SLU

Department of Forest Resource Management

Annual Report 2009

CERTIFIED ISO 14001 SEMKO CERTIFICATION

Johan Fransson
Head of Department

Contents

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Dear Reader,

It is my pleasure inviting you to read about some of the activities from the Department during 2009! These include undergraduate, Master´s and doctoral studies, and research within six competence areas (research groups), as well as three major programmes of environmental monitoring along with communicating information to our society.

When reflecting upon 2009, I would like to draw your attention to some selected highlights. First of all, the SLU evaluation entitled "Quality and Impact" was completed and the international experts evaluating the research group of Remote Sensing and the National Forest Inventory recognized these groups as world leaders! The Faculty research programme Heureka has, after eight years of work, successfully completed development of a new forest management and planning software package with special focus on multi-purpose forestry. A Heureka unit has been formed at the Department to secure continuity and future development. The programme for Institutional support to Wondo Genet College of Forestry and Natural Resources was also completed after 23 years of work. The programme was one of the biggest Swedish forestry aid programmes through history and was carried out with the financial support of Sida.

Two larger research programmes had their kick-off in the beginning of the year; EMMA (Environmental Mapping and Monitoring with Airborne Laser and Digital Images), aiming at developing new methods for vegetation mapping and monitoring, on land and at sea using laser scanning and digital aerial imagery, and Forest Power (a research programme within the framework of Botnia Atlantica) focusing on how to increase the extraction and use of biomass from the forest. Moreover, a contract was signed for the environmental monitoring Life+ project MOTH (Demonstration of an Integrated North-European System for Monitoring Terrestrial Habitats), where the objective is to develop and demonstrate a fully functional monitoring programme to support the reporting required by the EU's Habitats Directive. Furthermore, the research school on Forest Technology FIRST (Forest Industrial Research School on Technology) started as a joint Swedish-Finnish initiative to strengthen competitiveness in forestry through developing the next generation of forest operation systems. The Department has actively contributed to a number of government mandates, international reporting (e.g. FAO, UNFCCC, Kyoto Protocol) and both participated and organized conferences as part of the Swedish presidency of the EU along with side-events at the climate meeting in Copenhagen. Also, SLU has established three data platforms to support, coordinate and follow-up data and information management within SLU's environmental monitoring programmes; our Department was proud to be selected to host the data platform for the Faculty of Forest Sciences. Finally, we had seven doctoral dissertations (an all time high!), a great reflection of our commitment to first class research.

In the pages that follow you will find some of the highlights from 2009, for further reading I recommend you to study the Master's thesis reports and doctoral theses 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 2009:

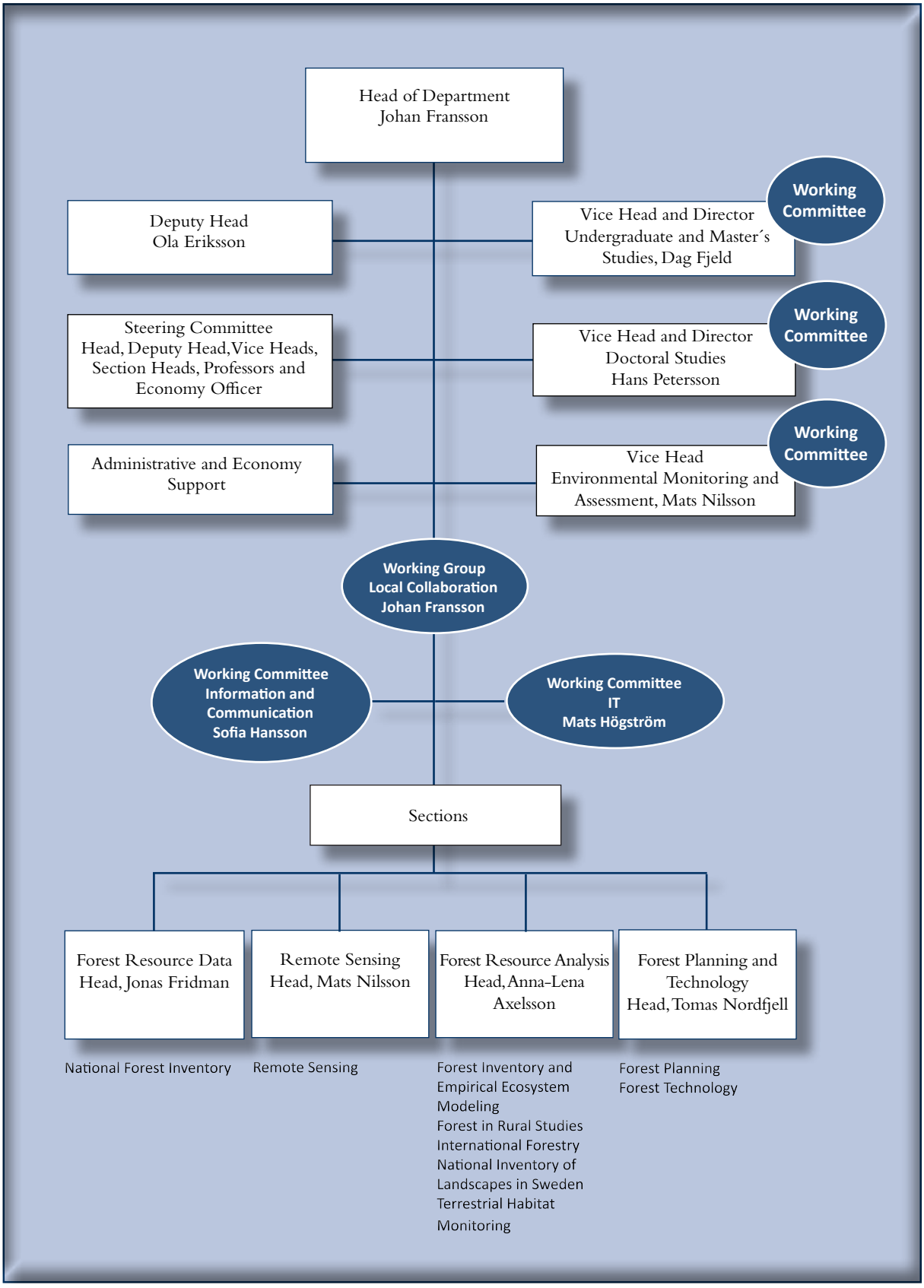
- Anna Ringvall earned the competence of Associate Professor (docent) in Forest Inventory
- Göran Ståhl was appointed as Professor of Honour at the University of Copenhagen
- Ola Lindroos was employed as Assistant Professor in Forest Technology
- Ola Eriksson was elected as chairman for COST Action FORSYS (Forest Management Decision Support Systems)
- Rolf Gref retired from the Section of Forest Planning and Technology after 34 years of employment at SLU
- Torgny Lind was appointed as Acting Head of the Section of Forest Resource Analysis
- Mattias Nyström won a bronze medal in multi-sport at the World Championship in Portugal
- Lennart Norlén, Carina Westerlund and Sören Wulff, were honoured in a special celebration for employees that have served the government (SLU) for 30 years

I hope you will enjoy reading this annual report and do not hesitate to contact us if you would like to find out more about the 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



Text and figure:
Sofia Hansson

Department Steering Committee

From the left:
Torgny Lind
Hans Petersson
Mats Nilsson
Johan Fransson
Tomas Nordfjell
Jonas Fridman
Dag Fjeld

Missing from the picture:
Maud Andersson
Anna-Lena Axelsson
Ola Eriksson
Håkan Olsson
Göran Ståhl
Iwan Wästerlund

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 2009.

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, field administration, student course registration, information issues and layout of reports.

Picture of the employees at the Department 2009

On 24th of November the Department's staff gathered for a Department day. In the morning we learned about empathy and understanding from Professor Stefan Einhorn followed by discussions on the theme in the afternoon. To round off we enjoyed sporting activities at IKSU before a nice culinary dinner at the restaurant Örnen.

Pictures: Sofia Hansson and Maria Bergling, SLU

Press Clippings

"A whirlwind of progress"
In the forests surrounding Remmingstorp in Västergötland researchers have been simulating a storm. Chainsaws have been used to fell approximately five hectares of forest to study if eventual damage can be detected by radar satellites.
ATL Lantbrukets Affärstidning, 10th September

"30 years in government service"
Lennart Norlén, Carina Westerlund and Sören Wulff were honoured in a special celebration for employees that have served the government (SLU) for 30 years. The ceremony took place in Umeå the 3rd of December.

"Heureka allows the possibility of detailed forest planning"
The Heureka research program has, after eight years of work, reached its' target. This means that there is now an advanced and modern data based planning and analysis tool for forest planning, which is also free. The Heureka system is targeted primarily at professional forest planners, but can also be used by private forest owners.
Skogsaktuellt, 9th December

"Great need of pre-commercial thinning"
The Swedish union of forestry, wood and graphical workers (GS) wants an increase in precommercial thinning in Swedish forests. This could generate 1 300 new jobs across the country, the union has calculated. According to GS we would need to undertake precommercial thinning on 450 000 hectares of forest annually to catch up the backlog that has build up. Data from the Swedish National Forest Inventory shows that there is currently 1.4 million hectares of forest land in acute need of precommercial thinning.
Dagens Arbete, June

"FIRST – a research school which will lift Nordic forest technology"
May 2009 saw the kick-off for a major Swedish-Finnish investment in forest technology. FIRST (Forest Industrial Research School on Technology) is an initiative from the Swedish forestry sector. The project includes eight Swedish and four Finnish doctoral projects, which are entirely based on the needs of the forestry sector.
Nytt från Skogforsk, 18th February

"SLU takes part in Climate conference"
The Climate conference in Copenhagen is now underway. The Department participated with a well-attended side-event named Challenges and solutions in reporting of LULUCF (Land Use, Land-Use Change and Forestry). In this side-event, organised by SLU, scientists from Sweden and Finland gave their view on various subjects related to the reporting of the LULUCF-sector. The Department was represented by Anders Lundström, Hans Petersson and Per-Erik Wikberg.
SLU Press, *December*

"Forestry sector behind initiative for a new research school"
Spring 2009 sees the start of a new Swedish-Finnish research school known as FIRST. Initiative for the school is from the forestry sector and expectations are high. Researchers will work in close collaboration with the forestry sector within twelve projects, which are aimed at solving common forestry problems.
KK-stiftelsen, 14th January

"New technology gives more profitable thinning"
The forestry sector may soon have a new and profitable option – bio-energy thinning of dense young forest stands. With a new technique, known as boom-corridor thinning, a large new source of forest fuel can be obtained, which can significantly contribute to energy supply.
Västerbottenskuriren, 30th November

"The proportion of broadleaves is increasing in Swedish forests"
Broadleaved trees are on the rise in Swedish forests. Not since the 1920's has the proportion of broadleaves been as large as it is today show the latest figures from the Swedish National Forest Inventory, undertaken by the Swedish University of Agricultural Sciences (SLU). The growing stock in Sweden continues to increase and, as with previous years, it is broadleaves that contribute most to this increase. Broadleaves now make up almost a fifth of the national growing stock, approximately 600 million cubic meters.
Dagens Nyheter, 25th September

Göran Ståhl was appointed as Professor of Honour at a special ceremony at the University of Copenhagen during the spring 2009.

"Better land use consultation via reindeer husbandry plans"
SLU and the Swedish Forest Agency in collaboration with several reindeer herding communities (samebyar) have developed reindeer husbandry plans (Renbruksplan). These plans help improve communication between the reindeer herders and the other land users during consultation about forest management or other exploitations. Reindeer herders also benefit from the plans when planning their use of reindeer grazing areas.
Miljötrender, April

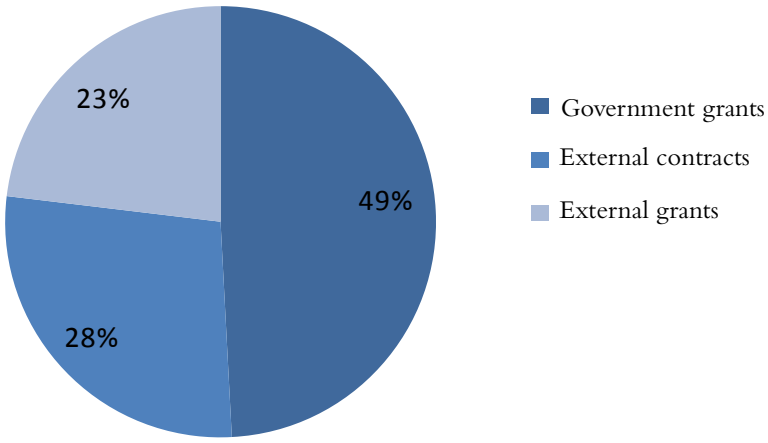
"SLU examines the role of forests in climate issues"
Climate forests ability to bind carbon dioxide is a contentious issue. SLU has therefore been given the task of investigating how the use of forest and land affects fluxes of greenhouse gases.
Miljöaktuellt, 21st January

Facts and Figures

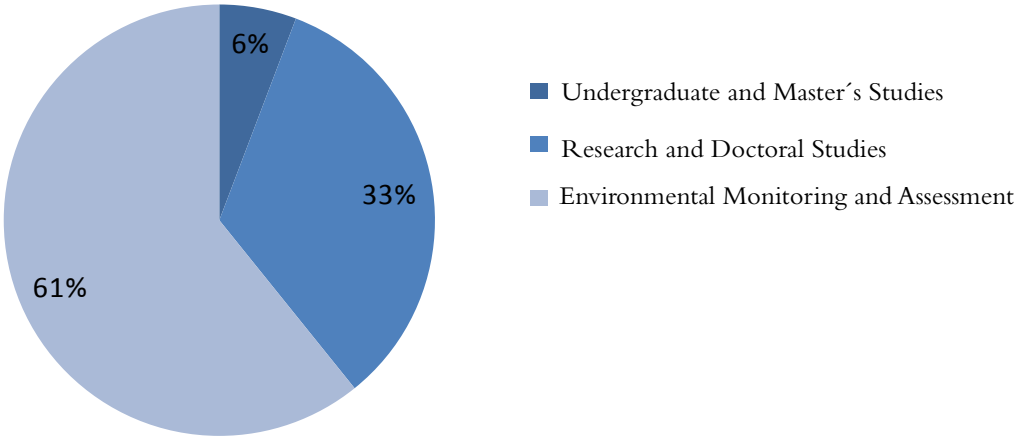
Revenues (1000 SEK)	Undergraduate and Master´s Studies	Research and Doctoral Studies	Environmental Monitoring and Assessment	Support Function	Total
Government grants	7 099	17 178	39 056	0	63 333
External contracts	315	5 944	29 299	160	35 718
External grants	5	19 782	9 730	230	29 748
Other revenues	0	60	27	21	108
Total	**7 419**	**42 965**	**78 112**	**411**	**128 907**

Costs (1000 SEK)					
Staff	3 903	22 112	42 978	5 021	74 015
Premises	694	2 198	2 177	-161	4 907
Other operative expenses	576	12 340	20 415	2 176	35 506
Depreciation	30	71	319	32	452
Overheads	1 221	6 730	10 876	-5 954	12 873
Total	**6 424**	**43 450**	**76 765**	**1 113**	**127 752**

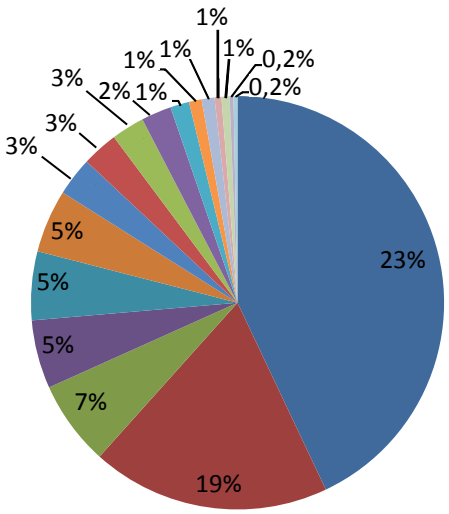
Revenues



Costs



External Contracts and Grants



	Financier	Incomings (million SEK)
1	Swedish Environmental Protection Agency	29.9
2	EU	13.0
3	Kempe Foundations	4.6
4	Formas	3.7
5	Sida	3.7
6	Swedish Board of Agriculture	3.4
7	Swedish National Space Agency	2.1
8	Swedish Forest Industries Federation	2.0
9	Brattås Foundation	1.8
10	Country Administrative Board	1.6
11	Forest Society of Sweden	1.0
12	Mistra	0.7
13	Saami Parliament	0.7
14	Swedish Forest Research Institute	0.4
15	SNS	0.4
16	Swedish Forest Agency	0.2
17	Swedish Energy Agency	0.2
	Other, accruals	-4.1
	Total	**65.6**

Personnel Categories	Number of Work-Years*
Professors	4.5
Associate Professors/University lecturers	9.3
Assistent Professor	1.8
Researchers	19.2
Post doctoral students	2.2
Doctoral students	23.0
Other teachers	1.9
Administrative staff	4.6
Technical staff	36.0
Technical staff (field)	40.0
Total staff	**142.5**

*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 programme (Jägmästarutbildningen). The Department is also active in contract education for forest companies and international co-operation with other universities. Our course selection in the Master of Forestry Programme 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.

In 2009, a one and a half year collaboration project was concluded between the Department and six Russian Universities and Institutes, which has worked towards improving education within operative management of timber logistics and timber roads.

Subject co-ordinators. Curriculum development is handled by subject coordinators: Jonas Bohlin (Remote Sensing and GIT), Sören Holm (Forest Inventory), Ola Eriksson (Forest Planning), Dag Fjeld (Forest Technology and Wood Supply) and 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 a stable participation at SLU in Umeå (about 25 students per course). A high degree of sector participation in course concept development and instruction has resulted in good student evaluation.

During 2009 the total volume of teaching done at the Department was 108 full-time equivalents, corresponding to 99 annual performance equivalents. Approximated 16% of the total volume comes from Master's thesis (supervision of 16 theses in 2009).

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, in the fall of 2010 (co-ordinator Torgny Lind).

Courses Given at the Department in 2009

Subject	**Undergraduate Level** (years 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

Text: Dag Fjeld
Pictures: Julio Gonzales, SLU

Master's Thesis Reports

Forest Technology

Andersson, Maria. Förbättringsarbete och avvikelsehantering för ökad tjänstekvalitet hos SCA Skog AB Jämtlands skogsförvaltning.
(Supervisor: Dianne Staal Wästerlund)

Auselius, Jonas. Realisering av returer vid rundvirkestransport med lastbil: hinder, möjligheter, vinster och vinstdelning.
(Supervisor: Dag Fjeld)

Berg, Simon. Skogsentreprenadföretagens lönsamhet.
(Supervisor: Ola Lindroos)

Bergquist, Emelie.Varför lämnar maskinförare skogsbranschen?
(Supervisor: Dianne Staal Wästerlund)

Edlund, Marita. Produktivitet och lönsamhet vid skogsbränsleuttag längs skogsbilvägar.
(Supervisor: Ola Lindroos)

Edman, Torbjörn. Buntning av grot med lastbilsmonterad utrustning.
(Supervisor: Tomas Nordfjell)

Fridén, Per. Skogsåkeriägares inställning till organisationsförändringar.
(Supervisor: Dag Fjeld)

Johansson, Anders. Kvalitetssäkring av markberednings- och planteringsuppföljning hos SCA Skog AB Jämtlands skogsförvaltning.
(Supervisor: Dianne Staal Wästerlund)

Nilsson, Anders. Produktivitet och lönsamhet vid skörd av skogsbränsle i klen björkgallring.
(Supervisor: Tomas Nordfjell)

Nilsson, Björn. Costs, CO2-emissions and energy balance for applying Nordic methods of forest biomass utilization in British Columbia.
(Supervisor: Ola Lindroos)

Valinger, Karin. Skogsbrukets framtida arbetskraftsförsörjning: skogsmaskinföraryrkets attraktionskraft.
(Supervisor: Dianne Staal Wästerlund)

Remote Sensing

Krantz, Anders. Mapping of clear-cuts in Swedish forest using satellite images acquired by the radar sensor ALOS PALSAR.
(Supervisor: Johan Fransson)

Larsson, Henrik. Flygburen laserskanning kopplat till skördarmätning för datainsamling till operativ planering.
(Supervisor: Johan Holmgren)

Mukesh, Kumar. Geospatial monitoring and evaluation of UNESCO Worlds Heritage Forest areas in the Tropics.
(Supervisor: Mikael Egberth)

Wiklund, Olle. Gallringsinventering från helikopter utrustad med profilerande laser och kamera för låghöjdsfotografering.
(Supervisor: Mats Nilsson)

Forest in Rural Studies

Wilhelmsson, Magnus. Hur skogsägare skaffat sig underlag för beslut och åtgärder efter stormen Gudrun – en jämförelse mellan olika kategorier av privata skogsägare.
(Supervisor: Gun Lidestav)

More information: The Master´s thesis reports can be found in SLU:s digital archive Epsilon http://epsilon.slu.se

Doctoral Studies

Hans Petersson
Vice Head and Director
Doctoral Studies

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 2009 thirty students were enrolled, with a quite even number of men (16) and women (14). Seven doctoral students concluded their studies this year and 12 new students were recruited.

The doctoral students have made great progress this year and a 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 a doctoral student day organized by the Department. Representatives of the doctoral students have taken part in: the Working Committee of Doctoral Studies (Department level) and the Council of Doctoral Students (organized by doctoral students).

Supervision. Ten different senior researchers currently act as supervisors and the doctoral students are supported by more than thirty co-supervisors. The gender balance within the group is uneven with only one female supervisor and four female co-supervisors. During 2009 two additional male researcher have completed the course for supervisors at SLU.

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 then reports 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 programmes.

During 2009, the Department gave the doctoral courses: Gender and Natural Resource Management, Modeling Growth and Yield for Decision Analyses, Statistical Methods for Research with Focus on Application, Advanced Natural Resources Sampling, Forest Remote Sensing and Design of Experiments and Analysis of Variance. About 40 doctoral students were examined.

Doctoral Courses Given at the Department in 2009

Subject	Credits (ECTS)
Gender and Natural Resource Management	7.5
Modeling Growth and Yield for Decision Analyses	7.5
Statistical Methods for Research with Focus on Application	7.5
Advanced Natural Resources Sampling	7.5
Forest Remote Sensing	7.5
Design of Experiments and Analysis of Variance	7.5

Text: Hans Petersson
Pictures: Jenny Svennås-Gillner and Viktor Gärdebro, SLU.

Doctoral Theses

Forest Planning

Sofia Backéus
Forest Management Strategies for CO_2 Mitigation
December
Supervisor: Tomas Lämås

Karl Duvemo
The Influence of Data Uncertainty on Planning and Decision Processes in Forest Management
February
Supervisor: Tomas Lämås

Nicklas Forsell
Planning Under Risk and Uncertainty: Optimizing Spatial Forest Management Strategies
May
Supervisor: Ola Eriksson

Ali Salehi
Livelihood Dependency and Management on Semi-Arid Oak Forests: The Case of Southern Zagros, Iran
May
Supervisor: Ola Eriksson

Forest Technology

Dan Bergström
Techniques and Systems for Boom-Corridor Thinning in Young Dense Forests
November
Supervisor: Tomas Nordfjell

Forest in Rural Studies

Eva Holmgren
Forest Commons in Boreal Sweden: Aims and Outcomes on Forest Condition and Rural Development
December
Supervisor: Gun Lidestav

Bo Ohlsson
Farmers and Forest Land Use in Lao PDR and Vietnam
Mars
Supervisor: Ulf Söderberg

More information: The doctoral theses can be found in SLU:s digital archive Epsilon http://epsilon.slu.se

Pictures: Patrik Umaerus and Sofia Hansson

Remote Sensing
The EMMA research programme
– Environmental Mapping and Monitoring with Airborne Laser and Digital Images

Håkan Olsson
Competence Area Manager

Staff
Anna Allard
Peder Axensten
Jonas Bohlin
Mikael Egberth
Johan Fransson
Olle Hagner
Johan Holmgren
Mats Högström
Mats Nilsson
Karin Nordkvist
Kenneth Olofsson
Anders Pettersson
Emma Sandström
Per Sandström
Jörgen Wallerman

Post Doctoral Student
Michael Gilichinsky

Doctoral Students
Eva Lindberg
Ann-Helen Mäki
Mattias Nyström
Andreas Pantze
Heather Reese

The EMMA research programme aims to develop new methods for vegetation mapping and monitoring based on the possibilities offered by airborne laser scanning and automated analysis of digital aerial photos. The programme is financed by the Swedish Environmental Protection Agency. It started in 2009 and is scheduled to continue for four years. Both terrestrial and aquatic applications are addressed. The Section of Remote Sensing at SLU is the programme leader and the lead partner for the terrestrial part, whereas the aquatic part is lead by the Swedish Defense Research Agency (FOI). There are six more partners in EMMA, among them two groups at Stockholm University.

The Section of Remote Sensing is responsible for three work packages. Eva Lindberg (doctoral student), Johan Holmgren and Kenneth Olofsson are investigating the possibility of mapping understory vegetation occurring under a closed forest canopy. Both conventional small footprint airborne laser scanners with returns recorded as X, Y and Z co-ordinates, as well as full waveform laser data are used. Full waveform data means that the response at different layers in the vegetation from each emitted laser pulse is recorded, which should provide improved ability to detect the vegetation's 3D structure (see Figure 1).

Mattias Nyström (doctoral student), Johan Holmgren and Håkan Olsson are investigating the possibilities to use airborne laser scanner data as a monitoring tool for detecting vegetation changes. A first study is being undertaken in the ecotone between mountain birch forest and tundra. A grid with 88 sample plots has been accurately measured in the field and is being used as ground truth for estimates of tree height, canopy closure and above ground tree biomass (see Figure 2).
Using the laser scanner data TopEye Mk II, with 13 return pulses per m^2, areas of birch forest are clearly visible, as well as areas with willow. Thus, laser scanning is likely to be an efficient tool for monitoring future changes in the tree line ecotone. This is a mapping task that is otherwise difficult to perform with visual interpretation of aerial photos due to the complex mosaic of vegetation patches that forms the tree line. This work package will continue with studying the possibility of detecting vegetation changes between laser scanner registrations from different time points.

In the third work package Ann-Helen Mäki (doctoral student), Karin Nordkvist and Mats Nilsson are investigating new methods for large area vegetation mapping that will become possible as a result of the nationwide laser scanning being performed by the National Land Survey. The methods have in common that they use a digital surface model of the forest canopy and compare this with the digital elevation model of the ground, in order to obtain a canopy surface model that complements spectral data from satellite sensors. The digital surface model of the forest canopy might be obtained from either laser scanner data, or from automated matching of digital aerial photos. Preliminary results show that these methods could provide classifications that are much more accurate than current satellite data products.

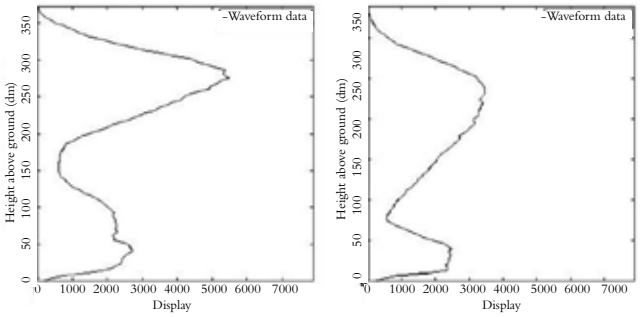


Figure 1. Histograms from full waveform laser scanner data, showing canopy form and understory, left: histogram from a plot with pine forest and an understory with 10 m tall spruce forest; right: histogram from a plot with spruce forest and an understory of 3 m tall birch forest.

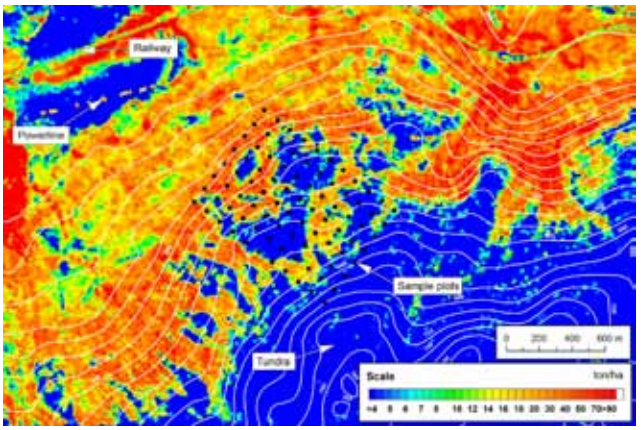


Figure 2. Map of above ground tree biomass at the transition zone between mountain birch and alpine vegetation without trees at Stordalen, 6 km east of Abisko. The biomass estimates are obtained by regression analysis of features from laser scanner data trained with field measurements from sample plots (shown as black dots in the map). The field measurements of stem diameters were transformed to biomass by aid of existing functions.

More information: http://emma.slu.se/

Text: Håkan Olsson
Figures: Håkan Olsson and Mattias Nyström

Forest Inventory and Empirical Ecosystem Modeling

– Stand establishment and early growth

One of the ongoing projects within this competence area concerns how to predict the status of stands after the regeneration phase. The project started in 2006 and ends during 2010 and it is financed by Formas and the Heureka research programme. Kenneth Nyström leads the project and Björn Elfving (SLU) and Ola Rosvall (Skogforsk) are involved as a reference group. During 2009, Bronson Bullock from North Carolina State University (USA) has participated as a guest researcher.

Project aim. In Sweden, about a third of the productive forest area consists of stands younger than 30 years. The main objective of the project is to enhance the accuracy and flexibility of our predicting tools for stand establishment by developing functions to model:
(i) A new plant population after simulated regeneration cuttings.
(ii) Individual trees from stand level data in seedling stand.
An overview of the individual tree data initialization in the stand establishment phase is given in Figure 1.

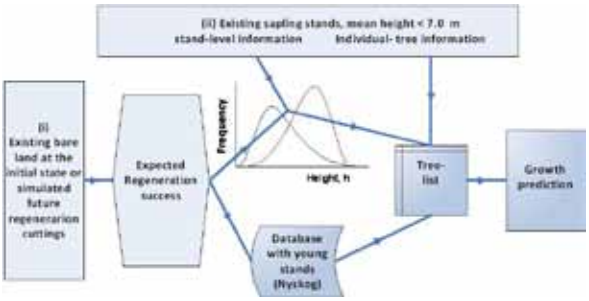


Figure 1. Flow chart of the simulation of the stand establishment and early growth.

(i) Stand establishment. In most growth simulators for management planning, e.g. Heureka, it is necessary to simulate the regeneration success and early development of the established seedlings before the actual growth modeling can start. There are mainly two options to generate a new plant population after harvest:

Imputation. The first approach to model regeneration success is by imputation of expected initial state, e.g. by selecting a single plot with desired characteristics. This approach was evaluated for the HUGIN-system and has now also been incorporated in Heurek's toolbox. A sample plot with tree data is assigned from a database to target stands, based on the estimated regeneration success.

Simulation by functions. A second approach to modeling stand establishment is to estimate the expected status of the established young stand by a set of functions linked hierarchically. This approach has been used in the project to simulate "synthetic" plant populations. The Weibull distribution was used to characterize species-wise frequency distributions for initial heights of established seedlings, by applying following sub-models:

- Estimate the expected regeneration result, Uk=*f*(site, method). This is the key variable and the same in imputation and simulation
- Estimate the expected total number of established seedlings per hectare
- Estimate the proportions of conifers and broadleaves
- Estimate the expected tree species composition
- Estimate the expected mean height and height variation for each tree species present
- Estimate the parameters for the Weibull probability density function species-wise
- Finally, individual trees are generated (species, heights) according to estimated Weibull distribution

Separate models have been developed for different regeneration methods.

(ii) Existing seedling stands. Models have also been evaluated in the project to create individual tree data in stands with an existing seedling population not described by individual trees. The height distribution of the initial stand is generated by regression models that predict the parameters for a Weibull distribution as a function of mean height and height variation within the stand. Separate regression models are used for different forest types defined by species composition. The expected height distribution for a natural regenerated pine stand with a mean height of 2 and 5 m, respectively, are illustrated in Figure 2.

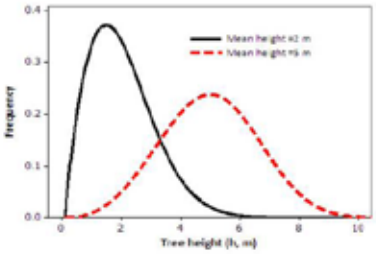


Figure 2. Illustration of predicted height distribution at 2 and 5 m mean height. Stand type: Pine stand, naturally regenerated and proportions broadleaves=0.

Early growth. For established seedlings the early development of the young stands to the pole stage (i.e. mean height of approximately 7-8 m) is projected by height-age curves for the main crop trees. Diameter, age and volume are estimated by static relationships using height as an important variable. Mortality and damage are predicted by a partly stochastic model. Additional sub-models are also included in the growth simulator to simulate the effects of pre-commercial thinning, intensive fertilization and use of genetically improved material.

Fulfillment of objectives. The models were developed to be directly applicable in the Heureka system, and the input variables are restricted to those variables that are measured or assessed in practical forest inventories today. Implemented tools for stand establishment and early growth form a solid base for flexible analyses from the regional down to the stand level, well in line with the main objectives for the project.

More information: Heureka - Annual Report 2007 and 2008.

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Forest Planning

– Participatory planning and multiple criteria in forest management

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Forestry is something that goes far beyond only growing trees. Interested parties require attention to environmental, recreational, esthetical and game values to name a few. The forester who does not know how to approach planning situations that require participation with stake holders could easily get into a messy situation, where good management alternatives are dumped in the ensuing confrontation. This has motivated an effort to develop methods and instruments for participation and multiple criteria. To understand our research direction we should look at the terms participation, Multiple Criteria Decision Analysis (MCDA) and get a glimpse at two related projects.

Participation is a process whereby stakeholders can exchange information, express opinions and articulate interests and have the potential to influence decisions and resources, which affect them. In a broad sense anyone who is affected by or/and may affect the decision at hand is a stakeholder. The main motives for undertaking participation are to improve solutions, to improve relationships between stakeholders and to make the decision-making process more democratic.

Multiple Criteria Decision Analysis is an approach that can be used in situations with conflicting objectives to evaluate the relative importance of these objectives in an analytical manner. Appropriately used, MCDA can help to structure the decision problem clearly, handle both qualitative and quantitative objectives and create a model that can be a basis for discussion with different stakeholders.

An MCDA process generally includes the following steps:

- Identification of the decision problem
- Develop plan alternatives
- Assessment of the importance of the various objectives and alternatives involved
- An overall ranking of alternatives according to their importance

This process often has to be iterative. Originally developed for single decision-maker situations MCDA is also increasingly used in situations with several decision makers in participatory processes as shown in Figure 1. We then have to add a stakeholder analysis step to the MCDA process.

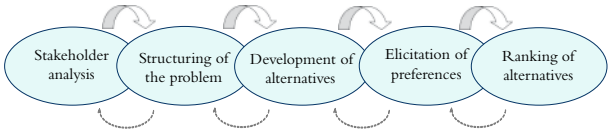

Figure 1. A general model of a participatory MCDA process with five different steps.

In the Lycksele project the overall objective was to produce a multiple-use forest management plan for the 8 000 ha of urban forest around the town of Lycksele, owned by the municipality and a few larger forest owners. The motivation for the project was the need for co-ordination of the forest planning and concern for preserving other values than timber production in the urban forest. The participatory process was designed to follow the general MCDA process model described in Figure 1, in order to incorporate stakeholders' preferences for objectives and different forest plans that were to be created as a part of the process. Stakeholders belonging to four main interest groups were identified: timber production, biodiversity, recreation and reindeer herding. Stakeholder objectives were defined, a map with zones of different general silvicultural treatments was created and three forest management plans computed based on the map. Preferences of the individual stakeholders were elicited and aggregated to produce one common preference ranking of the forest plans. The results were presented to the Steering Committee who adopted the highest ranked plan as multiple-use plan for Lycksele. The plan is now used as a planning tool by the forest owners and a consultation routine has been implemented. The project started in 2006 and finished in 2009 and is an essential part of the doctoral project of Eva-Maria Nordström.

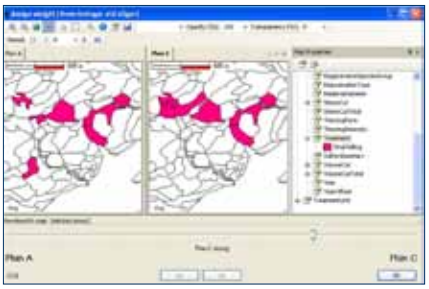

Figure 2. A comparison made in PlanEval between final harvests (red) in two different plans.

The objective of the PlanEval project was to develop and test a software application that enables multi-criteria analysis of plans created in the PlanWise application of the Heureka system (see e.g. Heureka - Annual Report 2008). Thus, it should aid the decision maker(s) to rank the PlanWise plans. The data of the plans can be presented as scalars, diagrams or maps to help the compare plans. Thanks to the courtesy of the manager of the Östad estate PlanEval could be tested on a real forest management planning problem for the 3 000 ha of the estate in South-Western Sweden. Three plans were analyzed by (i) developing a goal hierarchy, (ii) weighting the hierarchy and (iii) evaluating the plans against each of the objectives of the hierarchy. Figure 2 shows examples of a screen shot where final felling areas of two plans are compared. It became quite clear what plan was preferable for the forest owner. The Östad exercise has yielded valuable results for the future development of MCDA related tools. The project was conducted during 2009 and is part of the doctoral project of Anu Hankala.

Text and figures:
Ola Eriksson

Forest Technology
Techniques and systems for boom-corridor thinning in young dense forests

Bioenergy from young forests. The demands for bioenergy are increasing and consequently in Sweden more primarily forest biomasses must be harvested. Fortunately it has been indentified that young dense stands are rich source of biomass and could be harvested for bioenergy purposes. However, conventional harvesting systems suffer from low productivity in such stands and new harvesting techniques and methods are required to significantly increase efficiency. To reach a certain level of productivity the number of handled trees per work time unit must increase as the size of trees decrease (see Figure 1). Consequently, to facilitate a development of more rational harvesting techniques and equipments for young dense stands, geometric (boom-corridor) thinning is preferable to a thinning from below treatment (see Figures 2 and 3).

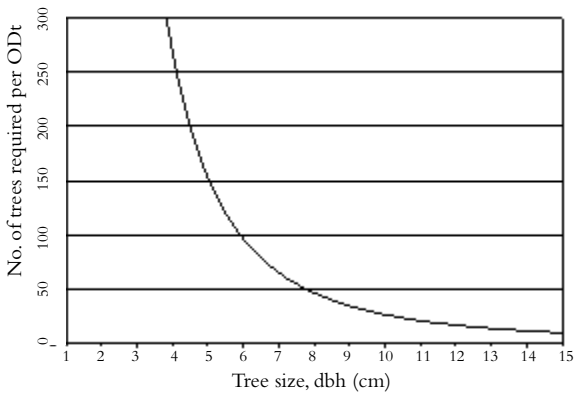

Figure 1. Number of whole trees of different sizes required for one oven-dry tonne (ODt).

To study the effects of boom-corridor thinning on the harvesting productivity a doctoral project titled Techniques and Systems for Harvesting Young Forests were initiated in 2005. The initiators of the project were Professor Tomas Nordfjell at the Department and Professor Urban Bergsten at the Department of Forest Ecology and Management, SLU.

In September 2005 Energy Engineer Dan Bergström was employed for four years of doctoral studies within the project and on the 27th of November 2009 he defended his thesis entitled Techniques and Systems for Boom-Corridor Thinning in Young Dense Forests.

The thesis were based on four individual studies including simulations of geometrical thinning systems and field studies of conventional equipments and prototypes for felling, bunching and compression of small diameter trees. It was concluded that even today it is possible to perform a profitable harvest in certain young stands by conducting boom-corridor thinning and if implementing new techniques specially designed for boom-corridor

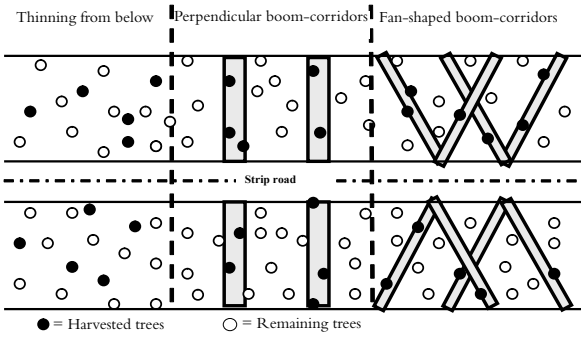

Figure 2. Sketch of possible thinning methods; thinning from below and two boom-corridor thinning patterns between strip roads.

thinning the efficiency can be expected to increase significantly. Such techniques could be commercially available in a near future if development efforts are taken! Further, if equipment for semi-debranching and load compression is implemented in the harvesting operation the removals of nutrients from the stand is reduced at the same time as the fuel quality and transport efficiency are increased. During the project new questions were raised and Dan Bergström hopes that he will have the opportunity to continue doing research for many years about forest bioenergy operations at the Department.

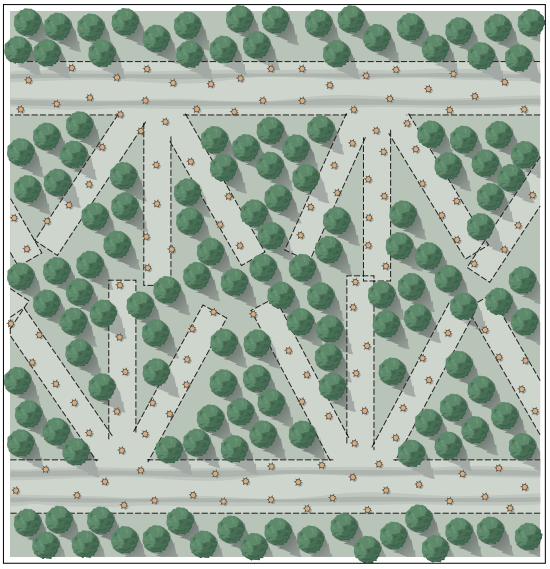

Figure 3. Sketch of fan-shaped boom-corridors between parallell strip roads. Illustration: Per Thorneus, Tidningen Skogen.

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Forest in Rural Studies
Continuous Forest Owner Analysis
- A Swedish database for forest owner analysis

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Background. In Sweden, as in other countries with a growing and increasingly diverse population of forest owners, there is an apparent need for higher quality and more detailed quantitative data to describe and understand present conditions and predict and explain future trends.
Therefore, the project Continuous Forest Owner Analysis, beginning in 2006, has within the competence area Forest in Rural Studies developed a database for forest owner analysis by combining existing forest measurement statistics, gathered on a regular basis since 1992 by the Swedish Forest Agency, with records from individual forest owners.
The database consists of annual interview inquiries on cuttings and silviculture from 1992 to 2008. The interview inquiry form is sent to the registered forest owner. With telephone guidance from a forest ranger at the Swedish Forest Agency, the owner answers the questions and comments on the reported activity for each of their holdings with respect to the previous year. At present data for more than 30 000 Non-Industrial Private Forest (NIPF) owners management units are included in the database. A management unit is made up by one or more holdings owned by the same owner or a group of owners within the same municipality, with a size of 5 to 5 000 ha, owned by a physical or juridical person with less than ten forestry employees, are included in the database. The sample is a stratified simple random sample, stratified by county and area size, from the target population of NIPF management units in Sweden.

The database also contains information about the registered owner's gender and age, whether they are resident within the management unit municipality, the total number of owners and whether any self-activity in harvesting or silviculture has occurred. In addition, area and volume of final felling, cleaning, other cuttings, thinning and scarification, planting, supplementary planting, sowing, fertilization as well as property area are recorded in the database. Information on forest certification has been included since 1999. From 1992 to 1994 the database contains data similar to 1999-2006. However, as the connection between the land registry and the specific answers given by the individual owners is lacking from 1995 to 1998, reported activity cannot be matched to the owner data for that period.

Target population. The size of the target population was on average 199 000 holdings, sample size 2 230 and number of respondents 1 765 for the period 1999 to 2006. On 8-9th of January 2005 the severe storm Gudrun hit the southern part of Sweden, particularly the county of Småland. A great number of NIPF owners witnessed how much of their forest, ready for thinning and final felling, was felled by the storm. This catastrophe is reflected in the large drop in the number of responses from 2004 (53%), the interview inquiry form for reported activity during 2004 being distributed to forest owner's in January 2005. Most likely it has, together with the subsequent storm Per that occurred in January 2007, affected the response rates for 2004, 2005 and 2006, with a response rate of 69% for the period 2004 to 2006, but 85% for 1999-2003.

Applications. As an example of application of the database, an analysis of the extent of forest certification within pairs of owner categories was performed for the years 1999-2006. The categories were self-active or not self-active, male or female and resident or non-resident NIPF owner. The total number of management units analysed was 11 665 of which 1 955 were certified. Certification was found to increase with size of the management unit. This is evident for all examined categories except for female owners, where a somewhat lower degree of certification, 17.8%, was observed in the largest area class (≥1 000 ha) compared to the second largest area class (200-999 ha), 18.5%.
Another application indicates that the degree of management activity for the years 1999-2006 is generally higher on certified management units than on non-certified management units. Final felling was performed on twice as many certified forest properties and planting occurred on three times as many. For thinning the greatest differences were found between certified and non-certified properties. The reasons for the higher activity on certified management units cannot be explained by further analysis of the database. Supplementary questionnaires or interviews addressing the NIPF owner's incentives will be needed to address this question.

The major strengths of this database are that it is based on a well-tested survey design, it is carried out in a similar way every year and it has a high response rate. One reason for the high response rate is the limited numbers of questions, which focus only on work performed. The database can, therefore, be used confidently to establish a baseline which can serve as a point of departure for developing more in-depth research questions and surveys. When interpreting results from analyses using data from this database it must be recognized that the information provided by respondents is only their view of the amount of work, which has been undertaken. Because the information is given during a telephone interview with a local forest ranger it is likely that data reliability is high. In order to determine any such bias, validation studies are to be conducted in the near future to compare the interview data with field data. As indicated by the examples above, a number of comparative studies of ownership trends over time can be examined.
As the Department and the Swedish Forest Agency has come to an agreement on an annual data delivery as from 2009 and by establishing the database, quality data is secured and continuity over time is guaranteed. The database are available, under special stipulations, for use by researchers and other authorities.

Text: Solveig Berg Lejon
Picture: Ola Borin, SLU

International Forestry

- Addressing sustainable resource management and rural livelihoods through institutional support to a Forestry Faculty at Wondo Genet, Ethiopia

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Background. The programme for Institutional support to Wondo Genet College of Forestry and Natural Resources was run through SLU during 1987-2009 with the financial support of Sida. On behalf of SLU, the Department has co-ordinated the collaboration during 2004-2009 with Mats Sandewall as the programme co-ordinator and Anne-Maj Jonsson as chief administrative officer. An additional six personnel from our Department, and around 30 staff representing 13 other Departments within two faculties of SLU, were engaged during the last six years. The programme was one of the biggest Swedish forestry aid programmes through history, costing about 10 million per annum over 23 years. Its completion in March 2009, with a conference attended by the president of Ethiopia, donors, stakeholders and collaborating partners, highlighted the outcomes, obstacles and potentials of such large scale development programmes.

The 7th batch of MSc in Forestry students with Swedish guest lecturers.

The programme. The programme objectives are expressed through the vision of Wondo Genet; to be a centre of excellence in education, research and extension in forestry, and to play a major role in the sustainable management and conservation of natural resources, food security and poverty alleviation within Ethiopia. The input of SLU was through technical assistance in various fields, with a continuous dialogue on transfer of responsibilities to the College, allowing them to sustainably manage the activities. In the final programme period 2004-2009, no expatriates were stationed at Wondo Genet, however, there were three locally employed SLU staff. Technical support was through 173 consultancy weeks, when advisers and lecturers from SLU visited the college for pre-defined assignments.

The main programme components are summarised below:

- **Education.** By successive development of Diploma, Bachelor and Master's programmes in Forestry, Doctoral scholarships and a local Doctoral programme in the planning stage, some 1 600 Diploma students, 1 300 Bachelor students, 150 Master´s students and 25 doctors were graduated during the course of the programme. The initial years of each component included some of the training in Sweden (sandwich model) with a gradual transfer to Ethiopian and local management after some years.
- **Research.** Master´s and doctoral studies dominated research in the country in the past. To make research in tune with local development needs, a poverty- and people-oriented action research programme (DOIT AR) was initiated within the Swedish collaboration. Some 50 local academic staff defined and conducted thematic research projects jointly with local farmers.
- **Doctoral programme.** 25 college staff obtained the doctoral degree in sandwich programmes at SLU and other universities. Their research topics could be grouped into Forest Ecology (13), Forest Management and Wood Science (7), Institutional and Rural Development (4) and Statistics and Design (1). Some 15 of those doctors currently remain as lecturers and researchers at Wondo Genet.
- **Other.** Infrastructure development, like buildings, internet, library, laboratories etc., a guesthouse and complementary income generation capacity through sawmill and plantation management, have substantially increased the capacity to receive students, researchers and visitors.

Wondo Genet researchers testing maize crop varieties jointly with farmers.

Aims and achievements. The programme aim can be seen in three levels; 1) Training individuals, 2) Building institutional capacity in training professionals who can form a critical mass influencing forest policy and management in Ethiopia and 3) Contribute to actual development of society and natural resources. The first-level achievements can be most easily evaluated. The second level is more complex. Our impact is through educational programmes and capacity building, local and international networks, college infrastructure and a change of mindset and visions among staff. As for the third level, forest and societal development in Ethiopia in recent years have been problematic. On the other hand thousands of foresters trained at Wondo Genet have filtered into society and should make positive change when bits, pieces and politics are in place. For SLU the co-operation has generated experiences and contacts among hundreds of university staff in different countries. We, including Wondo Genet, have established a platform for change. Can we make use of it?

Text and pictures:
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Environmental Monitoring and Assessment

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Vice Head
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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 and assessment. 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 Habitats Directive via the programmes National Inventory of Landscapes in Sweden and the project Terrestrial Habitat Monitoring. 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 environmental monitoring 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 programmes and projects 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 the environmental monitoring activities provide a unique and valuable source of information for different research projects. The connection between environmental monitoring and assessment and undergraduate and Master's studies is important, as it spreads knowledge about these activities and the basis of information used to make decisions about the sustainable use of the country's natural resources.

The Department's environmental monitoring 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 participating in conferences and national and international networks and projects.

Text: Mats Nilsson
Picture: Åsa Gallegos Torell

National Forest Inventory

County-Wise Monitoring of Forest Environmental Quality

- An example of how data from the NFI can be used in long time-series to study changes in different indicators of bio-diversity in the forest landscape

Data from the National Forest Inventory (NFI) can be used, by for example county councils, as a cost effective resource in the monitoring of environmental quality and forest status. During 2009, the NFI has been working under contract for a consortium of Swedish county councils within Norrland along with Dalarna, Värmland, Örebro and Västmanland to create an information resource for the evaluation of their forestland and surrounding areas. The time-series studied were primarily from 1983-2008, but for certain variables older material has also been used. For more recently introduced variables in the NFI the time-series were shorter. The most recent five year period (2004-2008) will also form a reference period for future studies of environmental quality.

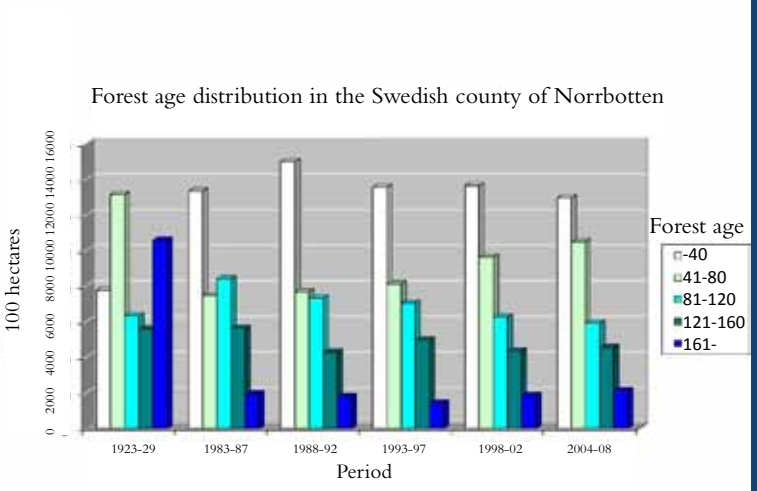
Since 2003 the NFI has also collected data from within protected areas such as National parks and Nature reserves, which are protected from active forestry. This allowed NFI to even present data about forests, which are not impacted by forestry or other exploitation. However, in order to be able to compare longer time-series during which time new protected areas have been formed, all areas within the protected areas for the year 2008 were removed.

In co-operation with representatives from each country council a detailed project plan was created during the spring of 2009, the NFI compiled and analyzed data during the summer and autumn and the final results were presented in December 2009. Data delivery was in the form of tables and figures illustrating both current status and temporal changes in the forests of the respective county. The numeric and illustrative data were also complimented by a written report with conclusions and information about uncertainty levels for the results.

Amongst the 19 environmental quality variables included in the analysis were:

- Area of old forest, according to the governments environmental objectives
- Volume of dead wood per hectare
- Standing volume of Aspen, Rowan and Goat willow
- Area of forest land within 0.5 or 1km from a navigable road
- Area of forest with high recreational value

A follow up study in five years is planned using NFI material for the period 2009-2013. This follow up will also include calculation of the uncertainty in any eventual temporal changes to help give a picture of the confidence level in observed changes.



Change in forest age distribution for the Swedish county of Norrbotten, 1920 to date.

The project leader for this contract was Tina Nilsson from Norrbotten's county council. Many of the results from this study will be available via respective county council's homepages. At the NFI, compilation, analysis and presentation has been carried out by Göran Kempe with assistance from Jonas Dahlgren. During 2010 the NFI will continue to provide support to the county councils in summarizing the work and making it available on their homepages.

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Text: Göran Kempe
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National Inventory of Landscapes in Sweden
NILS Data Management - NIDa

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The programme also uses other employees within the Department´s competence areas and environmental monitoring programmes.

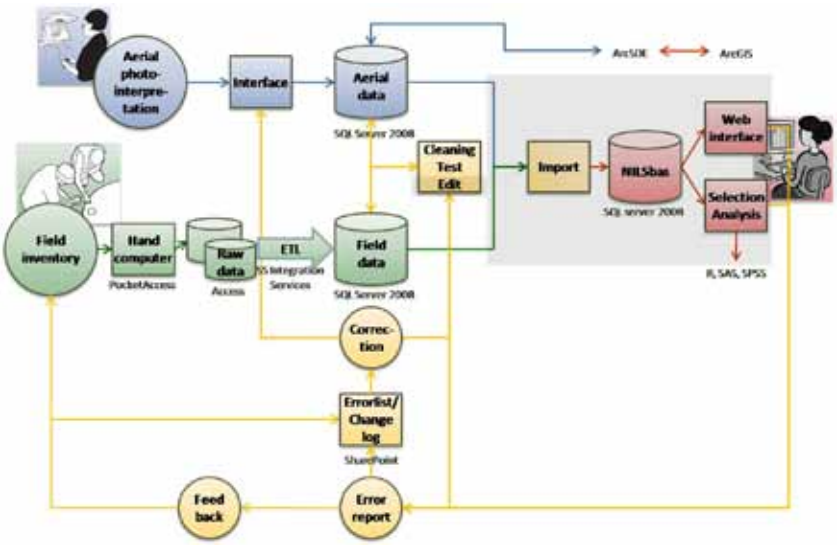
Background. The National Inventory of Landscapes in Sweden (NILS) is collecting data that are of interest for a wide range of users, both among academic and non-academic organizations. To be able to provide data of good quality, timely and in an easy accessible form, data management structures, processes and routines are of high importance.

The main objectives in the NIDa project are:

1. To provide structures and routines for NILS data collection and input to ensure good and robust data quality
2. To build a functional database structure for maintaining and storing of NILS data and metadata
3. To develop an application for data analysis, including feedback and data refinement processes
4. To establish an external web application for publication and export of data and results to all users

Present activities. Besides further improvement of data quality assurance during 2010, the project now focuses on developing and implementing a database design that is functional and robust. The main NILS data warehouse (NILSbas) will integrate data from aerial photo-interpretation and field inventory, including necessary metadata and other information. Eventually, NILSbas will not only cover the basic activities in NILS, but also data from other projects that use the NILS infrastructure.

Future plans. An application for data analysis will be built during 2011. The application will support the performance of standard calculations, which include, i.e. estimates of areas and proportions of various variables, landscape indices and assessments of temporal changes in measured parameters.



Conceptual chart of the system architecture in NILS. Parts that are not implemented at present are shaded in grey. Two separate databases are used for editing collected data from aerial photo-interpretation (blue) and field inventory (green), whereas NILSbas will be the base for data selection and analysis (red). Data quality is assured in several steps (yellow).

The project group consists of system developers, staff responsible for data collection and input (field inventory and aerial photo-interpretation) and analysts: Pernilla Christensen, Åsa Eriksson, Åsa Gallegos Torell, Sofia Jonsson, Peter Krooks, Liselott Marklund, Anders Pettersson, Johan Tegman and Joakim Åström. The project is financed by the Swedish Environmental Protection Agency over a period of five years starting in autumn 2008.

Earlier work. A feasibility study was carried out in 2007. It outlined NILS data management processes that provides the base for our current project work. So far the project has focused on data quality processing. We have implemented routines for correction of invalid data and developed an application for data import from the field inventory, including tests on data completeness and consistency. The application is also used for tests on data from the aerial photo-interpretation.

Finally, in 2012 we plan to implement a web interface. External users will be able to download basic and aggregated data, calculations of state and change estimates with standard errors and metadata. Data output will be possible for a certain geographic region in Sweden or a certain time span.

There is continuous interaction with other environmental and monitoring programmes and projects at the Department such as the National Forest Inventory and Terrestrial Habitat Monitoring.

Further reading. Från datafångst till datavärdskap – Översyn av datahanteringen i Nationell Inventering av Landskapet i Sverige (NILS) 2008. Arbetsrapport, Sveriges lantbruksuniversitet, Institutionen för skogsekonomi, vol. 208.

Text and figure:
Saskia Sandring

Terrestrial Habitat Monitoring

The main objective of the environmental monitoring project Terrestrial Habitat Monitoring (THUF) is to build a national monitoring system for estimating the distribution and assess the conservation status of terrestrial habitats. The project that was started in 2008 is financed by the Swedish Environmental Protection Agency and 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 EU legislation to halt the ongoing biodiversity loss.

The THUF project is organized in two parts. First – in order to assess information on distribution and status of the most abundant habitat types throughout the Swedish landscapes, the project will make use of the two ongoing national environmental monitoring programmes: the National Inventory of Landscapes in Sweden (NILS) and the National Forest Inventory (NFI). The 2009 field season is the second season that all sampled field plots in NILS and NFI have been categorized as whether or not belonging to any of the habitat types that are listed in the Habitats Directive. Second – in order to get enough data from less abundant habitat types that only in minor extent will be found within NILS and NFI, the project has designed pre-stratified sampling methods by combining interpretation of aerial infra-red photos followed by a field survey.

The THUF project will provide data from less common habitats, as for Swedish broadleaved forests.

Pre-stratification sampling design. During the first three months in 2009 interpreters, using a point-grid design with 101 points, interpreted a total of 5 900 points within the 2009 selection of areas to be field surveyed in NILS. All points, which correspond to circular plots with ten meter radius, were classified into general habitat categories. Depending on the abundance of categories including interesting habitat types 717 plots were selected for the following field survey. Field assessment was conducted in collaboration with the NILS programme.

The random sampling method using the point-grid design will not allow to assess habitats that follow linear structures with enough accuracy. Especially for habitats that are connected to seashores, a line-intersect sampling design for the interpretation of aerial photos will be used. During the autumn of 2009, the first test of the line-intersect methodology was conducted. Four areas (two in Southern and two in Northern Sweden) were interpreted and thereafter followed by field surveys.

Training the use of moss-species as indicators for specific habitats

Life+ project. In August 2009 a positive answer was received on the application to the European Commission's Life+ programme for the project Demonstration of an Integrated North-European System for Monitoring Terrestrial Habitats (MOTH). The project that will operate during 2010-2014 has a total budget of 4.8 million € and is co-financed by the Swedish Environmental Protection Agency. 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 with the use of stratified sampling methods, as described above.

Habitats workshop. During 7-9 July a workshop in Persåsen in the Swedish county of Jämtland was organized. The objectives of the workshop were to promote the information exchange between different projects and organizations working with the implementation of the Habitats Directive, to study and discuss different habitat classification problems, and to compare and evaluate conservation status in different habitat types. The workshop was arranged as a number of field excursions where different case studies were examined. A total of 26 participants attended the workshop, most of them from Sweden (the Department, the Swedish Environmental Protection Agency, the Swedish Species Center and the counties of Jämtland and Västerbotten), but also from Denmark, Latvia, the European Topic Center in Paris and the European Commission Directorate-General for the Environment in Brussels.

Evaluation of protected areas. During the autumn 2009 an additional project, financed by the Swedish Environmental Protection Agency, was performed. The aim of the project was to test whether field methods used in THUF could be used to evaluate a selection of previously classified forested habitat types within protected areas.

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Staff
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The project also uses other employees within the Department´s competence areas and environmental monitoring programmes.

Text: Åsa Hagner
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Publications

The publication list below includes work that was published during 2009. The publications are presented for each of the Department´s competence areas and environmental monitoring programmes separately. Peer reviewed scientific articles are listed first followed by book chapters, prooceedings and reports. In the end of the publication list, articles in popular science and online publications are listed.

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National Inventory of Landscapes in Sweden

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Field Staff

Every year the Department organizes and implements extensive inventories of forests and landscapes in Sweden. To carry out this work a number of field workers are employed.

National Forest Inventory

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Specific Adapted Monitoring of Forest Damage

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