

RAPPORT

5 • 2007

Life Forests for water

-summary from the final seminar in Lycksele
22-24 August 2006



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EU Life Forests for water

Fotograf

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Papper

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Tryck

JV, Jönköping

Upplaga

200 ex

ISSN 1100-0295

BEST NR 1782

Skogsstyrelsens förlag
551 83 Jönköping

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Foreword

The demand by citizens and environmental organisations for cleaner rivers, lakes and groundwater has been evident for many years. This demand was one of the main reasons why the European Commission made water protection a priority of its work. The European water policy was thoroughly restructured and in 2000 the new Water Framework Directive (WFD) was adopted. Some key aims of the new directive was to start management planning based on river basins and to get the public involved more closely in the process.

The Life Forests for water project aims to demonstrate how forestry in Europe could assist in the achievement of the objectives of the WFD. The demonstrations reflect a range of EU conditions. The development towards WFD implementation has differed a lot between countries as well as the importance of the forestry sector. The project started in September 2003 and will close in August 2007.

Partners in the project are the Swedish Forest Agency (beneficiary), the Office National de Forêts, the Forestry Commission, the Forestry Research Institute of Sweden, the Swedish University of Agricultural Sciences, the County Administrative Board of Västerbotten, the County Administrative Board of Jönköping, the World Wide Fund, the Centre National de la Recherche Scientifique, the Syndicate Mixte D'Aménagement de l'Arve et de ses Abords, the Syndicat Intercommunal de l'Ouvèze, the Union Régionale des Associations des Communes Forestières de Rhône-Alpes, the Communauté de Communes du Val de Drôme, the Université Lumière Lyon 2, the Université Jean Moulin Lyon 3.

This report is a compilation of presentations and excursions held at the Life Forests for water final seminar in Lycksele, Sweden, August 22-24 2006. Many thanks to each one of you who contributed with interesting presentations, creative discussions and, last but not least, to the great atmosphere!

/Elisabet Andersson, project manager

Summary

The Life Forests for water final seminar was held in Lycksele, Sweden, August 22-24 2006. This was the third international seminar arranged within the project. The first was held in France in 2004, and the second in Scotland 2005.

70 participants from the UK, France, Estonia, Austria, Norway, Italy and Sweden took part in lectures and excursions. Preliminary results from the project were presented and invited speakers presented new research results that related to the topic forests and water and how we can work towards reaching the aims of the Water Framework Directive (WFD).

Public participation is one of the keys when trying to achieve the goals of the WFD. Participation groups have been established on super-local, local, regional and national levels. Participation events have taken place on the above mentioned levels as well as on international level. However, the willingness to join a participatory group has varied between countries and also between regions. The main reason for this lack of interest is probably the fact that many people do not consider forestry as an important contributor of pollutants to water.

Different activity levels on the participation scale has also been tested, from basic information through leaflets, open seminars etc. to the high activity level in super-local participation groups where forestry actions have been suggested and also carried out. In this way, people can choose which activity level suits their level of interest. Most important is to inform the public about the different possibilities to take part in the process and to make them feel invited.

Demonstration sites have been established in all three partner countries. There are pedagogical foot paths where the public can learn about the values of forests by water, sites showing best practice forest management – leaving buffer zones at regeneration cutting, restoring buffer zones, plantation after regeneration cutting, how to promote social benefits, the impact of forestry on slope stability and flooding are some examples. There are sites showing the results of restoration actions – improving aquatic fauna migration by replacing bad road culverts, adding dead wood in the stream, replacing boulders after timber floating cleaning for example.

At some sites monitoring programmes have been set up to study the effects of different forestry actions on water quality, for example the effect of cleaning drainage systems, and leaving a wide buffer zone compared to no buffer zone along a stream when clear felling an area. The demonstration sites can be used for excursions and training sessions to increase the knowledge and demonstrate how forestry can contribute to achieving the aims of the WFD.

The project has still a few months to go. All tasks and activities are not finished yet, so there are more results to come.

Characterisation and regulations

Water quality in Swedish boreal streams – a matter of spatial scale and forest management

Stefan Löfgren, the Swedish University of Agricultural Sciences

As part of the implementation of the WFD, a characterisation of the ecological status of lakes and streams should be performed. The classification system includes biological, chemical and hydromorphological indicators. Each water system should be divided into water bodies, and the ecological status in each water body should be defined. If the water bodies are too large, we will lose small perturbed lakes and streams where measures potentially should be undertaken e.g. forest soil liming. On the contrary, if we choose too small water bodies an excess number of catchments will be targeted for measures.

In this project, we studied three water bodies in two streams typical for the boreal region in northern and southern Sweden, respectively. The ecological status in the six water bodies was characterized according to the proposed Swedish classification system. Forestry is the main anthropogenic disturbance in all catchments. Due to the WFD-rule “one out, all out”, none of the streams fulfilled the criteria for good ecological status. One or more of the biological quality indicators classified the ecological status as moderate or worse, while the chemical indicators indicated good or high status.



Figure 1. In the Balån catchment, leakage of mercury is measured to see variations before and after clear felling. Many Swedish boreal streams will not achieve good ecological status, partly because of the WFD-rule “one out, all out”.

There are two explanations for the divergent results 1) there is no causal relationship between biological status and anthropogenic perturbation as exemplified by the naturally acidic Balån and 2) the statistical uncertainty connected to each indicator classification system is amplified by the “one out, all out” rule, causing a large number of misclassifications as exemplified by the fish status in Fifflekull. Due to purely statistical constraints, more than one third of the water bodies with good or high ecological status will be classified as having moderate or worse status. The results indicate that many Swedish boreal streams will not achieve good ecological status and thereby become potential objects for measures. This will most probably influence the forestry sector by demands for action. Hence, from a legal, economic and administrative point of view it is important that the water authorities take into account the classification system constraints when they characterize the water bodies and implement their programmes of measures.

Characterisation in practice – how different sources may contribute

Mats Johansson, the County Administrative Board of Västerbotten

When trying to characterize the Balån river system, problems with the scaling was discovered. The bigger scales are too narrow and give unshaded maps. The smaller scales give too much information. In the characterization of the Balån river system, road crossings were about to be detected. Following the red map (large scale) there were 30 road crossings but following the blue map (smaller scale) there were 118 road crossings.

Another hard question is how does one count the artificial land? Is forestry modified land? Is a clear cutting from 1988 still modified land after almost 20 years or is it just clear cuttings from the recently five years that counts as modified land? The definitions are somewhat unclear, especially when considering whether or not to add the land used for agricultural purposes.

This case study of the river Balån described some aspects of the characterization process. It was shown that the spatial scale of analysis will largely influence the results. Larger scales may neglect problems at a local scale, while finer scales may result in too much and sometimes irrelevant information. This was illustrated with road-water crossings in the Balån catchment. On the map scale 1:250 000, 30 crossings were detected, while the analysis of the 1:100 000 map resulted in 118 crossings. The analysis of hydromorphological status also included land use, drainage, channel modifications and continuity. The results showed a variation from good to moderate status in the catchment. The presence of artificial barriers had a very decisive negative influence.

Finally, a possible programme of measures for Balån was presented. A local participatory group gave valuable input both to the characterization and to the proposed measures.

A landscape perspective on water quality in forest watercourses

Johan Temnerud, the Swedish University of Agricultural Sciences

Few studies deal with the impact on local management such as forestry in environmental surface water assessment sites in Sweden. Assessments and management impact at different spatial scales, local and landscape, are debated topics. Environmental sites usually have large catchment size, but there are many (not yet sampled) small streams in the landscape. Of Sweden's approximately 527 000 km river reaches, 150-200 000 km are estimated to be (coniferous) forest headwaters. The largest variation in water chemistry is observed in headwaters, changes in small streams may not always be reflected in rivers. The variation in headwaters depends on which chemical parameter is considered, during which season (discharge) the sampling took place and on the mosaic of the land use (forest, mires, lakes etc). Since a large part of watercourses are found in forests, the question is whether representatives from the forestry sector should be more involved in the Society for Water Conservation?



Figure 2. Johan Temnerud discussed variation in water chemistry parameters measured in headwaters versus small streams.

UK experiences of the Water Framework Directive and forests

Tom Nisbet, the Forestry Commission

Forestry is considered as being a risk in reaching good ecological status, especially concerning loch water bodies. Work is being done in order to identify in which way forestry affect the water quality. Scotland has guidelines for describing the ways to work with the risk, and some of the guidelines are being transcribed

into General Binding Rules. They will be tested and, if found to be deficient, strengthened with additional measures as Targeted Binding Rules and land management contracts are three ways to divide the risks so that they become easier to deal with. The Targeted Binding Rules are especially connected to special water bodies. Scotland has criteria's to determine whether or not we have to have assessments for the forest owner from how much the forest contribute to pollution further down streams. It depends on factors like altitude and kind of forest.

In England and Wales, the forestry is not seen as being a risk for achieving good ecological status. This is due to that the forests in these areas are not mainly used for timber production but instead for recreation and biodiversity. In England and Wales, the most risk from forestry is diffuse sources and morphological sources. 40 % of the water bodies are in risk of not reaching good ecological status because of the contribution of nitrogen from agricultural areas.

French experiences of the Water Framework Directive and forests

Olivier Ferry, the Office National des Forêts

In France, water authorities are usually focused on urban, industrial and – more recently – agricultural pollution. Forestry takes only a small part in the common discussion. Generally speaking, Frenchmen think that the polluters pay principle is the key to solve problems. They are therefore rather uninterested in working on a free basis. Most of the citizens do not consider forestry as a polluter. They are aware of the link between forestry and water, but since forestry is not seen as a pollution risk it is not included in discussions to reach good ecological status.

There are needs of research for better characterizations of water protection services provided by forestry. There is also a need to identify the beneficiaries and decide who shall pay for good water quality. Is it the polluters, the beneficiaries and perhaps the taxpayers? This is – or should be – a main issue in European central governments! One way is to set up mechanisms for managing contracts between beneficiaries and providers. In France, this is difficult partly because every catchments area has a great number of forest owners. In local contexts this might not be a problem, but in a big scale there are difficulties. There is an example from Germany (Munich), where the same problem was solved in a somewhat more direct way. This experience and others are inspiring water authorities which put their forest owners into a choice where the options are either to discuss and sign contracts devoted to drink water protection or to sell the forest to the municipality.

Water and forestry authorities are confronted to a political choice if they want to prevent the risks. To reach this, we need to communicate with the citizens, and the best way to do that is to start in a local level and then move on to regional, national and international levels. The Life Forests for Water project gave us an opportunity to do that.

Restoration

The role of forests in prevention and restoration actions in France

Hervé Piégay, the Centre National de la Recherche Scientifique

The forest has been positively appreciated by the water managers in France, particularly since the end of the 19th century following major forestry restoration works performed in the mountain areas. The forest is then considered as a natural infrastructure for the local communities, which is now useful to conserve but also restore, to provide services in term of water management. Because forest acts on controlled parameters of the fluvial systems (water and sediment transfer, fluvial forms at the reach scale), any forestry action can influence the good ecological status of river channels. Afforestation is therefore a useful objective for water improvement, as well as changes in forestry practices.

Replanting actions has been widely promoted to protect populations but it is also an interesting mean for limiting eutrophication and preserving water quality. By the way, the management of forest is a key element in term of fluvial hazard management (e.g. flooding and bank erosion). It is possible, when acting on the forest, to reduce the natural risks. Such approach, promoted to reduce natural risks, can also influence the good ecological status of the river channel. As a consequence, risk management and ecological management of river channels have to be approached jointly in the spirit of the Water Law of 1992 in order to identify a good balance between the different stakes and satisfy over a long time scale (10 to 30 yrs) the users. Moreover, the measures performed to improve the ecological status of river systems when considering habitat features may reinforce the fluvial risks (e.g. in term of bank erosion or local flooding), this one being not always easy to clearly characterize, which explains that such measures which engage the responsibility of the decision-makers in term of public safety, are difficult to be applied.



Figure 3. Large woody debris causes problems with undermining the bridges in France. To solve this, wood traps have been built up streams of some of the bridges at risk.

Restoring the rivers of northern Sweden – what forestry can do

Niclas Hjerdt, the Umeå University

Timber floating has had a great impact on the ecology of rivers in northern Sweden. Most rivers have been canalized in order to improve the floating of logs downstream. It is usually difficult to visualize the original appearances of the rivers. To get a complete picture of the impacts of restoration, we need to examine abiotic factors affecting river ecosystems, such as morphology, hydraulics, hydrology, temperature, retention, as well as interactions between these factors and riparian vegetation, benthic fauna and fish.



Figure 4. The spectacular Vindel River, one of few non-regulated large rivers in Sweden. The river has been restored after the timber floating era, but because of great cultural values also, some of the timber floating constructions have been left. Parts of a stone pier can be seen in the lower right corner of the picture.

The morphology of canalized streams and rivers usually lack many important elements, such as large boulders, large woody debris and gravel beds. When these elements are returned to the channel during restoration, they affect channel hydraulics in many ways. The combined hydraulic effects of restoration were measured using dye tracer experiments. The results showed that restoration generally reduce stream velocity as well as increase the volume of water held within a reach. However, opposite effects were also observed in some slow-flowing reaches of big rivers, where the removal of float way constructions (e.g. box booms and stone piers) reduced damming caused by these objects. Stream temperature was measured to examine the effects of restoration on ice formation. Prior to restoration, atmospheric cooling of turbulent reaches caused the formation of anchor ice along the streambed, which in some cases would form large ice

dams. After restoration, surface ice formed around protruding boulders in the channel which insulated water from atmospheric cooling and prevented the formation of anchor ice. We hypothesized that this will increase the survival of fish and invertebrates during the early stages of winter. The retention of solutes and particles generally increase after restoration, especially if both wood and stones are added. Similarly, the frequency of bank flooding increases in the restored waters. Frequent flooding generally enhances biodiversity of riparian vegetation. For both fish and riparian vegetation, the number of species increased after restoration, whereas no response could be detected for benthic fauna and stream metabolism.

If forest management actively promotes complexity and heterogeneity in the near-stream area, primarily by leaving buffer zones along stream channels, a great deal would be won. The natural recruitment of large woody debris in stream channels requires that riparian forests are excluded from harvesting.

Restoring forest wetlands - Swedish experiences

Lennart Henrikson, the World Wide Fund for Nature

The limnological environments are in many ways in great need of hydrological restoration. Forestry can carry out a great deal of the hydrological restoration and on the same time contribute to the WFD goals. There ought to be no draining of land areas that still are hydrologically intact, and some drainage systems can preferably be refilled. Ca 300 000 – 400 000 ha of drained land do not contribute to forest production but only cause environmental problems.

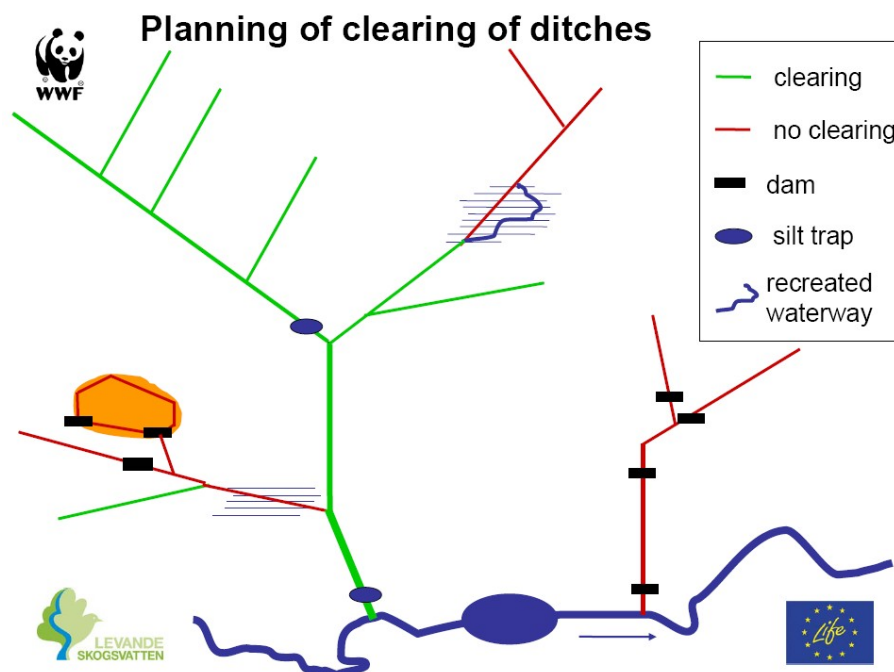


Figure 5. A plan for how clearing of drainage systems could be performed in order to contribute to the goals of the WFD was presented by Lennart Henrikson, WWF Sweden.

To show this, demonstration areas have been set up at four sites. The aim was to restore the hydrology in landscapes with lack of natural wetlands. Simple and

inexpensive methods were used in order to keep the costs down. In the beginning, a gap analysis was made. After that, the ditches were worked through one by one, and those who did not contribute to forest production were refilled. In order to make hydrological restoration more efficient, it could be included in forestry planning.

Restoration and prevention, the importance of protective borders

Bruna Gumiero, the Italian Centre for River Restoration

Italy has been strongly fragmented due to harsh urbanisation. The remaining riparian zones are therefore even more important. There is a long list of benefits that can be made by leaving or restoring riparian zones in general. Firstly, riparian zones have a key role for nutrient retention. They also provide a source of slowly decomposable nutrients and form debris dams, both enhancing the availability of nutrients for aquatic organisms. Flood plains cover 2.5 % of the land surface but contribute with more the 25 % of the total ecosystem services. The riparian zones are of very great importance to keep up the ecosystem services. Keeping or, when needed, restoring them, can help us reach the goals set by the WFD.

Riparian ecosystem Value	
Funtion/service	US\$ ha yr⁻¹
Recharge of groundwater/drinking water	7,600
Flood protection	7,240
Self purification capacity	1,659
Cultural benefit	1,761
Recreation	491
Habitat/Refugia	439
Climate regulation	265
Total	19,580
(Costanza et al. 1997)	

Figure 6. The key to ensure that the land owners/farmers want these woody strips on their land, is demonstrating that the woodland has an economic value. An example of this was shown by Bruna Gumiero.

Participation

Forests for water – preliminary results

Elisabet Andersson, the Swedish Forest Agency

The aim of the project is to demonstrate how forestry can assist to achieve the objectives in the WFD, and this has been done in many different ways. Something very important to the progress and results is the public participation. Participation groups have been established on several levels. Many forestry actions have been performed and are being planned on the initiative from super-local participatory groups, and that is the ideal way for contributing to the aims of the WFD. However, forming the groups was not always an easy task. The enthusiasm when it comes to join a group varies between countries and also between regions. One reason for lack of enthusiasm has been that people do not think that forestry has an impact on water quality that is of any importance. Another reason is that people take good water quality and water supply for granted.

Demonstration actions have been carried out in all three partner countries and it has resulted in a great number of sites for showing good practice of forest management, for example buffer zones, wetland restoration, and water passages. A number of seminars and courses have been held, and the project has produced training material which has been used in the super-local participatory groups to increase the knowledge about water and the impact of forestry on water quality. Traditionally, water managers and forest managers have not worked together to any extent, but improvements have been made in all three countries. Taking active part in participation groups on different levels is one good way to meet and start to cooperate.

The Water Framework Directive and forests – the Swedish perspective

Bo Sundström, regional water director of the Gulf of Bothnia District.

Sweden is divided into five water districts. The Bothnian bay (Luleå), the Bothnian Sea (Härnösand), the North Baltic (Västerås), the South Baltic (Kalmar) and Skagerrack/Kattegat (Göteborg). The Competent Authorities are still under development and there is still a lot of organizational work to do. There is cooperation with other nations. Norway has not really started yet, but they are interested. Finland is easier to cooperate with, mostly because they are in the EU and has similar organisation and budget. The forest industry is important to include in the work with the WFD. An area of 70 % of Sweden's total area is somehow related to forestry, so it has a great impact on the water objects.

Experience form the Mediterranean areas (rivers Drôme and Ouvèze)

Claude Barthelon, the Office National des Forêts

In the area of Rhône Mediterranean system, the work with the WFD is supported by the foresters in the area. The area is big and has been divided into nine catchments with both local and regional communities. The divisions are completely different from the administrative and are instead limited by natural borders. The work has been focused on the link between forestry, social values and water qualities. Research in the Drôme and Ouvèze areas has shown that less forested river basins transport four times the sediment as in areas more densely wooded.

Several restoration actions have been performed and through all the work offers have been made in order to get the measures sustainable. To reach out with information, folders have been written and signposts have been put up together with games for children. A mascot in the shape of a giant mollusk was adopted and an interactive CD showing the dynamics of the water was produces. A simulation program called “des matélosopes” has been invented. “Des matélosopes” work by giving all tress a number and let the computer simulate what the area will look like in twenty years if some of the numbered tress are harvested.

The European perspective

Annika Nilsson, the Ministry of Sustainable Development

The main difference with the WFD compared to other international corporations, is that the WFD is working with natural borders and not the administrative borders.

From the start, the WFD has focused on international corporation. The common implementation strategy started on a voluntary basis in order to “make governments, stakeholders and experts work together”. The work was started with making a timetable and after that, a river basin management plan was written. The river basin management plan stresses the importance of more active stakeholder involvement in order to achieve a better understanding of, the impact their activities have on the water status, and the possibility for more efficient remedial measures from both a water status and a stakeholder point of view. Therefore, the organizations representing the stakeholders were more involved in early discussions. Efficiency is based on creative discussions, even if they might be frustrating sometimes. A project like Forests for Water gives an opportunity to reach good ecological status in a reasonable time period. There are often specialists in water, forestry and ecology engaged in these projects but there is also a need for information and communication specialists.



Figure 7. Seminar participants at Skravelforsen, Gargån, a restored river channel where boulders have been put back into the stream. At the time of visit, the water level was extremely low.

Experience from the alpine areas (rivers Arve and Arly)

Michel Meylan, president of the Syndicate Arve

The development during the last fifteen years has brought drastic changes to the river valley. The free spaces have been colonized. Before this, the forest had the function of preventing the urbanization and also protecting the river. Now, when the forest has been cut down, the areas are being settled. Life-programs are a tool for knowledge and have made it possible for different actors in water management to communicate. It is important to establish a line between forest and water, and it is also important to have an international corporation. In the contact with land owners in France, the issue WFD is often raised. When the WFD came, some negative reactions were noticed, but the major part of the discussion was in a positive manner. A questionnaire was sent to the citizens and over 85000 answers were collected, showing in a great public interest.

Experience from the north and south of Sweden

Stefan Johansson and Viktoria Hedström, the Swedish Forest Agency

A large part of the work during the Forests for water-project was to set up participatory groups on different levels. On the local level, already existing groups were joined. In southern Sweden this worked very well. However, in the north of Sweden, there was a need for establishing new groups on the super local level. The aim of the groups was to increase the forest owner's knowledge about the link

between forest and water, and to inspire them to suggest actions to improve the status of their waters. For example, to neutralize pH and regain nutrition to the forest, ash has been spread or is being planned for spreading. Also, small nature conservation agreements have been signed between the landowner and the Swedish Forest Agency to protect certain forest and water environments.

Concluding remarks

Lovisa Hagberg, the Swedish Forest Agency

One big challenge in working with the WFD is that the water has not been integrated in forest management and vice versa. Both forests and water managers have their own subcultures. Are forests or water the primary resource? The answer varies between countries. In Sweden, forests are financially more important, but in France, water is more important than forests. True participation is very time-consuming and requires conflict resolution competence. Nevertheless, this is the way to go.

Excursions

The excursions focused on the study and demonstration sites of the Forest for water project in the county of Västerbotten, see the maps in Appendix 1. Västerbotten is located in the heart of the boreal region in Sweden and is by 57 % covered with forest, meaning 3.2 million hectares of productive forest. Lakes cover 500000 hectares; there are 1400 kilometers of large rivers and several thousand kilometers of smaller streams.

Tuggenbäcken

The small river Tuggenbäcken inhabits some 14000 individuals of the red listed freshwater pearl mussel. The mussel needs water of good quality and clean gravel beds to survive. It also needs one of the host species trout or salmon to reproduce. Despite the fact that all these factors exist in this small river, the freshwater pearl mussel still do not reproduce. To improve the conditions for the mussel, restoration works have been made along the river. Gravel beds were put into the water and secured with bigger natural boulders. Road crossings have been remade to allow the host fish to migrate up streams. The liming program in the area has been reconsidered.



Figure 8. Improved road crossing in Tuggenbäcken by putting boulders downstream of the culverts.

The guides here were Lennart Henrikson, the WWF, Jakob Bergengren, the County Administrative Board of Jönköping, Stefan Andersson and Mattias Sundqvist, the County Administrative Board of Västerbotten.



Figure 9. Freshwater pearl mussel, found in the Tuggenbäcken.

Balån

The Balån catchment is a part of the Öre River catchment, discharging in the Gulf of Bothnia. It represents a typical boreal stream in Northern Sweden, with the surroundings dominated by coniferous forests and peat lands. The stream hydro-morphology is affected by constructions such as dams and channels and also cleanings connected to former log driving. Research is being made to monitor the aquatic effects of clear felling and buffer zones. The results are not yet measurable but there is a weak trend towards increased leakage of mercury on the spots with insufficient buffer zones. Characterisation has been made according to the proposed Swedish classification system. The acid status and the nutrient status are good. However, both the benthic fauna and fish surveys indicate moderate of poor ecological status. The result indicates that many boreal streams in northern Sweden will not reach good ecological status, mostly due to the WFD-rule “one out – all out”.



Figure 10. Clear felling in the Balån catchment. Buffer zones have been left in order to monitor the effects on the aquatic system.

The following persons guided us at the Balån demonstration site: Eva Ring and Lars Högbom, the Forestry Research Institute of Sweden, Ola Kårén, the Holmen Skog, and Stefan Löfgren and Kevin Bishop, the Swedish University of Agricultural Sciences.

Vindelälven

At the end of the nineteenth century, the forest industry had started in Sweden. An important part of this was the availability of waterways that could be used for transporting timber down streams. Extensive clearings of the rivers took part in order to improve the transportation abilities. As a result of this, the diversity in the water environment has diminished. The Vindelälven is an example of a river that has been cleared for timber floating. As being one of few large rivers in Sweden not regulated for hydro power purposes, there are great values in restoring the ecology here. On the same time there are values connected to the cultural inheritance of the stone pier constructions along the river. To balance these goals, the most spectacular stone pier constructions have been left while most of the river has been restored in order to increase the ecological diversity.

Erik Törnlund, the Umeå University, guided us.



Figure 11. Seminar participants on one of the stone piers in Beukaforsen, Vindelälven.

Gargån

The Gargån is the second largest tributary to the Vindelälven. The catchment is entirely covered by forest which has been used by man for at least 200 years. On the 6 km long section, there were a total of 28 different float way constructions. 21 of these have been removed, and seven are left for historical and cultural reasons. Great efforts have been made to restore the spawning areas for fish. Fish as

trout and salmon play an important role in the aquatic ecology, for example as host fish for the freshwater pearl mussel. In the restoration project some circular culverts that functioned as migration obstacles have been replaced by half-culverts that leave the stream-bed material intact. After restoration of timber floating clearings, follow up studies show that the sections where constructions have been removed has become up to 35 % wider, much deeper and the speed of the water has been reduced with 30-40 %.



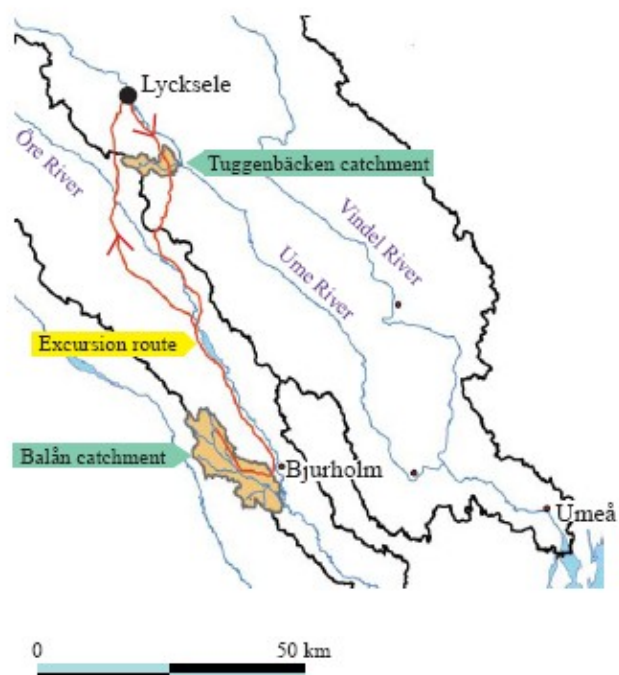
Figure 12. Daniel Holmqvist is telling us about the restoration work in Gargån.

The guides here were Kristina Nilson, the Swedish Forest Agency, and Daniel Holmqvist, the Vindel River Fishery Advisory Board.

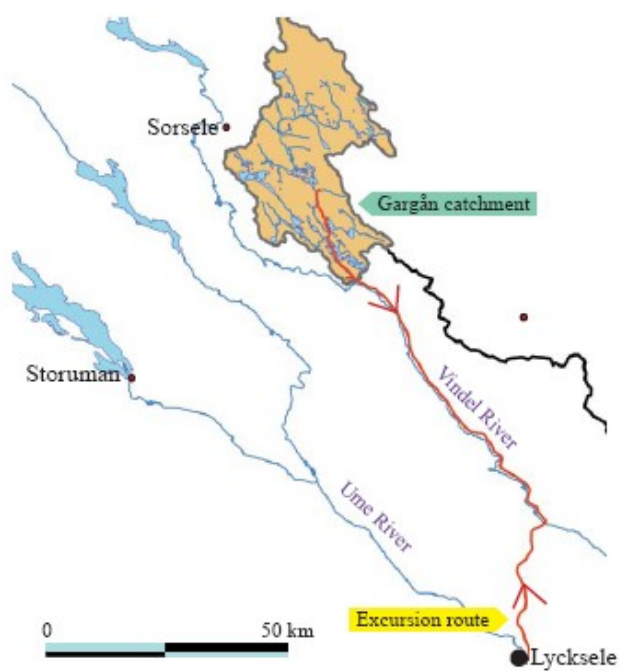
Appendix 1

Excursion maps

Route August 23



Route August 24



Appendix 2

Title of posters

- 1) EUFRO FOREST Operations Ecology Watershed Impacts: A New Working Group. Kevin Bishop, the Swedish University of Agricultural Sciences, Sweden.
- 2) Forest scavenging, acidification and the WFD: A perspective on policy and practice from Galloway, SW Scotland. Robert Dunford, the University of Durham, UK.
- 3) Emergy evaluation – a method for balancing forest and water use interests in the ecology-economy interface of a watershed? Erik Törnlund, the Umeå University, Sweden.
- 4) EU project Forests and water, Kajsa Wivstad, the Swedish Forest Agency, Sweden
- 5) Influence of woody debris and channel characteristics on the retention of coarse particulate organic matter in boreal, headwater streams. Niclas Dahlström, the County Administrative Board of Västernorrland, Sweden.
- 6) Forest Planning with Consideration to Water Quality. Karin Öhman, the Swedish University of Agricultural Sciences, Sweden.
- 7) Integrated Land Use Planning and River Basin Management. Hubert Siegel, the Federal Ministry of Agriculture, Austria.

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- 1988:1 Mallar för ståndortsbonitering; Lathund för 18 län i södra Sverige
- 1988:2 Grusanalys i fält
- 1990:1 Teknik vid skogsmarkskalkning
- 1991:1 Tätortsnära skogsbruk
- 1991:2 ÖSI; utvärdering av effekter mm
- 1991:3 Urboträffar; utvärdering
- 1991:4 Skogsskador i Sverige 1990
- 1991:5 Contortarapporten
- 1991:6 Participation in the design of a system to assess Environmental Consideration in forestry a Case study of the GREENERY project
- 1992:1 Allmän Skogs- och Miljöinventering, ÖSI och NISP
- 1992:2 Skogsskador i Sverige 1991
- 1992:3 Aktiva Natur- och Kulturvårdande åtgärder i skogsbruket
- 1992:4 Utvärdering av studiekampanjen Rikare Skog
- 1993:1 Skoglig geologi
- 1993:2 Organisationens Dolda Resurs
- 1993:3 Skogsskador i Sverige 1992
- 1993:5 Nyckelbiotoper i skogarna vid våra sydligaste fjäll
- 1993:6 Skogsmarkskalkning – *Resultat från en fyraårig försöksperiod samt förslag till åtgärdsprogram*
- 1993:7 Betespräglad äldre bondeskog – *från naturvårdssynpunkt*
- 1993:8 Seminarier om Naturhänsyn i gallring i januari 1993
- 1993:9 Förbättrad sysselsättningsstatistik i skogsbruket – *arbetsgruppens slutrapport*
- 1994:1 EG/EU och EES-avtalet ur skoglig synvinkel
- 1994:2 Hur upplever "grönt utbildade kvinnor" sin arbetssituation inom skogsvårdsorganisationen?
- 1994:3 Renewable Forests - Myth or Reality?
- 1994:4 Bjursåsprojektet - *underlag för landskapsekologisk planering i samband med skogsinventering*
- 1994:5 Historiska kartor - *underlag för natur- och kulturmiljövård i skogen*
- 1994:6 Skogsskador i Sverige 1993
- 1994:7 Skogsskador i Sverige – *nuläge och förslag till åtgärder*
- 1994:8 Häckfågelinventering i en åkerholme åren 1989-1993
- 1995:1 Planering av skogsbrukets hänsyn till vatten i ett avrinningsområde i Gävleborg
- 1995:2 SUMPSKOG – ekologi och skötsel
- 1995:3 Skogsbruk vid vatten
- 1995:4 Skogsskador i Sverige 1994
- 1995:5 Långsam alkalisering av skogsmark
- 1995:6 Vad kan vi lära av KMV-kampanjen?
- 1995:7 GROT-uttaget. Pilotundersökning angående uttaget av trädrester på skogsmark
- 1996:1 Women in Forestry – What is their situation?
- 1996:2 Skogens kvinnor – Hur är läget?
- 1996:3 Landmollusker i jämtländska nyckelbiotoper
- 1996:4 Förslag till metod för bestämning av prestationstal m.m. vid självverksamhet i småskaligt skogsbruk.
- 1997:1 Sjövatten som indikator på markförsurning
- 1997:2 Naturvårdsutbildning (20 poäng) Hur gick det?
- 1997:3 IR-95 – Flygbildsbaserad inventering av skogsskador i sydvästra Sverige 1995
- 1997:5 Miljeu96 Rådgivning. Rapport från utvärdering av miljeurådgivningen
- 1997:6 Effekter av skogsbränsleuttag och askåterföring – *en litteraturstudie*
- 1997:7 Målgruppsanalys
- 1997:8 Effekter av tungmetallnedfall på skogslevande landsnäckor (*with English Summary: The impact on forest land snails by atmospheric deposition of heavy metals*)
- 1997:9 GIS-metodik för kartläggning av markförsurning – *En pilotstudie i Jönköpings län*
- 1998:1 Miljökonsekvensbeskrivning (MKB) av skogsbränsleuttag, asktillförsel och övrig näringskompensation
- 1998:2 Studier över skogsbruksåtgärdernas inverkan på snäckfaunans diversitet (*with English summary: Studies on the impact by forestry on the mollusc fauna in commercially used forests in Central Sweden*)
- 1998:3 Dalaskog - Pilotprojekt i landskapsanalys
- 1998:4 Användning av satellitdata – *hitta avverkad skog och uppskatta lövröjningsbehov*
- 1998:5 Baskatjoner och aciditet i svensk skogsmark - tillstånd och förändringar
- 1998:6 Övervakning av biologisk mångfald i det brukade skogslandskapet. *With a summary in English: Monitoring of biodiversity in managed forests.*
- 1998:7 Marksvampar i kalkbarrskogar och skogsbeten i Gotländska nyckelbiotoper
- 1998:8 Omgivande skog och skogsbrukets betydelse för fiskfaunan i små skogsbäckar
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- 1999:2 Internationella konventioner och andra instrument som behandlar internationella skogsfrågor
- 1999:3 Mållklassificering i "Gröna skogsbruksplaner" - betydelsen för produktion och ekonomi
- 1999:4 Scenarier och Analyser i SKA 99 - Förutsättningar

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2000:2	Skogliga Konsekvens-Analyser 1999 - Skogens möjligheter på 2000-talet
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2001:9	Projekterfarenheter av landskapsanalys i lokal samverkan – (LIFE 96 ENV S 367) Uthålligt skogsbruk byggt på landskapsanalys i lokal samverkan
2001:11A	Strategier för åtgärder mot markförsurning
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2002:8	Demonstration of Methods to monitor Sustainable Forestry, Final report Sweden
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Forests and forestry can contribute to improve and maintain good water quality. This report is a summary of the final international seminar for the project EU Life Forests for Water. It presents results and experiences from different countries working actively with forest and water issues according to the requirements of the Water Framework Directive, for example with the public participation process, management of forests by water, restoration, and monitoring.