria
Salehi Ali

The Heureka research programme develops analyses and planning tools for multi-purpose forestry. In its second phase 2005-2009 it runs as a thematic research programme at the Faculty of Forest Sciences, SLU. In this phase it has funding from Mistra, the Swedish Forest Industries Federation, the Kempe Foundations and SLU. Seven departments at SLU and also the Swedish Forest Research Institute (Skogforsk) participate. The programme management and the core of the system development are, however, located at the department.

The vision of Heureka is to substantially contribute to the sustainable multi-purpose management of Swedish forest landscapes through provision of up-to-date decision support tools for a number of important stakeholders. Heureka provides tools for studying future environmental and economic consequences of today's decisions about forest landscape management. This is possible because reliable forecasts of the development of forest landscapes can be done, given specifications of what forest management regimes will be applied. The development of the tree layer is known to have large impact on other biotic and abiotic conditions, e.g. the field layer vegetation and the properties of run-off water. Thus, by being able to make accurate forecasts of the development of trees and stands, it is possible also to forecast the outputs of other goods and services than timber when a certain management programme is applied. Consequently, short- and long-term analyses can be performed at forest companies as well as by national and regional authorities in order to identify appropriate management regimes or forest policy.

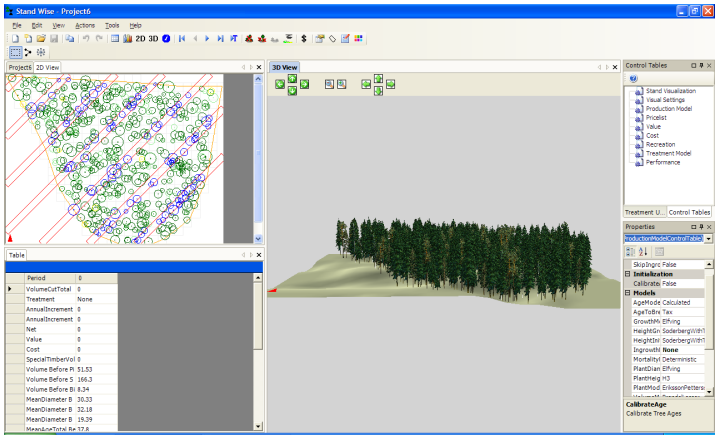


Figure 1: One of the main applications (software) of the Heureka system is the interactive stand simulator StandWise. The simulator enables analyses of stand development and management actions. In addition, stand projections can be visualized in 2-D maps and 3-D images.
Figure from Wikström P., Klintebäck F. and Westling J., BeståndsVis - en simulator för analys av skogsskötsel, SLU, Fakta Skog, no. 4, 2008.

Based on a core system with a common model base, different applications are developed to suit the needs of important user categories, ranging from governmental organizations to individual forest owners.

Three main applications have been developed:
- RegWise for national and regional level analyses
- PlanWise for long term planning in large and small scale forestry
- StandWise, an interactive stand simulator

The first application is developed to meet the needs of national and regional authorities while the latter two applications focus on groups that actively manage the forest landscape. It is possible to perform many different types of environmentally strategic analyses with Heureka, e.g. analyses of management regimes for sustaining biodiversity, analyses for reducing net carbon dioxide emissions, analyses of recreation facilities for different groups of people, and integrated analyses where several factors are addressed simultaneously. In 2008, the applications were running in first versions and interfaces, functionality, etc., took shape (cf. Fig. 1).
A number of other specific methods and tools have also been developed, e.g. Heureka Ivent, a software for field survey, and an innovative instrument, PosTex, for the positioning of trees on field sample plots. Ivent and PosTex were introduced in field surveys during 2008. A total of more than 10 000 trees were positioned in different Heureka projects and in external projects.

Apart from hosting the system development team and the research programme management a number of Heureka projects were running at the department in 2008:
- Design of management alternatives to suit nature conservation practices
- Simulation of young forest development
- Optimization procedures for tactical planning and for handling spatial aspects
- Data acquisition combining field survey and remote sensing for (i) analyses of large geographical areas, for (ii) forest holding management planning, and for (iii) operational planning
- System for objective field survey as a base for long term planning
- Tools for multi-criteria decision analyses

The department was also active in communication activities related to Heureka, meetings and seminars with forest companies, forest owner associations, the Swedish Forest Agency, and international activities such as a seminar with a Russian delegation, a presentation at a SNS meeting on Iceland, and a Heureka event at the international conference Forest Adaptation 2008 in Umeå.

Forest technology - Biofuel works

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Wilhelmson Aspman Emma

The competence area Forest technology undertakes research for the development of efficient methods and techniques for timber and forest fuel procurement in an environmentally friendly way. Below are two examples from the five master´s thesis currently within projects related to biofuel works and a note about the project Forest power.

Productivity at stump harvest
Written by Linnea Hedman, who won a price for best master´s thesis at the ESS conference in May, 2009.
The purpose with this study was to investigate the time consumption for harvesting and forwarding of stumps and the distribution of time on the different work phases, make an economic analysis of stump harvest, evaluate the number and quality of the soil preparation where no extra measure was taken and make an overview of the market of stump harvest devices. There are 3-4 different devices for stump harvest on the market and the most common is the Finnish device Pallari. It has been used in this study where harvest of about 400 stumps has been studied and the time consumption has been recorded. The productivity of stump harvest was on average 4.1 ton DM/G0-h and the mean size of the stump was 131 kg DM. Time consumption was different according to the diameter of the stump, tree species and the humidity of the soil. Stumps from spruce on fresh soil took less time to harvest than stumps from spruce on moist soil. Stumps from pine took more time to harvest than stumps from spruce. A stump with a diameter of 20 cm took 55-70 sec to harvest and a stump with a diameter of 60 cm took 170-220 sec to harvest. Due to the larger stumps higher volume the production in ton DM/h was considerable higher for large stumps. The cost for stump harvest and forwarding with this method was on average 77 SEK/MWh when 100% of the stumps were removed. The average withdrawal was 54.7 ton DM/ha. Crane movement was the work phase that took the longest time, 48% of the total time consumption was due to this phase. The number of soil preparation points was on average 3675 per hectare.

Evaluation of a method for subjective assessment of tree biomass quantities in road right-of-ways
Written by Andreas Eriksson
There is currently 213 000 km of forest roads in Sweden that could be suitable for biomass harvesting. Harvest of biomass along forest roads both provides biomass and maintains the quality of the roads. Currently, the volume of biomass along roads can only be assessed post harvest, chipping and industry deliverance. As the decision of whether or not to harvest should preferably be based on more than personal experience, the TJ-method has been proposed. The TJ-method is a subjective method to quickly determine the dry matter quantity with the assessment being conducted from the roadside. The dry matter quantity is calculated by estimating diameter, height and number of trees. The objective of this study was to evaluate the suitability of using the TJ-method for estimating the dry matter quantity both before and during harvesting. The study evaluated the method in different types of stands and when being used by different people. This study was performed on three blocks, based on the stands' mean diameter in breast height. Four study units of each block were studied. In total 12 study units were objectively inventoried and these results were used as reference values. There were differences in the estimation height and number of trees, mean diameter and dry matter quantity between the blocks in post-harvest estimations. However, the differences were statistically significant only for the former two variables. Estimations for the block with the largest mean diameter gave best results. There were no significant differences between the two trial persons' post-harvest estimations. The TJ-method was more accurate when estimations were made by the machine operator during harvesting than when estimations were made from the roadside before harvesting. There were no significant differences in estimations between different blocks when estimations were made during harvest. With good training and most importantly, a systematic follow-up of estimations, this method can provide reliable, cost-efficient data that can be used when making decisions on whether to harvest along roads or not.

Truck mounted bundler
Picture:
Magnus Pettersson, SLU

Stump harvester
Picture: Magnus Pettersson, SLU

Forest power is a large EU financed project approved in November 2008. The project aims to increase the value and quality of products and services within the forest fuel supply, feed-stock conversation and combustion chains. The project will run from 2009 to 2011 with a total budget of a 4.5 million € and involves the following co-operating organizations: Unit of Biomass Technology and Chemistry (BTK), SLU, Umeå; Energy Technology and Thermal Process Chemistry, Umeå University; Bio-Fuel Region, Umeå; Finnish Forest Research Institute (Metla), Kannus, Finland; Centria, Kokkola, Finland; Ostrobothnian Rural Institute, Kannus, Finland; Ostrobothnian forest owners association, Kokkola, Finland; Skog og landskab, Ås, Norway and ALLSKOG, Norway. The project has an overall aim to increase the general understanding about renewable forest energy sources and utilization within the Bothnia Atlantica area.

Forest in rural studies

Forest commons in boral sweden

- aims and outcomes on forest condition and rural development

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Staff
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Holmgren Lina

Doctoral student
Holmgren Eva
Thellbro Camilla

To illustrate the research undertaken in this competence area, Eva Holmgren's PhD-project is depict, as it both thematically and methodologically is well situated in the core of Forest in rural studies. With basis in the department´s competence in forest and environmental monitoring, the competence area is occupied with human-induced change processes and its influences on rural communities. In this particular PhD-project, the worldwide interest within the framework of "commons", as a mean to deal with multiple, sometimes opposing objectives and/or use rights, is applied on the Swedish forest commons. Even though Sweden has a long experience of commons, there is still not much research conducted on the Swedish forest commons. By this PhD-project, the knowledge gap will be diminished, as it examines the influences of Swedish forest commons on forest condition, management, local economy, environmental values as well as local well-being. The approach is largely rationalistic, i.e. outcomes of forestry activities are assessed in relation to aims. According to the stated objectives, forest commons should serve as exemplars for improved forest management, focusing on increased and sustained timber production. They should provide sustainable economic support for farmers and the local economy, providing a sound basis for taxation and helping to secure the continued existence of the independent farming community.

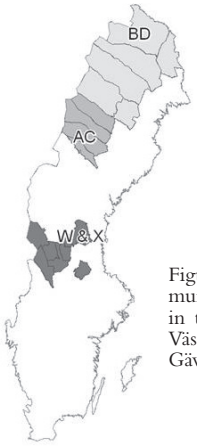

Figure 1: Map of Sweden, showing municipalities with forest commons in the counties of Norrbotten (BD), Västerbotten (AC), Dalarna (W) and Gävleborg (X).

The objectives of this PhD-project is to region-wise (cf. Fig. 1) compare: (i) the state of forests under common and other types of ownership; (ii) the forest common shareholders with non-shareholders with respect to the harvesting intensity and related business activities on their individually managed forest properties, including consideration of taxes paid to the local municipality; (iii) the environmental condition in the forest under common and other types of ownership; (iv) the contributions from three case study commons to local well-being; and (v) in terms of the relation between government and broader governance, to describe, analyze and discuss the interaction of the state and its bureaucracy with the forest commons.

In the first study, the state of the forests comprising all 33 forest commons were assessed, using National Forest Inventory data, and compared to other forests within the same municipalities. A second survey was conducted in the form of a case study with income tax declaration data relating to: forestry production parameters, sales revenues, operating costs and investments, disposable income and local municipal tax revenues. In a third study National forest inventory data on biodiversity indicators were compared regionally between ownership categories.

The fourth study was conducted on social aspects, assessing the extent of the economic support and its availability to support rural development and contentedness among the local shareholders. Finally, policy mechanisms by which the functions of forest commons have been steered are reviewed. The results from this study thus add to previous studies of government and governance in Swedish forestry, which have not in particular focused on common forests.

Re-planting activities year 1923 in Storuman, Västerbotten. The labor consisted of small-scale farmers and their children. Picture: SLU, Forest Library.

Preliminary results from this study indicate that the governing structure has dominated from the very beginning. Even if all forest commons are controlled by the now partly deregulated Forestry Act (1993) the commons are still under the forest commons law and by-laws regulating their every day activities to a higher extent than for example private, individually managed forests. The PhD-thesis will be defended by Eva Holmgren in December 2009. The final research findings will then be presented and discussed regarding the extent to which the aims of the Swedish forest commons have been fulfilled, and further discussed in relation to the broader theoretical context of forest common property regimes.

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Staff
Söderberg Ulf

Doctoral students
Garedew Efrem
Ohlsson, Bo

International forestry

Why do farmers plant trees?

- A multi-disciplinary study in three countrys

Background. Trees and forests are important resources in the improvement and sustaining of rural livelihoods. New plantation projects are continuously being implemented worldwide with varying success. Farmers and entrepreneurs plant trees for many different reasons such as for income generation, as insurance and long term investment, as multipurpose crop for household use, to mark ownership or tenure, for erosion control and for soil improvement. Sometimes numerous small units produce great values. How does it influence the national economy?

Picture: Mats Sandewall, SLU

The study. We have analyzed the characteristics and mechanisms for a viable and sustainable farm based forestry in three regions. The study focused on 3 major research question 1) what are the land use and socio-economic trends 2) what have been the supportive and necessary prerequisites for the development 3) how has farm forestry changed people's life and livelihoods? The studied countries were Ethiopia (plantation started more than 100 years ago but has declined since the 1970s), Vietnam (where farm based plantations have expanded strongly over the last 20 years) and Sweden (where farm forestry and industrial forestry have formed the back bone of the national economy for more than a century). A multidisciplinary methodological approach was applied, including official statistics, interviews, group discussions and systematic field observations to study the physical environment, the socio-economic situation and the policies, strategies and legal framework that influence farm based forestry in studied countries.

Results. The Vietnamese study took place in a region where a major pulp and paper industry was established in the early 1980s. Initially the existing state forestry had great difficulties in providing sufficient raw material for the new factory. In the 1990s a farm based plantation forestry emerged simultaneously with economic reforms and strong economic growth. This plantation development was most rapid close to the industry. We concluded that a number of factors had been important – a stable market, good infrastructure, new technology and skilled labor, a policy that allowed private ownership and marketing, and a favorable forest policy. When these conditions coincided farm forestry had expanded. There were also tendencies for increased income rifts and that the poorest groups could not invest in plantations or improve their living standard. The Swedish literature study displayed similar land use trends from natural forest on to clear cutting and use of land for extensive (low productive) agriculture towards an economically viable private forestry underpinned by forest policy, industrial market and private landownership. Those changes, however, occurred over a longer historical period in Sweden than in Vietnam. In Ethiopia the study illustrated another sequence of events. Plantation forestry introduced by leadership in the past could not be sustained during times of drastic land reforms on several occasions. The confidence, willingness and possibility for people to invest were thereby removed. Despite some national economic growth in recent years and a severe shortage and national demand for wood based material there is neither a functioning market nor legal opportunities for people to invest in tree planting enabling them to sell and earn cash income. There is also no supportive forest policy in place. In many parts of the country trees are only planted within homesteads and for subsistence use, while natural forests are being degraded because of unauthorized logging.

Picture: Mats Sandewall, SLU

Conclusion. The study concludes that when a number of key conditions coincide and create "an enabling environment" for investment it promotes the development of sustainable private plantation forestry and conditions for improved livelihoods for broader societal groups. The poorest strata seem to have difficulties in benefiting from this development.

This project has been funded by Sarec/Formas and the Swedish University of Agricultural Sciences (SLU), It is a cooperation between SLU, Department of Forest Resource Management, Center for International Forestry Research (CIFOR), Vietnam Forestry University and Wondo Genet College of Forestry and Natural Resources.

Environmental monitoring and assessment

Mats Nilsson
Vice head
Environmental monitoring and assessment

Description of the program branch

SLU has a unique task as a Swedish university to carry out not only research and teaching, but to also conduct long-term environmental monitoring (referred to as Foma). This means that SLU should follow changes in the environment's condition, evaluate problems, and provide a basis of information for the sustainable use of natural resources. This information is delivered to the Swedish government and parliament, national and regional government authorities, businesses, and other interested organizations. The Swedish Environmental Protection Agency has assigned the department the task of gathering information for the observation and follow up of the terrestrial habitat's condition and changes as well as the Species and Habitat directive via the programs National inventory of landscapes in Sweden (NILS) and Terrestrial habitat monitoring (THUF). SLU is responsible for official statistics given in the area *Forests' condition and changes* via the National forest inventory (NFI). In addition to these, there are also a number of smaller Foma projects at the department.

The department has a long tradition of working with environmental analysis, such as the work done by the NFI which was started as long ago as 1923. Today the department runs a wide array of environmental monitoring programs, accounting for approximately two-thirds of the total budget. One of the department's strengths is the combination of research and environmental monitoring activities, leading to important synergistic effects. As an example, methods and models developed in research can be used in environmental monitoring activities. At the same time, data collected by Foma programs provide a unique and valuable source of information for different research projects. Even the connection between Foma and undergraduate and master´s studies is important, as it spreads knowledge about Foma activities and the basis of information used to make decisions about the sustainable use of the country's natural resources.

The department's Foma activities include data capture, analysis, reporting, and communication with the responsible agencies and customers both within and outside of SLU. An important part of the environmental monitoring is a continual improvement of the methods and models used in order to improve the quality of the collected data, and to assure the quality of the whole process from data collection to finished product. Increased internationalization makes it all the more important to follow and actively take part in international development by taking part in conferences and national and international networks and projects.

Picture: Ola Borin, SLU

National forest inventory
Forestry consequence analysis and timber balance (SKA-VB 08)

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Program manager

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Bååth Härje
Cory Neil
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Lundström Anders
Nilsson Per
Odell Gunnar
Olsson Bo-Gunnar
Pålsson Anders
Sjöström Anders
Stensson Jakob
Toet Hans
Walheim Mats
Westerlund Bertil
Åkesson Hans

As one example of the application of data from the National forest inventory, presented here, is a brief description of the recently conducted SKA-VB 08.

The overall objective of the project is that the Swedish Forestry Agency in collaboration with relevant government authorities, the forestry sector, the energy sector and other interested parties, analyse the current and expected future timber balance from a broad social perspective for different regions in the country. SKA-VB 08 plays a central role in this analysis by providing information on different physical resources and thereby facilitating the comparison of impacts for different scenarios. SKA-VB 08 provides the possibility of more in-depth analysis of ecological, economic and social consequences and comparison of the sustainability, including vulnerability of different scenarios.

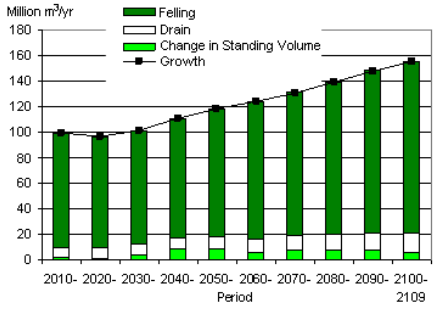
The project consists of a broad forestry consequence analysis (SKA 08) and also a timber and wood fuel analysis (VB 08). The project will provide a basis for strategic analysis and decision making for forest management and the use of forest resources. This information can then be used by the government, government authorities, the forestry sector, the energy sector and other organisations.

The project is headed by a steering committee and a reference group and is divided into six sub-projects:

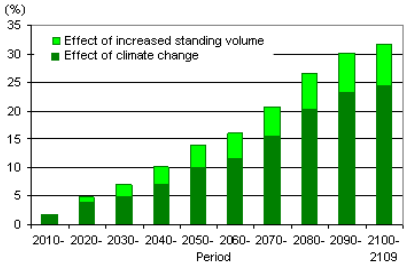
1. Reference scenarios and sensitivity analysis. Project leader: Anders Lundström, SLU
2. Environment. Project leader: Erik Sollander, SKS.
3. Forest management intensity. Project leader: Sven A. Svensson, SKS
4. Climate and vulnerability. Project leader: Johan Bergh, SLU
5. Primary wood fuel. Project leader: Tomas Nordfjell, SLU
6. Timber and wood fuel balance. Project leader: Jenny Malmhäll, SKS

Other contributing persons from SLU are:
Majvor Asplund, Dimitris Athanassiadis, Neil Cory, Sören Holm, Urban Nilsson, Per Nilsson och Kenneth Nyström.

Implementation. To demonstrate the effects of a range of management plans four scenarios were constructed. They have been formed to reflect the wide range of prerequisites from the many possible different priorities which can be placed on timber production and environmental aspects in future forestry development plans. The government's forestry bill and the Environmental Objective Council's in-depth analysis of the national environmental objectives have both influenced the shape of these scenarios. The potential consequences of climate change, where CO2 emission reductions are incorporated, have been included in all the scenarios. The scenarios are projected for 100 years using the HUGIN system. Forestry characteristics are based upon data from the National forestry inventory for the period 2002-2006.



Mean annual increment, potential felling (incl. pre-commercial thinning), annual drain and change in standing volume. (million m^3/yr). Reference senario, productive forest land, all owners.



Forest growth as a result of climate change in the reference senario, fraction of growth not due to climate change (%). Divided into the direct effects of climate change and the effect of an increasing standing volume. All land use classes and ownership categories.

The four scenarios are:

Reference. This scenario is based upon development at current forestry levels, environmental legislation up to 2010 and predicted effects of climate change.

Environment. This scenario is based upon fulfilment of the current national environmental objectives, primarily the objective Sustainable forests.

Production. This scenario demonstrates the effects of a higher timber production from an increase in investments in forest management.

Environment and Production. This scenario combines both fulfilment of the national environmental objective along with an increase in timber production.

Further reading:

Skogliga konsekvensanalyser 2008 - SKA-VB 08, Rapport 25, 2008, Skogstyrelsen

National inventory of landscapes in Sweden – Little NILS

During 2008, the county administrative boards in Örebro, Stockholm, Södermanland, Uppsala, Västmanland and Östergötland counties have co-operated with the department in a project for developing a monitoring scheme, called Little-NILS, for demands at a regional (county) level. The aim of the project is to investigate how the methods and the infrastructure of the national monitoring programme NILS (National inventory of landscapes in Sweden, also managed by the department) can be used to increase understanding about prerequisites for biodiversity at a regional level and to deliver data on the state and changes in the landscape. The project is coordinated by Helena Rygne, Örebro county, and Anders Glimskär, Department of Ecology, SLU, Uppsala. The project aims at providing data as a basis for evaluating the Environmental Quality Objectives, and the goal is to get a cost-efficient system by fully exploring the synergy effects of combining national and regional scale monitoring.

Considering the limited yearly budget, a regional monitoring project must make use of as much as possible of available national methods, results and organisation for environmental monitoring. However, for sparsely occuring features, regional monitoring may use other methods to direct the efforts of data collection more strictly towards certain areas, ecosystems or structures. To reduce costs for individual counties, it is necessary that this monitoring is organised for groups of counties with similar environmental and geographical conditions, in which both data collection and analyses are performed jointly. The counties involved in the project have identified and made priorities for important topics in need of more data. Based on these priorities, areas of interest have been chosen for which a new monitoring scheme will be developed, which also can make use of available data from national programmes. For most purposes, there is still a need for further method development, which will be undertaken during 2009. The final system of methods should be flexible and possible to use for varying demands also in other regions.

Picture: Aina Pihlgren. SLU

An important criterion in the selection of variables and topics for the project has been to what extent they contribute to the evaluation of the regional Environmental Quality Objectives. Another limitation concerns the available budget for monitoring in each county. The county administrative boards involved have chosen to focus mainly on following the development in the agricultural landscape and in mires. For forest habitats, in comparison, other organisations have a more obvious responsibility to follow environmental changes also at a regional scale.

The work up to now have resulted in four regional monitoring programmes:

- Landscape features and small biotopes in the farmland landscape
- Lowland grasslands
- Mires
- Shores of inland waters

The monitoring of farmland biotopes, grasslands and mires will be operative during the second half of 2009. The development and implementation work is performed by Anders Glimskär, Karin Terä, Aina Pihlgren, Species Information Centre, SLU, Uppsala and Johan Wretenberg, Örebro county. A project for developing methods for monitoring exploitation and land use along shores continues in 2009, performed by Merit Kindström and Klara Tullback Rosenström, Stockholm county, which could result in methods, which could be applied from 2010.

As the amount of data available from the national NILS programme increases and new schemes for regional monitoring start, the possibilities to analyse landscape properties, patterns and content increase, for example habitat fragmentation or landscape diversity. This has been identified as a topic of high priority for the counties in the project. The work with formulating suggestions for analysing landscape properties have involved Anna Allard and Marcus Hedblom, Department of Ecology, SLU, Uppsala.

Picture: Aina Pihlgren. SLU

Johan Svensson
Program manager

Staff
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Eriksson Åsa
Gallegos Torell Åsa
Kindström Merit
Lagerqvist Kjell
Marklund Liselott
Pettersson Anders
Sandring Saskia
Sundquist Sture

The project also uses other employees within the department´s competence areas and environmental monitoring programs.

Terrestrial habitat monitoring

Hans Gardfjell,
Project leader

Staff
Hagner Åsa

The project also uses other employees within the department´s competence areas and environmental monitoring programs.

Terrestrial habitat monitoring (THUF) is a new environmental monitoring program at the department. The main objective is to build a national monitoring system that will make it possible to estimate the distribution and assess the conservation status of terrestrial habitats. The project is financed by the Swedish Environmental Protection Agency and the development is motivated by the requirement for all European member states to report on their implementation of the Habitats directive to the European commission. The Habitats directive is a cornerstone in European legislation to halt the ongoing biodiversity loss.

Gymnadenia nigra (L.)
Picture: Hans Gardfjell, SLU

Åsa Hagner, Bjärehalvön
Picture: Hans Gardfjell, SLU

Maria Sjödin determines the age of an Alnus glutinosa (L.)
Picture: Hans Gardfjell, SLU

Collaboration with the National inventory of landscapes in Sweden and the National forest inventory is essential. THUF has assisted in the development and implementation of new methods and variables in these two programs. At the beginning of the 2008 field season all sampled field plots were categorized and it is determined if they are located in one of the habitat types that are listed in the Habitats directive. With the addition of the new variables it is also possible to make an assessment of the conservation status and that will allow us to undertake a nationwide assessment of the distribution and the conservation status of the most abundant habitat types with high conservation status.

During 2008 a lot of time has been put into development and design of new and improved inventory methods. The presently used random sampling methods will not allow us to assess less abundant habitats with enough accuracy. We are therefore planning to use a two-phase sampling design where we are combing interpretation of aerial images with a field survey. During the autumn of 2008 we conducted the first test of our point-grid methodology in 7 areas in southern Sweden.

In November 2008 we submitted an application to the European commission's LIFE+ program. The title of the proposed project is "Demonstration of an integrated North-European system for monitoring terrestrial habitats" (acronym MOTH). The objective of the project is to develop and demonstrate a fully functional monitoring program that is suitable to support the reporting process required by the Habitats directive.

Publications

The publication list below includes work that was published during 2008. The publications are presented for each of the department´s competence area and environmental monitoring program separately. Peer reviewed scientific articles are listed first followed by book chapters, prooceedings and reports.

Remote sensing

Scientific articles

- Holmgren J., Persson Å. and Söderman U. 2008. Species identification of individual trees by combining high resolution LiDAR data with multispectral images. International Journal of Remote Sensing, vol. 29, no. 5, pp. 1537-1552.
- Magnusson M., Fransson J.E.S. and Olsson H. 2008. Change detection of thinned Norway spruce stands using optical SPOT-4 satellite data. Canadian Journal of Remote Sensing, vol. 34, no. 5, pp. 431-437.
- Tomppo E., Olsson H., Ståhl G., Nilsson M., Hagner O. and Katila M. 2008. Combining national forest inventory field plots and remote sensing data for forest databases. Remote Sensing of Environment, vol. 112, no 5, pp. 1982–1999.

Book chapters

- Eriksson L.E.B. and Fransson J.E.S. 2008. Forestry applications, Radar data. In Advances in Photogrammetry, Remote Sensing and Spatial Information Sciences: 2008 ISPRS Congress Book, pp. 447-449. Edited by Li Z.,Chen J. and Baltsavias E., CRC Press/Balkema, Taylor & Francis Group, London, UK.
- Nilsson M. 2008. Forestry applications, Prediction of forest variables using remote sensing trained field data. In Advances in Photogrammetry, Remote Sensing and Spatial Information Sciences: 2008 ISPRS Congress Book, pp. 454-455. Edited by Li Z.,Chen J. and Baltsavias E., CRC Press/Balkema, Taylor & Francis Group, London, UK.

Proceedings

- Eriksson L.E.B., Santoro M. and Fransson J.E.S. 2008. Temporal decorrelation for forested areas observed in spaceborne L-band SAR interferometry. In Proc. IGARSS 2008, Boston, Massachussetts, USA, 6-11 July, 2008, pp. 283-285.
- Eriksson L.E.B., Sandberg G., Fransson J.E.S., Magnusson M. and Ulander L.M.H. 2008. ALOS PALSAR calibration and validation activities in Sweden. In Proc. the First Joint PI Symposium of ALOS Data Nodes for ALOS Science Program in Kyoto, Kyoto, Japan, 19-23 November, 2007.
- Fransson J.E.S., Magnusson M., Olsson H., Eriksson L.E.B., Folkesson K., Sandberg G., Santoro M. and Ulander L.M.H. 2008. Detection of clear-cuts using ALOS PALSAR satellite images. In Proc. EUSAR 2008, 7th European Conference on Synthetic Aperture Radar, Friedrichshafen, Germany, 2-5 June, 2008, pp. 103-106.
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