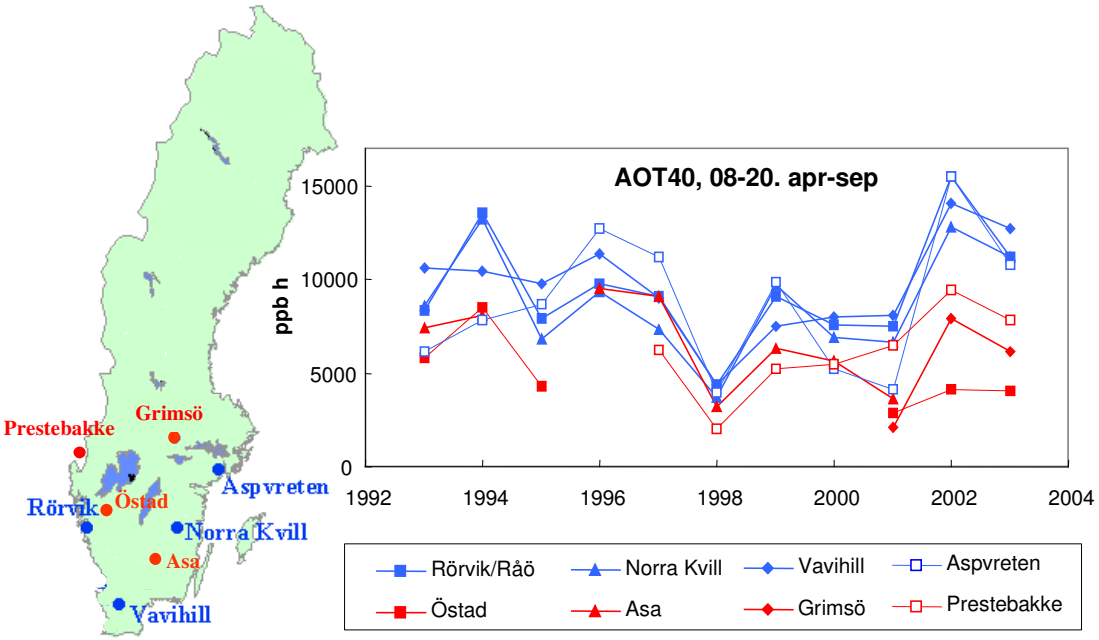
International and National Abatement Strategies for Transboundary Air Pollution

International and National Abatement Strategies for Transboundary Air Pollution

Phase II: 2003-2006

Programme plan for 2006



Comparison of daylight AOT40 at different monitoring sites 1993-2003.

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1 Introduction

The 8 years ASTA research programme on transboundary air pollution will end in 2006. It started in 1999 with the aim to increase basic knowledge and develop new concepts to be applied in the next generation of control strategies. These strategies were expected to be launched and negotiated in 2005-2006. Today, the new strategies are emerging; the EU CAFE strategy was launched in September this year and within the next year, we may see proposals for the revision of the Gothenburg Protocol and the EU NEC Directive. We can now see that much of ASTA's research has influenced the scientific support process, although there are areas where new concepts and results are not fully implemented in the strategies.

ASTA and the ASTA scientists have and are still taking an active part in the process through scientific research and through facilitating communication between science and policy. Resources have to an increasing extent been directed towards application projects and towards communication and implementation of the results. In the context of implementation and communication ASTA has taken a wider responsibility than just communicating results generated within the project. Through workshops and preparations of assessments and "background documents" ASTA has significantly contributed to the general understanding and consensus-building within Europe. The communication has always been made in the context of the needs from European or national policies. The main international customers of the results are the European Commission (CAFE) and the Convention on Long-Range Transboundary Air Pollution (CLRTAP).

ASTA has through its long term commitment become an important actor in the development of European air quality policies. The long term engagements of key scientists have formed a strong position and trust that has positively influenced science-policy interactions. Many of ASTA's scientists are deeply involved in both scientific research and knowledge integration within several of the most important fields of policy; in particular origin and composition of atmospheric aerosols, acidification of soils and water and its recovery, nitrogen effects on ecosystems and biodiversity and ozone effects to forests and crops.

In addition, ASTA is supporting national Swedish actors in the national policy development. In particular the work is done in relation to the Swedish Environmental Objectives and in relation to the development of the forest sector. In addition to the core funding from Mistra, this research has a complementary financial support from the Swedish National Board of Forestry, The Swedish Environmental Agency and the Swedish Energy Agency.

2 Main results during 2005

The most important findings and results during the 2005:

- Further development and international presentation of the ASTA model on biodiversity changes due to environmental impacts (climate factors, nitrogen and acid deposition).
- A CBA analysis of ozone and acidification effects in Sweden.
- The organisation of the workshop on Science - Policy interactions in Göteborg in October.
- The organisation of a workshop on how to include non-technical measures in integrated assessment models and European air pollution strategies in Göteborg in December 2005.
- The publication of the AMBIO Special Issue on Transboundary Air Pollution, AMBIO, Vol. 43, No. 1, 2005.
- A broad participation in the 7th Acid Rain Conference in Prague. ASTA was represented by approximately 30 scientists, of 18 posters, 7 oral presentations and 4 chair persons.

- Active participation and co-organisation of workshops on nitrogen; CLRTAP workshops in Berlin (May) and Brighton (October) and a COST workshop in Braunschweig (November). The Brighton workshop was a joint meeting between the Expert group on Dynamic modelling and biodiversity scientists working on vegetation changes due to N deposition.
- Participation in the organisation of the workshop on ozone effects and the preparation of new concepts for critical levels for ozone in Obergurgl Austria.
- During 2005 has ASTA produced two PhDs: Cecilia Akselsson LTH and Adam Kristiansson LTH.

Table 1 Activities and results from ASTA 2005.

Activity	**Results**
The organisation of a workshop on science-policy relations "Constraints and Prospects for a wider dialogue between scientists, experts, decision-makers and citizens".	Organised in Gothenburg in October 2005.
Investigations of linkages between regional air pollution effects and climate change.	Participation in Task Force of Hemispherical Air pollution. ASTA scientists participate in EU projects with emission projections for SO_2 and NOx, climate change impacts on surface waters.
Investigation of the cost-efficiency of including non-technical measures in air pollution control.	Meta-analysis report and organisation of a workshop in December
CBA analysis of air pollution.	A draft report on acidification.
Evaluation of a dynamic model on biodiversity effects due to S and N deposition.	The model has been presented and discussed at three workshops. Internal presentations and discussions within ASTA.
Taking active part in the Acid Rain Conference in Prague in June 2005.	The ASTA scientists were well represented at the conference. The conference covered: ozone, nitrogen, carbon/nitrogen, acidification, liming, CBA etc. "Acid rain" is a good example of how good science can lead to good policy. A rising demand of hemispheric and global focus was presented.
Plan and prepare background material for a workshop on ecosystem effects of (low dose) nitrogen deposition.	ASTA has been co-authoring the main background document for the Brighton workshop.
Develop scientific and science-policy issues of importance for the air pollution policies after 2006.	Partly postponed to 2006. Partly covered through a contract with Swedish Environmental Protection Agency.
Lead the development of critical limits for ozone impacts on forest trees.	Workshop in Obergurgl in November.
Participation in assessment of results of dynamic model results in Europe.	Collaboration activities with research groups in Europe and North America. The Brighton workshop.
Assessment of current knowledge on the role of nitrogen in acidification of soils and surface waters and possibilities for improvement of dynamic models.	Workshop on Nitrogen Processes and Dynamic Modelling, Brighton 26-27 October 2005. Background document to the workshop "Model chains for assessing impacts of nitrogen on soils, waters and biodiversity: a review."
Participation in the further development of the EMEP model.	Collaboration with MSC-W on model development on particulate and ozone.

Short progress reports of the ASTA activities during 2005 are also given in connection with the description of each activity later in the Programme Plan.

3 Overall objectives and benefits to stakeholders

The overall goals for Phase II of the ASTA programme are:

1. To support the LRTAP Convention, especially the revision of the Gothenburg protocol, with scientific results and analysis tools, evaluations and assessments.
2. To support the CAFE programme of the European Commission, in particular the revision of the National Emissions Ceilings directive (NEC) and the air quality directives/strategies with scientific results, analysis tools, evaluations and assessments.
3. To support national Swedish negotiators and policy makers, active in the CLRTAP and CAFE processes, with appropriate scientific information, tools and assessments for the national strategy.
4. To provide relevant information for the revision of the national Swedish environmental quality objectives, of which is the first is expected to take place in 2003/2004 and possibly a second in approximately 2007.
5. To provide scientific information concerning transboundary air pollution, CLRTAP and CAFE to Swedish societal sectors and organisations (forestry, energy etc), which support the ASTA programme, as well as to make it available to the Swedish community and its citizens in general.
6. To include the interactions between long-range transport of air pollutants and forestry (whole-tree harvesting, wood-ash recycling, compensation fertilisation) in the scientific basis used in national assessments of land-use and forestry alternatives.
7. To improve the general scientific understanding of transboundary air pollution and its effects, and to communicate this to stakeholders and others interested.

3.1 Potential benefits to stakeholders

As already mentioned, the most important activities for ASTA are to support the LRTAP Convention and the CAFE programme of the EU. ASTA will closely follow all the work under these bodies and contribute where appropriate. ASTA will continue to take initiatives to workshops, assessments, improvements of manuals etc. The ASTA board will continuously take decisions on such activities.

The ASTA programme has today activities and competence making it possible to follow and interact with most of the bodies under CLRTAP and EU CAFE. The relations with CLRTAP's different bodies are illustrated in Figure 1. In Table 2, the expected time schedule of CLRTAP and CAFE is put into perspective of the suggested activities of the ASTA programme.

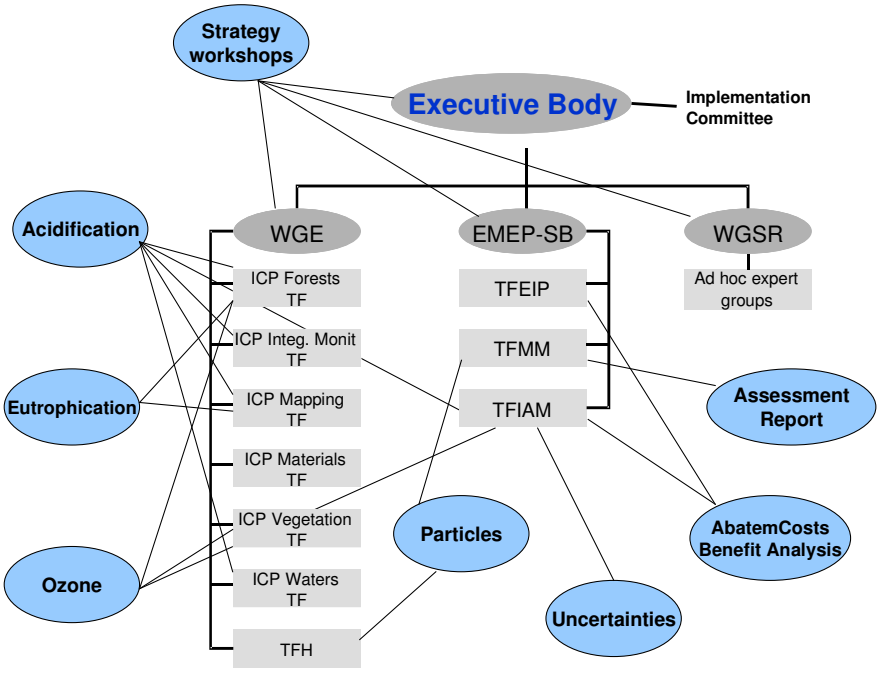

Figure 1 The relations with CLRTAP´s different bodies and ASTA research. ASTA activities are marked in blue. The figure does not contain the Task Force on Hemispheric Transport of Air Pollution established in 2005.

Table 2 Activities within LRTAP and CAFE, and the related activities within the ASTA programme during the period 2005-2007.

Year	Major ASTA activities	LRTAP	EU/CAFE
2005	ASTA conference: "Legitimacy- scientific and social – in air pollution abatement in Europe" (October 2005)	Possible set-up of an expert group on social science as a consequence of the workshop	Thematic strategy of CAFE
	ASTA workshop on effects of nitrogen on vegetation in ecosystems. ASTA workshop on nitrogen dynamics and acidifying impacts of nitrogen deposition (co-organiser of a joint workshop on N in Brighton in October. Active participation in workshops on Nitrogen in Berlin in May and in Braunschweig in November.)	Improved maps on CL for eutrophication and acidification. Inclusion of dynamic aspects on control strategies Improvement of acidification assessment	Improved maps on CL for eutrophication and acidification. Inclusion of dynamic aspects on control strategies
	Workshop on non technical measures	Information on costs and benefits	Info on costs and benefits
	Further development on uncertainties	TFIAM workshop on RAINS methodology	
	Background material on PM emissions and long range transport	Expert group on PM	
2006	Book on effect quantification, critical loads and levels	Negotiations	Processing through the Council and the Parliament
	Final reports of the ASTA programme.	Revision of Gothenburg protocol	
	Further development of new concepts for assessment of effects. Support to the implementation of dynamic aspects in mapping CL in European countries	Inclusion of dynamic aspects in revision of Gothenburg Protocol	Revision of the NEC Directive
2007			Final decision by Council and Parliament

4 Directions for 2006

Since 2006 is the last year of ASTA, several of the activities will be directed towards finishing the programme. The overall budget is decreasing which will give less room for both basic and applied research activities. Since there is a large possibility that ASTA will be followed by new programme supported by the Environmental Protection Agency, it is however important to keep those activities active, that will be core parts of the new programme.

The delays in both the CAFE and the CLRTAP process of a year or more will cause some problems in terms of both research and communication.

Activities 2006:

- Support to organise a JEG (Joint Expert Group) meeting in 2006 to promote and make further use of dynamic models in the work of CLRTAP and CAFE

- Implementation of new parameterisation in the EMEP dynamic particle model. The work has started in 2005 and will continue during 2006.
- Post workshop activities in relation to Obergurgl (Nov 05), WGE workshop on critical levels and revision of the chapter 3 in the Mapping Manual of the LRTAP convention.
- Completion and international reporting of CBA on ozone and acidification.
- Reporting of feature of Non-technical measures (NTM) and their importance in air pollutants reduction applied to two meta-analyses.
- Carry out a feasibility study on a Nordic IAM
- Completed PhD thesis (Martin Letell, Gothenburg University)
- Report on a proposed modelling strategy how Nitrogen should be treated for the purpose of critical loads and target loads calculations.
- A workshop on common issues on Climate Change and Air Quality, Research and Policy. The workshop held in Dublin 9-10 January 2006.
- The ASTA book - to summarise the main results of the ASTA programme in an international context.
- Publish a book on the social science perspective on air pollution.

4.1 Organisation of the work

ASTA Phase II is organised in four interdisciplinary, principal Themes:

Theme 1: Source-effect relationships, indicators and target setting
Theme 2: Realisation, costs and benefits
Theme 3: Uncertainties, transparency and communication
Theme 4: Support to national strategies

A schematic sketch of the ASTA Phase II organisation is presented in Figure 2.

Theme 4:
The research in Theme 4, *Support to national strategies*, is financed by the Swedish National Board of Forestry and The Swedish Energy Agency. The work within this theme is mainly directed through a steering group consisting of main stakeholders of the project and the detailed plans for 2006 are not included in this document. In summary, the research is focussed on national assessments of the impacts of acidification and eutrophication for different scenarios of forestry, deposition, and related issues. A basic tool in this work is the national database of soil properties and land-use developed within the ASTA programme. The database is used for upscaling of e.g. leaching and nitrogen, base cations and carbon. The national programme also includes activities on assessment of ozone impacts on forest growth and particle emissions from bioenergy production.

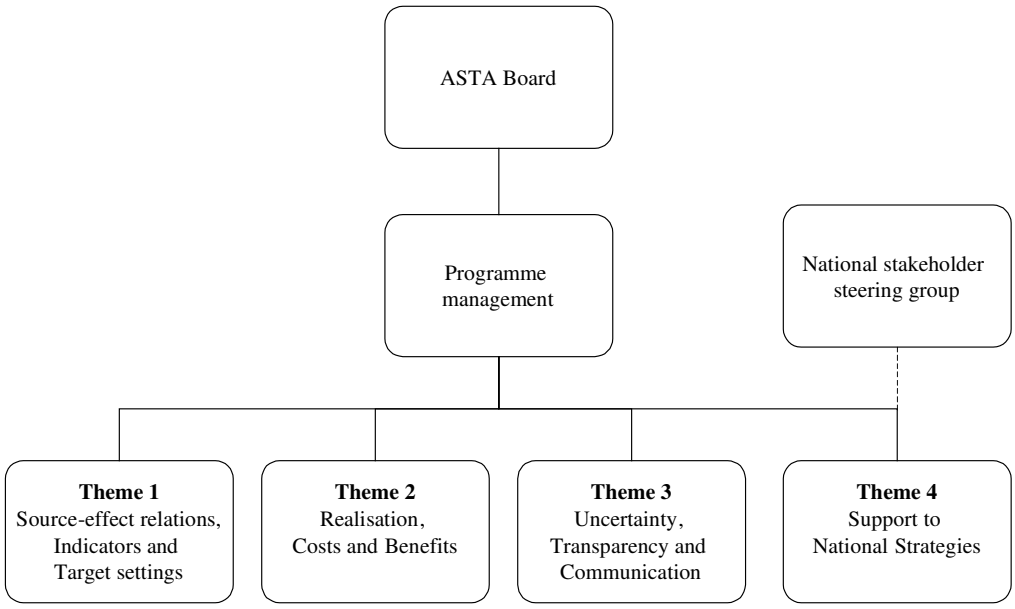

Figure 2 The organisation of ASTA Phase II

4.2 Organisation

ASTA has benefited from a very active and highly qualified board, which to a large part has remained intact over the first phase. This board will largely remain during Phase II. The members of the board are presented in Table 3.

Table 3 ASTA board members.

Function	Name
Chairman of the Board	Lars Lindau
Board Member	Gunnar Hovsenius
Board Member	Anton Eliassen
Board Member	Anna Lundborg (associated)
Board Member	Marie Uhrwing (associated)

Table 4 Management and secretariat.

Function	Name
Programme Director	Peringe Grennfelt
Deputy Programme Director	John Munthe
Co-ordinator Theme 1	Håkan Pleijel
Co-ordinator Theme 2	John Munthe
Co-ordinator Theme 3	Peringe Grennfelt
Co-ordinator Theme 4	Olle Westling
Steering Group Member	Göran Sundqvist
Steering Group Member	Harald Sverdrup
Steering Group Member	Hans Christen Hansson
Steering Group Member	Annika Nordin/Lars Ericson
Programme secretary	Jenny Arnell

5 National and international collaboration

5.1 Scientific collaboration

The scientific groups within ASTA are well established in different European scientific networks, some of them with EU funding. ASTA scientists are also included in the preparatory work for the 7th framework programme.

ASTA has a well developed scientific collaboration with CLRTAP Centres and ongoing international projects. This collaboration includes in particular a close collaboration with the Centre for Integrated Assessment Modelling at IIASA, the Co-ordinating Centres for Effects on implementation of the new concepts on critical loads and levels and MSC-W on ozone and particulates. ASTA scientists also participate in several international projects directly aimed at supporting the policy development. These activities include participation in the ACCENT Network of Excellence directed towards atmospheric chemistry, the EU funded project EUROLIMPACS, directed towards interactions between climate change and aquatic effects from atmospheric deposition. Another project is the NEPAP network with the aim to support the CAFE programme with scientific expertise, which finished in 2005.

On the national scale there are strong links between ASTA and other research activities some of the other MISTRA programmes, some completed, such as MARE, SUFOR, SWECLIM, LUSTRA and RESE, is developed and will be further developed e.g. through an initiative to co-ordinate MISTRA-funded research activities on nitrogen. The well established collaboration with scientist active within the SUFOR programme will continue and result in model tools that in a more appropriate way may be able to support decisions on forest production and environmental policy.

The collaboration with the Swedish research programs, e.g. SNAP, will further increase the value of the research activities on particles.

6 Sub-programmes

The four sub-programmes are described in the overall programme plan for Phase II (found on http://asta.ivl.se).

7 Budget

7.1 Budget for 2006

The budget for 2006, including reserve, and costs for co-ordination and administration is estimated to 5 868 kSEK financed by MISTRA.

Table 4 Proposed budget for 2006 (Co-ordination, administration and reserve are not included)

	Total	**SLU/UU**	**LU Ke**	**IVL**	**GU S**	**GU M**	**ITM**	**LU Kä**
Theme 1								
1.1 Biodiversity	500	200	300					
1.2 Acidification and recovery	100		50	50				
1.3 Ozone Level II	400			275		125		
1.4 Particles	400						200	200
SUM Theme 1	**1400**							
Theme 2								
2.2 Valuation	375			325		50		
2.3 Scenarios and control measures	250			250				
2.4 Feasability study: Nordic IAM	250			250				
SUM Theme 2	**875**							
Theme 3								
3.1 Social science	500				500			
3.2 Uncertainties	250		100	150				
3.3 Communication	560			400			160	
3.4 Global strategies and future issues	300			300				
3.5 ASTA Book	450 (incl 120 to publisher)	45		45	45	150	45	
SUM Theme 3	**2 060**							
Sum per institute (ksek)	**4 335**	**245**	**450**	**2045**	**545**	**325**	**405**	**200**

8 Compilation of Themes and projects under ASTA – Activities during 2006

Theme 1. Source- effect relationships, indicators and target setting

Co-ordinator: Håkan Pleijel

Project 1.1: Models for assessing biodiversity changes in terrestrial ecosystems
Project leader: Annika Nordin (1.1.1) and Harald Sverdrup (1.1.2)
General Objective: To continue to develop and apply quantitative models describing the impacts of nitrogen deposition on vegetation changes in forest ecosystems. Testing and validating the ForSAFE tool for making critical loads for nitrogen, using biodiversity of the ground vegetation as criteria.
Status: Currently used European models for critical load calculations are not relevant to conditions in Sweden and the Nordic countries. Basic work on the development of new empirical and dynamic concepts to describe and predict vegetation changes as a function of nitrogen deposition needs to be continued. The ForSAFE-VEG model has potential to become a useful tool for describing vegetation changes in low- as well as high-deposition ecosystems. Further development of the scientific basis for the development of vegetation based critical loads are needed, both for dynamical models such as ForSAFE-VEG and new empirical models. A prototype of the ForSAFE-VEG model has been applied to 16 Swedish monitoring sites with encouraging results. Further refinement and testing is needed both for model accuracy and application to policies such as critical loads. Remaining questions includes 1) an increased understanding of processes explaining the discrepancy between chemical and biological recovery of ecosystems following decreased nitrogen input, 2) whether ecosystem effects of long-term atmospheric nitrogen deposition differs from those of forest fertilisation and 3) long-term effects of increased ecosystem N input on quality and quantity of berry and mushroom production. In addition a continued influence on European collaborations directing policies concerning nitrogen management and the determination of critical N loads to natural ecosystems is of great importance. Northern Scandinavia has extremely low background N deposition compared to most other parts of Europe. To understand fundamental processes directing nitrogen induced vegetation change studies needs to be performed in such areas.
Stakeholder: WGE and CAFE, Swedish EPA and other national environment authorities.
Acceptance: A large effort needs to be made on gaining acceptance of any new concepts and models for biodiversity predictions in Europe. A large effort aimed at increasing this acceptance was made from this project during 2005 as results of both experimental work and model development were communicated with CAFE and CLRTAP at the ICP Vegetation meeting in Almeria in February, at the 15th CCE Workshop in Berlin in April and at the WGE Workshop on Nitrogen Processes and Dynamic Modelling in Brighton in October.
Organisation: 1.1.1 Annika Nordin, SLU and Lars Ericson, UU. 1.1.2 Harald Sverdrup and Salim Belyazid, Chemical Engineering, Lund University
Co-operation: Cooperation is planned with Center for Ecology and Hydrology in Bangor Wales, Great Britain, Risö National Laboratory, Danmark, IAP and BUWAL, Schweiz, Institute of Forest Research, Mogilså, Iceland
Main deliverables: 1.1.1 Results from low-dose N experiments for publishing in scientific journals. Operable ForSAFE-VEG model, calibrated and tested for Sweden, adapted for other European countries.

Budget 2006:
1.1.1 200 kkr
1.1.2 300 kkr

Activities 2006:

1.1.1 Summarizing results for publication in scientific journals. Low-dose N experiments in the field will be terminated.

1.1.2 Refinement and testing of ForSAFE-Veg including:

- Completion of generationship from SAFE to ForSAFE-VEG.
- Inclusion of MAKEDEP components.
- Re-design of the ground vegetation growth module with respect to the nitrogen and carbon cycle, necessitated from testing results
- Include the simple phosphorus module as designed Inclusion of the designed wind-effect module

Project 1.2: Finalisation of dynamic model concepts including output description, links to RAINS and comparability with presently used critical load concepts for soils and freshwater.
Project leader: Filip Moldan (IVL); Mattias Alveteg (LTH)
General Objective: To review results from dynamic model assessment of recovery from acidification, critical loads and target loads in Sweden and to harmonise the interpretation of the results with other European countries.
Status: During 2005, results of dynamic models were reported to CCE (CLRTAP-WGE). These will be published in a CCE report late in 2005. Work has been initiated during 2005 to assess the Swedish results in comparison to other countries with respect to fresh waters. Methods to include dynamical modelling results in RAINS have been proposed (i.e. Target Load Functions) but this work has not been completed.
Stakeholder: CLRTAP-WGE, CAFE and national authorities
Acceptance: Dynamic models for acidification and recovery are well established in the CLRTAP community. Methods to include the results in RAINS have not yet been finalised.
Organisation: Co-operation between IVL Göteborg (Filip Moldan, Veronika Kronnäs, John Munthe, Cecilia Akselsson) and LTH (Mattias Alveteg, Harald Sverdrup)
Co-operation: Joint Expert Group on Dynamic Modelling (JEG), IIASA, CCE, ICP forest, ICP Waters, National Agencies, NIVA, CEH, Univ. of Virginia
Main deliverables: Assessment of dynamic modelling of acidification and recovery in Sweden, JEG meeting report 2006. Report on inclusion of dynamic modelling results in RAINS.
Budget 2006: 100 ksek (IVL 50 kSEK, Chemeng 50 kSEK)
Activities 2006: Support to organise JEG meeting in 2006 to promote and make further use of dynamic models in the work of CLRTAP and CAFE. Co-operation with IIASA on inclusion of dynamical modelling results in RAINS.

Project 1.3: Ozone
Project leader: Håkan Pleijel and Per Erik Karlsson
General Objective: To finalise the development of flux-response relationships for crops and forest trees and the derivation of critical levels from these. To actively support the implementation of the new critical levels for ozone in the Mapping Manual of the LRTAP convention and in negotiations on a European level.
Status: The workshop in Obergurgl, November 2005, will set the agenda the finalisation of methods during 2006.
Stakeholder: WGE CCE, ICP Vegetation, ICP Forests, ICP Mapping and modelling, EU CAFE programme
Acceptance: The flux-based approach is accepted for some crops but will need further refinement for trees. Consideration of application in IAM needed for both receptors.
Organisation: IVL and GU
Co-operation: Botan, SLU Asa, Karlstad University, and certain other research groups in several European countries, which contribute data to the European scale analyses performed within ASTA for crops and forest trees
Budget 2006: 400 kSEK (125 GU, 275 IVL)
Activities 2006: 1.3.1 Contribution to assessment of ozone impact and critical levels for forests and crops on a European scale. Post workshop activities in relation to Obergurgl (November 2005) WGE workshop on critical levels (Karlsson and Pleijel, chair persons for working groups in the workshop). New text (forest) and revision of existing (crops) text for the chapter 3 in the Mapping Manual of the LRTAP convention. The aim is to change the flux-response relation of ozone effects on forests from temporary to permanent. Publication in the scientific literature of methods included in the Mapping Manual for forests and crops. This includes flux-response relationships for quality aspects of crop yield.

Project 1.4. Source-receptor relationships for long range transported particles
Project leader: H-C Hansson
General Objective: To establish the primary reference on physical and chemical particle characteristics, its dependence of origin and atmospheric processes in background air over N Europe to support model development and health risk assessment.
Status: Regional monitoring of particles is today limited to some integrated parameters (e.g. PM10). Present European dispersion models do not compare well with measured PM10. Model development needs therefore a more detailed description of particle size and chemical composition and their variation in time and space. ASTA has facilitated and supported such measurements performed within a Nordic network of background super sites. This network has now been further extended into a European network in an EU infrastructure project, EUSAAR. The collaboration between the modelling and monitoring communities has resulted in a validated description of the natural contribution of particles and organic compounds from the boreal forest and its interaction with anthropogenic particles in the atmosphere. Basic understanding and model description has been obtained for natural emissions giving the natural aerosol over the Nordic region. This is compared with the measured polluted aerosol giving a possibility to calculate the effect on the atmosphere, the climate and human health. The model is also found to well describe the ageing of the anthropogenic aerosol.
Stakeholder: EMEP: TFMM, MSC-W, CCC and Swedish EPA.
Acceptance: Health effects caused by particles are a main topic for the EU CAFE programme. There is also a need for a better description of the atmospheric processes governing the transport and deposition of acidifying and eutrophying compounds and acquiring a good description on the organic aerosol . There is a large political interest for a co-ordinated European policy.
Organisation: ITM and Lund University
Co-operation: Norwegian Meteorological Institute (MSC-W), Norwegian Institute for Air Research (NILU), University of Helsinki, Gothenburg University and Finnish Meteorological Institute.
Main deliverables 2006: Evaluation of the effect on regional climate by anthropogenic particles. A validated description of the organic aerosol Implementation of the validated process models into the EMEP model. A first evaluation of how particle mass measurements are effected by its water content.
Budget 2006: 400 kkr (ITM 200, LuKF 200).

Activities 2006:

1.4.2 *Cloud – Particle interaction*. Complete the research on the influence from the clouds on the particle transformation and deposition. This is important for the dynamic model within EMEP. This work will be in co-operation especially with FMI and University of Helsinki with support of NMR and the BACCI Nordic Center of Excellence, (BACCI: Research Unit on Biosphere - Aerosol - Cloud - Climate Interactions).

1.4.3 *Evaluation of the impact on regional climate by changing anthropogenic emissions.* Calculations will be done on how much the climate forcing is due to anthropogenic aerosols over the Nordic area. This is to estimate whether regulations of the emissions of particles and their precursors will have an possible effect on the climate change in the region.

1.4.4 *Implementation of new parameterisation in the EMEP dynamic model.* Within the framework of NORPAC, a NMR project, the updating of the dynamic EMEP particle model have started during 2005 and will continue during 2006. This work will be done in close cooperation with MSC-W and University of Helsinki.

1.4.3. *Continuation of measurements of EC and further evaluation of different analytical techniques.* Within NORPAC a common network for measuring EC is set up both for urban and regional sites to determine the emission factors of EC as well as to establish an quantitative description of how different atmospheric processes affect the EC concentrations.

Theme 2. Realisation, costs and benefits

Co-ordinator: John Munthe

Project 2.2: Valuation of effects
Project leader: Mohammed Belhaj
General Objective: To evaluate economic and other benefits for ecosystems etc. of additional control measures for air pollutants in relation to the control costs.
Status: Cost Benefit Analysis has become a more widely used tool for assessment within the environmental field, both international as well as national. Knowledge on how to value biologic diversity and how to incorporate the dynamic processes are still underdeveloped. CBA for air pollutants is currently on-going within CAFE. The work in ASTA has focussed on valuation of damage caused by acidification and ozone. The work on acidification is near completion and will be reported early 2006. For ozone, sufficient data has not been available until recently but this work is also expected to be completed during the first half of 2006. After completion, efforts are needed to ensure the acceptance of these results within CAFE and CLRTAP.
Stakeholder: WGE, WGS, CAFE and Swedish Environmental Protection Agency.
Acceptance: CBA is a required component of development of new directives in the EU. Although CBAs for health effects associated with particles in air are the main focus of the economic evaluations in CAFE, updated CBAs for ozone damage on crops and effects of acidification are highly relevant to the CLRTAP and not least for conditions in Sweden. Policies dealing with these pollutant impacts need updating. Updated and scientifically accepted CBAs are a necessary input to this process.
Organisation: Mohammed Belhaj, Stefan Åström, Catarina Sternhufvud, Per-Erik Karlsson Helena Danielsson, IVL Håkan Pleijel, GU,
Co-operation: IIASA, Swedish Environmental Protection Agency
Main deliverables: CBA ozone at EU level. CBA acidification at EU level For both topics, IVL reports will be prepared. Furthermore, the results and methodology will be summarised and submitted to an international journal. Presentations will also be made at relevant workshops within CAFE and CLRTAP.
Budget 2006: 375 kkr (325 kkr IVL, 50 kkr GU M)
Activities 2006: Completion and international reporting CBA ozone. Completion and international reporting CBA acidification

Project 2.3: Scenarios and non-technical measures
Project leader: Catarina Sternhufvud
General Objective: To support the validation process of the data used in CAFE and CLRTAP, by evaluating the possibilities to include Non-technical measures in IAMs.
Status: During 2006 the project on Non-technical measures, which includes theoretical analysis, meta-analysis and arrangement of an international workshop on NTM will be finalised.
Stakeholder: WGS, CAFE, TFIAM, Swedish EPA
Acceptance: The use of non-technical measures in integrated assessment models is gradually becoming accepted as an important means for reduction of transboundary air pollution. The importance of including these measures into IAMs is also understood.
Organisation: IVL, Swedish EPA
Co-operation: Swedish EPA, IIASA
Main deliverables: Project report: The feature of Non- technical measures and their importance in air pollutants reduction applied to two meta-analyses. Workshop report: Workshop on the importance of Non-Technical Measures for reductions in emissions of air pollutants and how to consider them in Integrated Assessment Modelling;
Budget 2006: 250 kkr
Activities 2006: Finalisation of the project on Non-technical measures, which includes one project report and one workshop report - see main deliverables.

Project 2.4: Feasability study for a Nordic Integrated Assessment Model
Project leader: Catarina Sternhufvud
General Objective: To analyse the benefits, possibilities and main obstacles of developing a Nordic Integrated Assessment Model for transboundary air pollutants and their impacts.
Status: During the course of the ASTA project, the potential benefits of developing an IAM for national and Nordic application have been discussed. The main areas of benefit are more geographically resolved presentation of impacts and emissions, better control over data and scenarios used in optimisation (e.g. cost curves), better possibilities to include alternative measures such as NTMs and a possibility to link air pollution measures with e.g. climate gas emission policies.
Stakeholder: Swedish EPA, Nordic countries EPA WGS, CAFE, TFIAM,
Acceptance: Validation of the RAINS data is essential for the credibility of their use. The use of non-technical measures in integrated assessment models is slowly becoming accepted for reduction of transboundary air pollution.
Organisation: IVL, Swedish EPA
Co-operation: Swedish EPA, Other Nordic countries via NMR projects and direct contacts, IIASA,
Main deliverables: Report: A Nordic IAM - feasability study.
Budget 2006: 250 kkr
Activities 2006: Carry out a feasibility study on a Nordic IAM including the following steps: - Stakeholder interactions aimed at establishing potential usefulness and relevance of a Nordic IAM for development of future air pollution and climate policies. Includes contacts with Nordic authorities and researchers. - Assessment of data availability. Assessment of data availability on emissions, control options and cost curves, atmospheric transport and deposition, impacts. - Identifications of limitations. What can be achieved in a Nordic cooperation over 3-5 years?

Theme 3. Uncertainties, transparency and communication

Co-ordinator: Peringe Grennfelt

Project 3.1: Scientific credibility in a complex society
Project leader: Göran Sundqvist
General Objective: To evaluate the influence of scientific credibility on the process of international agreements on emission control and contribute to an improved understanding of robust science-policy interactions on transboundary air pollution.
Status: Focus on the science-policy relations within the future revision of the Gothenburg protocol and EU directives for transboundary air pollution.
Stakeholder: The scientific community involved in the LRTAP and EU work.
Acceptance: Knowledge on how science interacts with policy is still underdeveloped. With the introduction of new concepts and models in the international regulation it is of great importance to gain knowledge on how science and policy interact, communicate and influence each other. Stakeholders have demanded an assessment of uncertainties in the revision of the Gothenburg protocol and the NEC directive. EU is requiring more transparency in the work of expertise in order to increase the credibility of expert knowledge. A close collaboration between the social science and the natural science expertise in ASTA may facilitate further interactions between science and policy in CLRTAP and CAFE communities. This was also the conclusion made at the international workshop on science-policy interactions organized by ASTA in October 2005.
Organisation: Göteborg University (Göran Sundqvist, Martin Letell, Rolf Lidskog), IVL (Peringe Grennfelt)
Co-operation: Social scientists at Boston University, University of New Hampshire, Edinburgh University, Linköping University (the book project below)
Main deliverables: An edited book on science-policy interactions (in the field of transboundary air pollution and comparisons to climate change) (Lidskog & Sundqvist) Completed PhD thesis (Martin Letell)
Budget 2006: 500 kkr
Activities 2006: **3.1.1** Chapter in the ASTA book “European Air in Science and Policy” **3.1.2** Completed PhD thesis **3.1.3** An edited book on science-policy interactions

Project 3.2 Future directions in nitrogen modelling

Project leader: Filip Moldan and Salim Belyazid

General Objective:
Continue work on how the future impact of nitrogen deposition should be best modelled in order to provide an assessment of recovery from acidification, and in general impacts of nitrogen deposition.

Develop a concept for estimation of critical loads for nitrogen, considering feedbacks from land management, climate change, natural events and grazing, based on biodiversity criteria and aspects of the nutrient and carbon cycling process.

Status:
Effects of nitrogen have been identified as one of the main areas of uncertainty within the effects community of CLRTAP. This is partly due to a lack of understanding of some basic processes in the biogeocghemistry of nitrogen, but also due to a lack of new, accepted concepts for critical loads based on responses in vegetation. At the Workshop on dynamic modelling of nitrogen held in Brighton, UK, in October 2005, several possibilities and areas for future research were identified.

Stakeholder: CLRTAP-WGE, CAFE Swedish EPA and national authorities

Acceptance: The problem of inadequate modelling of the effects of nitrogen is recognised and no general solution has been accepted. ForSAFE-VEG has been presented and discussed at various international workshops and is gaining acceptance as one of the more promising model structures for modelling nitrogen (and nutrient) cycling and vegetation response. Nitrogen cycling also has a large influence on acidification and recovery. There is a need to evaluate how these aspects are treated in acidification models and critical load assessments.

Organisation: Salim Belyazid, Harald Sverdrup, Chemical Engineering, Lund University
Filip Moldan, Sofie Hellsten, Cecilia Akselsson, IVL

Co-operation:
Center for Ecology and Hydrology in Bangor, Great Britain, Joint Expert Group on Dynamic Modelling (JEG), National Agencies, NIVA, Univ. of Virginia IAP and BUWAL, Schweiz

Main deliverables:
Report on a proposed modelling strategy how N should be treated for the purpose of critical loads and target loads calculations.

Draft version of a ForSAFE-VEG-based concept for critical loads

Budget 2006:
3.2.1 100 kSEK (LTH)
3.2.1 150 kSEK (IVL)

Activities 2006:
- Literature review on nitrogen dynamics and modelling approaches.
- Development of principal design of a ForSAFE-VEG based critical load concept.
- Basic outline of criteria handling and input data
- Basic CLMachine prototype
- Testing and iteration
- Participation at JEG meeting, modelling of effects of N using experimental data from Gårdsjön.

Project 3.3: Communication
Project leader: Peringe Grennfelt
General Objective: Ensure a customer-oriented and timely communication between ASTA and policy-relevant bodies and communities under CLRTAP, EU and other international organisations.
Status: The success of ASTA in terms of policy support depends strongly on the ability to customise and deliver the scientific material on time. Continued need for material even after IAM and strategy development purposes. ASTA has a strong interaction with the various bodies under CLRTAP and will be able to support several on-going activities within CLRTAP and CAFE.
Stakeholder: All bodies under CLRTAP, EU organisations, industrial organisations, NGOs, Politicians
Acceptance: Many stakeholders, policy makers and the general public do not consider transboundary air pollution as a remaining environmental problem.
Organisation: IVL and to some extent all the participants in the programme
Co-operation: The MISTRA secretariat, Swedish Environmental Protection Agency, UNECE secretariat, Nordic Council of Ministers, EU CAFE etc.
Budget 2006: 400 kkr (3.3.4), 160 kkr (3.3.7)
Activities 2006: There will be a continuously strong focus on communication of results and discussions with stakeholders and responsible organisations during 2006. 3.3.4 ASTA Annual report and the ASTA website. Production and distribution of the annual presentation of the research results within ASTA in the annual report. Continued presentation of up to date information is presented at the ASTA website, the website is also used as a platform for spreading information both within the ASTA research group and for example material to workshops etc. The ASTA website is found on http://asta.ivl.se/ 3.3.7 Workshop on common issues on Climate Change and Air Quality, Research and Policy. This workshop is arranged in cooperation with ACCENT, A FP6 Network of Excellence, in Dublin 9-10 January 2006. The objective is to produce an authoritative statement on the future direction of policy-research development in the field of Aerosol Impacts on Air Quality & Climate Change See also project 3.5 The ASTA Book

Project 3.4 Overall development and evaluation of regional air pollution strategies

Project leader: Peringe Grennfelt

Objective: Support the overall scientific work on strategies for regional air pollution.

Status: The upcoming strategies will contain several improvements in all compartment models and databases. There is a need to closely follow and evaluate the new concepts and models in terms of their scientific basis as well as in their ability to give results that are in accordance with the overall expectations. This activity aims to take a global view on all aspects of importance for the IAM strategies.

During 2005 activities have been focused on the following activities

a) Intercontinental transport of air pollution. We have followed the establishment of the Task Force on Hemispheric Transport of Air Pollution and made oral contributions to the TF meeting in Brussels in June and at a seminar in Tokyo in August.
b) Uncertainties and improvements in science policy interactions: Participation and chair of the TFIAM workshop on RAINS modelling in January 2005; participation in the organisation etc. of the science - policy workshop in Göteborg in October 2005.
c) Evaluation of key elements in science - policy interactions based on experiences from ASTA and NEPAP (Urbino Conference Sept; seminar at Mistra Sept.)
d) Participation in scientific organisation of the Prague Acid Rain Conference.
e) Participation in the establishment of COST729 (nitrogen).

Stakeholder: CLRTAP, EU CAFE, National experts, Industry, Scientific community TFIAM

Acceptance: The acceptance of the chosen concepts and model approaches will very much depend on evaluations and assessments (E&A) of IAM compartments as well as the overall IAM. This project aim to support the E&A process.

Organisation: IVL

Co-operation: IIASA, NEPAP network, CLRTAP, CAFE

Budget 2006: 300 kkr

Activities 2006:

3.4.1 Future issues

Future issues such as globalisation is of great importance. The outcome of the Göteborg workshops pointed to some areas of particular concern for the future. These include the expansion of the regional air pollution issues to a hemispheric scale (TFHTAP) and a more holistic approach to nitrogen. Some European initiatives are under development (EU research proposal; COST activities) and this activity aims to make sure that ASTA scientists and research will be part of these activities.

We will give priority to the following activities:

- Further development of activities under COST729. Of particular importance is the establishment of policy-relevant issues and synthesis activities.
- Investigation of the possibility of a more coordinated collaboration on research activities on transboundary air pollution effects (e.g. through an ERA project).
- Follow the work under TFIAM, in particular the further development of uncertainties in the RAINS model.
- Follow and investigate possibilities for national activities in relation to TFHTAP
- Initiate the development of background documents for Saltsjöbaden 3.

Project 3.5: The ASTA book
Project leader: Peringe Grennfelt/Håkan Pleijel
General Objective: To summarise the main results of the ASTA programme in an international context in a book for the international market.
Status: A draft list of contents is available.
Stakeholder: The book will prepared in a format suitable for both students at University level and for interested individuals in authorities, agencies and science.
Acceptance:
Organisation: The work will be led by Håkan Pleijel and a group of chapter editors with main responsibilities for the chapters. All ASTA scientists will contribute to the chapters.
Co-operation: The book will be published by "Studentlitteratur".
Budget 2006: 450 kkr (45 kkr each to IVL, GU S, ITM, SLU; 150 to GU M, 120 for guaranteed purchase of books from publishers).
Activities 2006:. Time table: December 2005 – Agreement with publisher on contents and time plan April 2006 – Main writing completed April-September 2006 – Chapter editing (mainly by Publisher) November 2006 – Printing December 2006 – Book available A draft list of contents is available and currently under discussion.

9 Abbreviations

ASTA	International and National Abatement Strategies for Transboundary Air Pollution
BACCI	Nordic Centre of Excellence, Biosphere - Aerosol - Cloud - Climate Interactions
CAFE	Clean Air For Europe (EU)
CCE	Coordination Centre For Effects (CLRTAP)
CCC	Chemical Coordination Centre (CLRTAP)
CLRTAP	Convention on Long-Range Transboundary Air Pollution
EMEP	Cooperative programme for monitoring and evaluation of the long range transmission of air pollutants in Europe (CLRTAP)
HEUREKA	MISTRA Programme
IAM	Integrated Assessment Modelling
ICP	Integrated Cooperative Program. Vegetation, Crops, Forests etc (CLRTAP)
IIASA	International Institute for Systems Analysis
JEG	Joint Expert Group
LUSTRA	Land Use Strategies for Reducing Greenhouse Gas Emissions (Mistra)
MSC-W	Meteorological Synthesising Centre West (CLRTAP)
NEC	National Emissions Ceilings
NGOs	Non-Governmental Organisations
NORPAC	Validated models describing Nordic urban and regional concentration of particles and organic/elemental carbon
RESE	Remote Sensing for the Environment (Mistra)
SUFOR	Sustainable Forestry In Southern Sweden (Mistra)
TFIAM	Task Force on Integrated Assessment Modelling (CLRTAP)
TFMM	Task Force on Measurements and Modelling (CLRTAP)
UN ECE	United Nations Economic Commission for Europe
WGE	Working Group on Effects (CLRTAP)
WGS	Working Group on Strategies