Good Practices in Northern Watercourses
Varpu Savolainen (ed.)

Good Practices in Northern Watercourses

Community Development, River Restoration
and Environmental Education

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Foreword & introduction

This document shows elements of good practice in managing northern watercourses and their environs. The focus in this publication is very pragmatic: several practical examples and cases implemented in the 3-year NorWat project (Integrated Approach to Northern Watercourses and their Community Development 2004–2007) are described. We also want to share our experiences about lessons learned – things we did well and things we could have done better.

The development of partnerships and public participation have been high on the agenda in all sub-themes and implementation of the project. We hope this focus can also be seen in this publication.

This document is based on close cooperation within and beyond the partner regions in Finland, Sweden, Norway and Scotland. The mutual exchange of ideas and experiences, as well as full and equal partnership are vital issues both at regional and transnational levels. We have tried to work at a ‘grass roots’ level to find solutions acceptable to the range of stakeholders. Pooling the different types of expertise has been rewarding to all partners. We have all learned from each other, and are keen, through this publication, to share those experiences with others.

Three main parts or themes

After the short country and region descriptions the publication has three main sections, according to the main themes of the NorWat project. The participatory approach is the key-issue running through all NorWat activities. It is the thread of this publication. Several cases are presented, and lessons learned are described openly.

In the first part, we concentrate on community development and its planning. There are plenty of examples of the practical utilisation of participatory planning methods used in NorWat. In the second part, we describe our experiences in watercourse restoration activities and in other kind of water quality improvement work. Also some relevant pre-NorWat experience, for example from Finland, is presented here. The idea is to disseminate good and useful practices. In the third part of this publication, the main focus is on environmental education. We
present a few education cases that were undertaken during the project. We hope that our examples and experiences can and will be applied in many schools in Europe. In the fourth part of the publication we have briefly described some key lessons from the project, to be used as helpful check-lists for future purposes. The focus in this final chapter is mainly in project management and administration, as the theme related lessons learned are described throughout the whole publication.

Networking and team work

This publication is a product of good team work. The articles have been written, commented on and revised by several colleagues across the country borders. We have applied continuous process writing. Also plenty of photos and figures have now been made available to the public.

The following people have given their valuable input in this work:

**Scotland**
George Hogg and Zoë Taylor, Scottish Natural Heritage
Bob Laughton, Spey Fishery Board

**Norway**
Øystein Dalland, Telemark College
Dag Funderud and Ottar Remmen, Nordreisa municipality

**Sweden**
Daniel Holmqvist, River Vindelälven Advisory Fishery Board
Greger Jonsson, The Rural Economy and Agricultural Society of Västerbotten
Leopold Sjöström and Stig Westberg, Vindel River Association
Annika Lindberg, Swedish Forest Agency
Mats Johansson, County Administrative Board of Västerbotten, Department of Environment
Tommy Stenlund, Municipality of Sorsele, Fishing Department

**Finland**
Jaana Leppänen, Anssi Eloranta and Kimmo Olkio, Central Finland Regional Environment Centre
Seija Tiitinen-Salmela and Erkki Rautiainen, Forestry Centre of Central Finland
Foreword & introduction

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Pekka Kokki, Kalle Laitinen, Ulla-Maija Humppi and Tuija Manerus, Town of Saarijärvi
Ari Rusila, Anneli Ylimartimo, Erkki Anttonen, Arto Riihinen, Eveliina Kinnunen and Juha Piilola, Jyväskylä University of Applied Sciences, Institute of Natural Resources

Pekka Salminen from the Library and Information Services of the Jyväskylä University of Applied Sciences has looked after the lay-out and production of this publication. Riitta Ruuska from the Natural Resources Library of the Jyväskylä University of Applied Sciences coordinated the final editorial and technical phases in preparing this publication. Jan Lustig from the Central Finland Regional Environment Centre has designed and created many of the figures. Juha Romula from the same institution has produced many of the map presentations.

George Hogg earns special acknowledgements for revising the English language, in addition to his writing tasks. Anssi Eloranta has very kindly shared his expertise in river restoration and has written most of the practical case studies in Part II. Special thanks to him, as well. The school teachers and pupils in all four countries have been very actively involved in the educational projects. Their role and enthusiasm has been essential in the success of all the school projects. In addition to the people mentioned above, there are several persons who have been working and participating in NorWat activities on the field. Thanks to all of them!

The NorWat project has been partly funded by the EU Interreg IIIB Northern Periphery Programme. We have received financial support also from the following institutions:

Scotland
Scottish Natural Heritage
The Highland Council
Moray Badenoch and Strathspey Enterprise
The Crown Estate
Spey Fishery Board

Norway
Development Department of Nordreisa Municipality
Regional Board, Northern Troms
Sweden
County Administrative Board of Västerbotten
Sorsele Municipality
The Rural Economy and Agricultural Society of Västerbotten
Vindelälven Advisory Fishery Board
Vindel River Association

Finland
Ministry of Environment
Municipality of Saarijärvi
Jyväskylä University of Applied Sciences
Regional Council of Central Finland
Forestry Centre of Central Finland

Thanks to all financial contributors for providing us the possibility for implementing this project and producing this manual.
We hope that this document as well as all other NorWat outputs, many of which can be found in the appendices of this publication, will provide a valuable tool and reference for similar work elsewhere in the Northern Periphery regions. We hope readers will find it both useful and enjoyable!

In Jyväskylä, Finland March 2007

Varpu Savolainen
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NorWat approach in project management

NorWat model of project management

The thread running through the project was of participatory and integrated approach to all activities. This meant also a decentralisation of power and shared responsibility. The participatory and integrated approach was reflected as well in the management structure as well as in the implementation of the project.

NorWat included partners from Finland, Norway, Scotland and Sweden. To reinforce a true transnationality both on the administrative and operative levels of the project, there were several horizontal groups with members from all partner countries. See the partnership structure in the figure on page 14.

First, the Transnational Steering Group was responsible for overseeing the project implementation of all the project partners. The group had two representatives from each participating country. The representatives were chosen by all project partners of the country in question. Second, the Transnational Thematic Working Groups worked closely throughout the implementation of the project. The coordination of these working groups was shared among the partner countries.

The day to day project management was carried out by a full-time Project Manager employed by the Lead Partner. Half of the project manager’s time was reserved for international coordination and management and half for national coordination and practical project implementation in Finland. The Project Manager was answerable to the Transnational Steering Group. In addition, Sweden, Norway and Scotland employed a quarter-time project officer to coordinate project activities in their regions and to work as National Coordinators. The latter officers were answerable to their National Steering Groups, which were established in each country to oversee national project implementation and to assist the project manager and project officers.
Lessons learned

The NorWat model of project organisation in itself proved to be practical and stimulating and led to strong commitment by partners. However, there were some minor differences in the implementation of the model between partner countries. For instance, the Finnish National Steering Group meetings became joint meetings with the Lead Partner, partners and other actors participating in the day to day project work. This inevitably led to poorer communication with some interest groups not involved in the practical project work. Thus one lesson learned in Finland was that the information flow taking place in the face to face meetings is not easily replaced by other communication means.

In every project there are problems and NorWat was no exception. Some of the difficulties experienced, such as key persons changing or organisational changes of key partners – which may lead to lack of commitment, to delays of action or to budgetary problems – cannot be controlled by any project. Further, where problems occur in partner countries, the NorWat model of a shared responsibility and a decentralisation of power may delay or even complicate the corrective actions by the Lead Partner. However, most of the risks in Norwat were successfully controlled by good planning, by the NorWat model of project organisation and of course, by excellent partners.

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Jyväskylä University of Applied Sciences
Institute of Natural Resources
NorWat model of project organization

Norway Partners
Finland Lead Partner Partners
Scotland Partners
Sweden Partners

TSG (Transnational Steering Group)
NC (National Coordinator) & RP (another Representative of Partners)
Project Manager & Representative of Lead Partner
NC & RP
NC & RP

NSG (National Steering Group)

Norwegian actors
Finnish actors
Scottish actors
Swedish actors

TWG1 Coordinator
TWG2 Coordinator
TWG3 Coordinator

Transnational Thematic

TWG1 for Theme 1
Norwegian actors
Finnish actors
Scottish actors
Swedish actors

TWG2 for Theme 2
Norwegian actors
Finnish actors
Scottish actors
Swedish actors

TWG3 for Theme 3
Norwegian actors
Finnish actors
Scottish actors
Swedish actors
Introduction to NorWat pilot areas
River Spey – pilot area in Scotland

River Spey catchment
In Scotland, the NorWat project was carried out on the River Spey and its catchment in the Scottish Highlands. The River Spey is the second longest river in Scotland. It has a catchment area of over 3000 km², and a stream network length of about 36500 km, of which the main stem of the river comprises 157 km. The river rises in the high ground of the Monadhliath and Cairngorm mountains, then flows in a north-easterly direction through scenic river valleys before discharging into the Moray Firth.

The River Spey catchment is split between two local authority administrations, Highland and Moray councils. Two thirds of the catchment also lies within the Cairngorms National Park. The River Spey is classed as one of the cleanest rivers in Scotland.

The solid geology of the River Spey catchment is dominated by slow-weathering crystalline rocks (schists and gneisses) in the uplands, with granite and sandstone in some places. The river system was initiated in the mid-Tertiary, and during the last 500,000 years the geography of the catchment as it is today was moulded by a sequence of four ice ages. Glacial erosion deepened many valleys and when the glaciers melted barriers of sediments were deposited, causing the formation of some long lochs. Most of the lower valleys are filled with outwash terraces. For most of its length, the River Spey flows through a wide, alluvial plain composed of silt, sands and water-borne pebbles.

River Spey communities and industry
There are about 23,000 permanent residents in the River Spey catchment. Some parts of the catchment, especially around Aviemore and Grantown-on-Spey, have a high number of holiday visitors. Populations are therefore higher during the summer, skiing season, and main holiday periods. None of the small planned towns (for example Kingussie and Aberlour) are built up to the edge of the river. There are also numerous small villages with fewer than 500 people (for example Carrbridge, Craigellachie). No community (except Aviemore at the height of the tourist season) has more than 3000 inhabitants.
A map of the River Spey and its catchment area.
Good Practices in Northern Watercourses

Hill farming, sporting (hunting) estates and forestry are the major land uses in the upper catchment, while cattle rearing, commercial forestry and arable farming are more prevalent in the lower catchment. However the most significant employers are the distilleries and related industries. There are about 30 malt whisky distilleries in the River Spey catchment, and several dark grain plants which convert distilling by-products into animal feed. Some areas of the catchment are very important water supply catchment areas, and a number of points provide water, by diversion to other catchments, for the generation of hydro-electric power.

A primary river for Atlantic salmon and sea trout

The River Spey is one of Western Europe’s primary rivers for Atlantic salmon and sea trout. The rod fishery associated with the river generates in excess of €17.9 million every year, and supports 367 jobs within the catchment. The Spey Fishery Board is responsible for the management, protection, enhancement and conservation of salmon and sea trout stocks in the river. This work is carried out in several ways: patrolling the river and coast to deter poaching; running a hatchery where up to 2 million River Spey salmon are hatched and planted out to enhance depleted areas of the river; monitoring of stocks which helps guide management; promoting public awareness and running an education programme in local primary schools.

The main stem River Spey was notified as a nationally important Site of Special Scientific Interest in 1998 on account of its important populations of Atlantic salmon, otter, freshwater pearl mussel and sea lamprey. The river and its tributaries are also designated as a Special Area of Conservation (SAC) under the EC Habitats Directive. The River Spey and its tributaries are almost entirely privately owned with around 400 owners and land managers in the SAC. This can affect how the river is managed.

Numerous bridges span the River Spey, of which the oldest, the Garvamore Bridge, was built in 1831. The river was mostly forded or crossed by ferry until the 18th and 19th century. Thomas Telford designed the Craigellachie Bridge which was built between 1812 and 1814 and is the oldest surviving bridge in Scotland. Salmon netting operation and timber floating were once important uses of the river. Now, apart from fishing, the river is used for recreation in the form of canoeing.
A typical scenery from the River Spey catchment area. (Photo: P&A Macdonald/SNH)
NorWat objectives in the River Spey area

The original objectives for the NorWat project in the River Spey and its catchment were:

- To focus on a small part of the catchment where careful integration of water quality, development capacity and land management is a significant issue. Work with local communities and agencies to consider future trends, opportunities and pressures, and the implications of this for water quality. In order to help to integrate these factors, best practice to safeguard water quality would be set out. Work together with the community and agencies to produce a “Community Development Plan” for the area, a useful reference document for all those involved in development, land management and water quality.

- For the Spey Fishery Board to work with the Crown Estate and Moray Council within the Glenlivet Estate on various improvement works along the Conglass Water (a tributary of the River Avon), including culvert removal and fencing-off of bank sides to reduce erosion.

- Environmental education work in the River Spey catchment using existing resources, such as the “River Bank” box of educational resource material, and the “Salmon Goes to School” project of the Spey Fishery Board. Running a complementary “School Goes to Salmon” component to plant out young salmon in burns, study the natural habitat and ecology, and catch and see maturing fish.

- To train the following groups that they work on and use the River Spey and tributaries – ghillies, countryside rangers and water sports Instructors. A joint training course run during the project will include river management, river ecology, water quality, and access to the river.
The Reisa River and the Nord-Troms region – pilot areas in Norway

NorWat activities were implemented in the Reisa River environs and Kvaenangen and Katfjord waters in northern Norway. The pilot sites were chosen in an area where all three NorWat themes could be run and integrated: 1) riverside village land use and development, 2) river habitats protection and restoration, and 3) water environmental education and information.

The Upper Reisa Valley pilot region

The rural districts of the Troms county coast and valleys constitute a pattern of individual riverside or “fiordside” farms, rather than villages. The clusters of farms and houses at Tørfoss-Sappen-Bilto (at the western riverbank of Reisa, 30–50 km from the outlet) and the adjacent eastern bank (Geira-Svartfoss-Rognli) are the innermost settlements of the Reisa valley (ca. 600 inhabitants). There is an upstream salmon stretch of another 40 km, of which 20 km form a canyon inside the Reisa National Park.

Limestone and dolomite rocks, and profiled water system relief (1200 m) cause extreme bio-diversity. There is a wide range from the riverbank alder and willow forests (Alnus and Salix sp) to terraced pine forests, to birch slopes and to high arctic plateaus. Some of the species are endemic or semi-endemic (e.g. Papaver radic. subsp.). The area is a historical meeting ground of the Sami reindeer husbandry, the Kvaen/ Finnish pioneer agro-settlement from the 1600–1900s and finally the Norwegian majority expansion. Today the population is about 300 in the valley district. Closing of the shops, post office and schools have threatened the vitality of the area.

The idea in the NorWat project was to counteract this negative tendency. Therefore, the objectives were to

- revitalize local skills in refining riverbank forest products (e.g. tar production), small-scale tourism and sustainable river transport, participatory planning and landscape measures (Bjørkli, Rognli and Holmen/ Slettset).
The upstream part of Reisa is a barren mountain river draining into the Finnmarksvidda plateau towards the north. (Photo: W. Offerdal)
• balance river restoration measures by re-opening the flow-channel at the Rognmo salmon tourism farm, and by planning and performing the Holmen-Tørfos river flow channel task.

• contribute to the revitalizing of the Sappen camp school's youth-hand children activities on environmental education. For example, environmental summer camps for Russian/Nordic children and youth were arranged, and mutual school visits by pupils, parents and/or environmental education specialists from Norwat partner countries were organized.

The Lower Reisa Valley pilot region

The Lower Reisa Valley is situated in the municipality of Nordreisa, with the area of ca. 3400 km² and 4950 inhabitants). The municipality includes the municipal and regional centre Storslett-Sørkjosen (ca. 2500 inhabitants), smaller farm and settlement clusters 5–20 km upstream the Reisa valley and the Kildal tributary valley, and also the outer fiord districts. Storslett has a central primary and secondary school and a regional high school, and other public and commercial services. Also the national park centre “Halti” is located in Storslett.

The project focus in this pilot region was to

• emphasise the planning processes for sustainable land and resource use at the Reisa outlet area. This was implemented through the following cases: the traditional hatchery task at Kjelderen, the landfill cases at Snemyr/Galsomelen/Styggøya and the multiple use of the fish farming areas.

• plan and restore riverbanks where artificial embankments have disturbed the natural river course. The river restoration sites of Kildal bridge, Høymelen, and Styggøya were selected as pilot sites.

• run environmental education programs, including cooperation between schools, adaptation of some river sections as outdoor educational areas, and school contacts towards hatchery activities.
The lower Reisa valley towards the south at Snemyr. (Photo: W. Offerdal)
The Northern Troms regional pilot area

The two municipalities of Kåfjord and Kvaenangen, (the southern and northern neighbours of Nordreisa with 2250 and 1500 inhabitants) are partners in NorWat through the Northern Troms Regional Board. The emphasis in this area was on environmental education and its integration with cultural landscape planning along rivers, and partly also in river restoration matters.

The Kåfjord Trollvik primary school was involved in the practical project actions. The school has about 60 pupils and is situated at the outlet of the Trollvik valley river (ca. 12 km long). During the project, the school focused on modern and traditional aspects of the river use.

As one example of the modern river utilisation the school was:
- tracing the development of the arctic char stock in Trollvik river and the modern impacts in this stock, i.e. the fish trap caused by the main road bridge just upstream the river outlet in the Kåfjord. Because of the local NorWat initiative, The Norwegian water and energy directorate NVE included this challenge to be solved in cooperation with the school, the landowners and the state road authorities.

As one example of the modern river utilisation the school was:
- tracing the Sami and Norwegian historical culture impacts along the river (reindeer tracks and hunting traditions, Sami and Norwegian settlement history along the river, place names, stories and memories). A reconstruction “gamme” (Sami turf hut) for environmental education was built at the river for these purposes.

The Trollvik environmental education activities are coordinated with similar approaches at Olderdalten primary and secondary school, in the neighbour community north of Trollvik.

In Kvaenangen municipality, the Burfiord primary and secondary school has focused on the following activities:

- A nearby lake and riverlet have been and will be monitored also in the future at all seasons. Special limnological sampling and analyse equipment package has been acquired for these purposes.
The school has made several cultural landscape field studies during the NorWat project. They have made a culture and nature information track/path along the Kvaenangen river. They have also made a traditional pine tar study and a Sami/Kvaen/Norwegian fjord settlement study in cooperation with the Nord Troms Museum and older farmers. For these activities the Burfiord school was honoured with the regional culture prize for school activities.

Detailed descriptions of the activities and experiences in the Norwegian pilot regions are described later in this book. The activities in Nordreisa, Kvaenangen and Kåfjord are also documented in photos and CDs.
<table>
<thead>
<tr>
<th>Place/restoration site</th>
<th>Task/objective</th>
<th>Miscellaneous remarks</th>
</tr>
</thead>
</table>
| 1. The Reisa outlet                   | Adjusting old riverbank constructions  
Analyzing the landscape history of Storslett village | Protecting nature reserve and preventing erosion  
Increasing village identity and planning NorWat case task: planning |
| 2. Tømmernes-Storslett                | River park                                                                     | River front at Halti National park centre                 |
| 3. Styggøya                           | Restoration of a river gravel deposit island  
Opening of an old flow channel | NorWat case task: planning                               |
| 4. Snemyr                             | Opening of an old flow channel and a flow influenced riverbank forest          | NorWat case task: planning and performing                 |
| 5. Annebakkkelv                       | Opening of an old flow channel and a flow influenced riverbank forest          | NorWat case task: planning                               |
| 6. Moskoelv                           | Restoring the riverbed                                                         |                                                            |
| 7. Haugset                            | Opening of old flow channels                                                   |                                                            |
| 8. Holmen bridge                      | River park, facilities for disabled people, fishing sites                     | NorWat case task: planning and performing                 |
| 9. Holmen-Skogstad-Slettset           | Opening of old flow channels and a flow influenced riverbank forest           | NorWat case task: planning                               |
| 10. Bergmo bridge                     | Erosion adjustment  
Securing the bridge                                                             |                                                            |
| 11. Rognnmo                           | Opening of an old flow channel                                                 | NorWat case task: planning and performing                 |
| 12. Sappen                            | Opening of locked riverbends in the tributary from the lake  
Sappen camp school                                                               | NorWat case task: Sappen camp school activities          |
| 13. Biltot                            | Cultural landscape  
Riverfront protection                                                          | NorWat case task: planning                               |
| 14. Furulund, Kildal river, tributary of Reisa | Opening of an old meander                                                        |                                                            |
| 15. Kildal bridge site                | Opening of an old flow channel and forest                                      | NorWat case task: planning and performing                 |
| 16. Høymelen in Kildal river          | Opening of a locked meander                                                    | NorWat case task: planning and performing                 |
| 17. Reisa/ Rotund fiords (not marked on the map; towards north west of 1) | Salmon farming: ecological security  
Protection measures                                                               | NorWat case task: planning and performing                 |
| 18. Galsomelen regional sewage deposit site (not on the map, close to 3) | Environmental vulnerability  
Protection measures                                                               | NorWat case task: planning                               |
| 19. The Goroso river bend (not marked on the map, close to 3) | NorWat case task: a field education site                                         |                                                            |
| 20. The Rognmo/Bilto/Bjørkli farms (close to 13) | History: tar and riverboats  
Landscape                                                                            | NorWat case task: community planning                      |
The Vindel River Valley – pilot area in Sweden

Vast area with decreasing population

The Vindel River Valley is located south of the Arctic Circle, mainly in the inland area in the county of Västerbotten, which is the second largest county in Sweden covering about 55000 km² (1/8 of the total area of Sweden) and with a population of 250000 inhabitants. Umeå is the county capital city with 110000 citizens, Skellefteå has 75000 and Lycksele 10000. Most of the county comprises small rural communities. The climate is characterised by cold and snowy winters and mild summers.

The Vindel River area comprises four rural municipalities: Sorsele, Lycksele, Vindeln and Vännäs. It is a vast area of more than 16000 km². The Sami culture, the settler culture, and the farming communities are significant for the local identity. The area is very sparsely populated with about 30000 inhabitants with an average density of 1.8 persons per km² (only 0.4 in Sorsele).

Industry is now developing in tourism, mining, electronics, car testing, small scale food enterprises, and service companies in the IT sector. However, the inland areas suffer from a steadily decreasing population, whereas any population growth concentrates on the coast.

Wild river habitats and protected areas

The Vindel River runs through wilderness from high mountains (up to 1600 m high) in the west at the Norwegian border, through forest and farming areas, to the coast of the Baltic Sea.

The Vindel Rivers is the third biggest river in Västerbotten (430 km long) and also one of the four nationally protected rivers in Sweden. It is also a designated Natura 2000 site under the Habitats directive. It is a natural river with a large number of untamed rapids. Natural fluctuations of the water level due to seasonal reasons – such as melting snow – are characteristic to the Vindel River. According to the Swedish law, the tributaries of the main river are also protected.
Introduction to NorWat pilot areas

The Vindel River is located in the Swedish Lapland.

Mountain scenery from the Vindel River Valley in northern Sweden. (Photo: Leopold Sjöström)
Good Practices in Northern Watercourses

The pilot area of the NorWat project in Sweden covers the middle part of the river Gargån, the second biggest tributary to the river Vindel River, located about 200 km west of Umeå within the municipality of Sorsele. The annual main flow of the river Gargån is about 7–8 m³/s, and the width is 10–15 m. Along the 6 km long target area, about 2.2 km is fast falling, rapid water.

The main NorWat objectives in the Vindel River valley

The overall purpose of the NorWat activities in Sweden was to raise awareness, responsibility and knowledge about the Vindel River area and to develop methods on how to use this outstanding natural and cultural resource in a sustainable way to foster rural development. One objective was to test a pilot model on how to initiate the implementation of the Water Framework Directive. Another objective was to exchange transnational experiences and knowledge in the field of river restoration and habitat preservation. An important objective was also to raise interest and knowledge among school children in the area about the local environment and to stimulate sports fishing and other outdoor activities.
Saarijärvi Watercourse – pilot area in Finland

Saarijärvi watercourse is one of the big water routes in the lake district of Finland. It flows towards the large lake of Päijänne. The height difference between the lake Kyyjärvi in the upstream and lake Päijänne is over 70 metres. The watercourse is located in the area of several municipalities: Kyyjärvi, Karstula, Pylkönmäki, Ürurinen, Multia, Soini and Kannonskoski and the towns of Saarijärvi, Äänekoski and Alajärvi. Most of the route is located in Central Finland. A mosaic of lakes connected by rivers and rapids is typical to the Saarijärvi watercourse. About 22% of the catchment area is covered by peatlands. This means that water in the route is quite humic and brown in colour.

Due to its natural environment, cultural characteristics and landscape the Saarijärvi route is considered to be one of the finest and most versatile regions in Central Finland. In order to protect its nature values there are several sites under the Natura 2000 series and other conservation programs.

The watercourse has served local people over centuries

Some of the environs of the watercourse have been inhabited for 8000 years, since the Stone Age. The significance of the watercourse to local people can easily be seen. Housing and other activities, such as agriculture are concentrated on the shores of the watercourse. The route has served local people as a traffic channel, but also as an important source of food – fish. The importance of the fishery as a source of living has decreased, but at the same time its value as a recreational activity has increased.

In addition to agriculture, forestry is an important form of land use and livelihood in the area. In the upstream or western and north-western parts of the watercourse, there are also several peat production sites.

NorWat activities were carried out mainly in the area of the municipality of Saarijärvi, for various practical and financial reasons. It is actually the Saarijärvi municipality authority and some active local people that took the very first steps towards this project. In its own strategic development planning work in 2001–2002 the town applied the so called
“balanced scorecard” method. The targets and factors for the future success of the town were formulated in several workshops. The quality of the environment and its sustainable use were given a high value. The Saarijärvi watercourse, a large part of which flows through the Saarijärvi municipality, was seen as a key factor, and the strategic plan was actually named as the “Saarijärvi Route”.

The importance of the Saarijärvi watercourse in the development of the region was widely understood. The municipality wanted to utilise this valuable natural resource better and looked for partners for development work. The neighbouring municipalities were informed widely about the planned activities.

**Facts about the Saarijärvi town**

The town of Saarijärvi was formally established in 1986, but the housing history in this lake area has roots back in the Stone Age. Now there are about 10000 inhabitants, 40 % of which live in the rural villages outside the town centre. The total area of the municipality is 1030 km², of which 142 km² is covered by water. The traditional ideal of “living in a detached house on the shore of a lake in the middle of a town” is in many cases true in Saarijärvi. Wood processing and graphic industry, electronics and metal industry are important sources of living in addition to agriculture and forestry. Bio-energy is also an increasing sector.

The number of active farms has decreased during the last 10 years. Now there are less than 300 active farms in the whole municipality. Most of the farmers are quite old, the average age being approximately 50 years. New sources of livelihood and new forms of entrepreneurship are therefore needed in the villages in order to keep them alive and attractive.

Two villages in Saarijärvi were selected as the pilot areas for NorWat actions. The selection was primarily based on the dynamism of the local people, their willingness to develop their own living environment. The location along the watercourse was also a central factor. In addition the municipality authorities were naturally involved in this decision.

Finally two different villages were selected: Lehtola-Koskenkylä-Muittari (later called as Lehtola) and Lannevesi. Whereas Lannevesi is one of the largest villages of the municipality with about 600 inhabitants and a high proportion of working age people, Lehtola has only about 200 inhabitants and a large group of older and retired people. The population
The Saarijärvi watercourse is a mosaic of small lakes, rivers and rivulets. Human activities are concentrated on the shores of the watercourse. (Map: Karittakeskus)
in Lannevesi is growing, but is decreasing in Lehtola. In both villages the landscape is strongly influenced by the watercourse and also by traditional farming activities. Most of the fields and farm lands are located on the shores of the lakes, rivers and rapids.

**Lehtola is in the middle of rapids**

Lehtola village is located in the north-western parts of the municipality, about 10 km away from the centre of Saarijärvi. A major part of the rapids of the Saarijärvi watercourse are located in the village of Lehtola. Agriculture has been the dominant source of living for more than 250 years. Even 50 years ago, there were ca. 100 active farms alone in the village of Lehtola. The village school was established in 1899, but was closed due to the small number of pupils in 2004. However, there are several active associations in the village, such as a youth association, farmers’ club, village association and hunting club. The old school building is now owned by the villagers themselves and is used for different joint activities, including the camp school site in NorWat, as later described in details.

Beautiful cultural landscape and nature, good atmosphere and spirit amongst the local people, active cooperation and neighbourhood help, tourism, bio-energy and other new businesses are seen as strengths and opportunities in the village. On the other hand, ageing of the population, decreasing number of families with children, closed shops and post office, poor road network, poor public transport, and scrub woodland regeneration in the traditional rural landscape are seen as weaknesses and threats.

**Lannevesi is in the middle of lakes**

Lannevesi village is located in the south-western parts of the Saarijärvi municipality, towards the capital of the province – city of Jyväskylä. The landscape is characterised by fairly big lakes (Summasjärvi, Lannevesi and Kiimasjärvi) and small agricultural sites surrounded by forests. In addition to the lakes, there are a lot of ponds, streams and hills in the village area. The history of settlement in Lannevesi is generally from the 1550’s, but there are several relics from the Stone Age. There are long traditions in handicraft in Lannevesi. Blacksmiths, carpenters, shoemakers and tailors grew up in the village. Lannevesi is famous also for its versatile cultural activities and artists.
The Lannevesi school was established in 1899 and is still open. The school was very actively involved in NorWat activities, as described later. Similar to Lehtola, there are several associations in Lannevesi: Sampo youth association, farmers’ club, forestry association, horse club, rural women’s club etc.

The local people in Lannevesi are actively involved in the development of their environs. The villagers wish to maintain the beautiful and attractive rural landscape in the village. They want to support entrepreneurship and welcome newcomers to the village. Services, public transportation, road network, need for new building sites and quality of environment are all issues that need to be addressed.
Introduction to NorWat pilot areas

Arable land, forest and water are typical elements in the scenery of Lehtola village. Lake Vartejärvi in the background is a part of Saarijärvi watercourse. (Photo: Seija Tiitinen-Salmela)

Further information about the town of Saarijärvi and its villages is available at: www.saarijarvi.fi
PART I
Participatory Approach and Community Development Hand in Hand
Public involvement in environmental issues

Public participation in environmental matters is closely linked to democracy, but also to effective planning methods. According to the Rio Declaration on Environment and Development “environmental issues are best handled with the participation of all concerned citizens, at the relevant level.” This should lead to less public protest, better plans and improved awareness.

Public involvement can be examined from three points of view: access to information, participation in planning and decision making, and access to justice in environmental matters (Aarhus Convention 1998).

Access to information in various ways

It is important that relevant information is provided to the public so that it is made as accessible to as many people as possible. Different cultures, different target groups and different activities cannot be reached with one and the same form of information. Therefore, public involvement can be enhanced by distributing information continuously and in ways most appropriate to particular audiences. Key questions in informing the public are:

• Plan when, how and whom you want to tell about the issue.
• Identify all possible stakeholders (groups and individuals) of the issue.
  – organised groups may be permanent or temporary (so-called ad hoc-groups formed either for supporting or opposing the issue in question)
• Provide relevant information regularly and continuously
• Think about timing: earlier rather than later
• Different means and tools are needed to activate different groups of people.
• Sometimes it is good to use neutral mediators to find a common language between planners, scientists and local people.
• Too much production of information can hide the essential points.
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Public involvement is a two-way process

Communication should be a two-way process. Therefore, in addition to providing access to information the public needs to be encouraged to participate. The needs of local communities can be met by working with the public, and participation raises public awareness. In addition, subjective experiences of local “lay people” may be important for promoting new issues and solutions and generating new ideas.

Benefits of public participation

- enhancing public awareness
- supporting democracy
- lowering number of complaints
- reducing risks of conflicts
- encouraging new innovations brought up by the public
- discovering "tacit knowledge"
- increasing local people’s commitment to the development work

- sharing of knowledge
- speeding up activities
- supporting local commitment to the actions
- contributing to a sense of partnership between experts, authorities and lay people
- contributing to the development of conflict management
Good Practices in Northern Watercourses

Participation at an individual level

There are several methods for enhancing individual participation: questionnaires, interviews, requests for written comments, interactive internet pages and service numbers. These methods are suitable for information delivery and collection. The interaction between different people and groups, and thus also learning from others, is missing in this approach.

Participation in public events

Public events are useful in information delivery and collection. Interaction between participants is possible. Timing and location of the event affect on the number and representativeness of the participants. Different public events are such as:

- open meetings
- public hearings
- open-door or drop in days
- field trips
- “Samoan” circle
  - participants move to the middle of the circle in turn to have their say

Participation in groups

Group methods are efficient when interaction is seen to be important. Group work can provide thoughtful discussions, understanding of different opinions, immediate feedback and possibly also long-term cooperation between participants. In addition to actual group work, there are several techniques to improve the activity of the group. The application of different methods may vary depending on whether it is important to improve the efficiency, balance, self-guidance, creativity, systematic or analytic approach of the group in question. Different group methods include such as:

- nominated work groups
- nominal group method to create new ideas and to put them into an order of importance
- “Delfi” method to collect different experts’ opinions and to refine them to find a collective opinion or solution
Participatory Approach and Community Development Hand in Hand

- mind mapping
- brainstorming to create plenty of new ideas
- workshops
- focus groups or group interviews
- expert panels
- benchmarking: step by step from the analysis of the present to comparisons, applications and development

Good practices in NorWat

In NorWat we have emphasised public participation and involvement of all stakeholders in all phases and activities of the project. Public participation has actually been the thread of the whole project and is running through this manual.

We have gained positive experiences in the following means of public involvement or participation:

- public info events
- public hearings
- public visiting days, “open-door or drop in days” and exhibitions
- informal “get-together” evenings with some information delivery
- learning and participating by doing; e.g. voluntary work and joint actions in small-scale watercourse restoration
- continuous informing through internet
- regular informative briefings or journals (e.g. monthly news-letters)
- visits to stakeholder groups
- personal contacts
- invitations to different project events, field trips, face-to-face seminars
- several small scale negotiations and events instead of few large scale hearings
- surveys and questionnaires
- panel discussions
- small-scale workshops (e.g. GOPP or Goal Oriented Project Planning workshops)
- utilisation of the so-called Multiple Use Matrix (MUM)
- planning inquiry approach
Several informative and participative village evenings were held for example in Lehtola village in Saarijärvi, Finland. (Photo: Seija Tiitinen-Salmela)

Later in this chapter, GOPP workshops, Multiple Use Matrix and planning inquiry approach are described in further details. Actual examples are presented.

Participatory planning approaches in northern river course management are also introduced as good practices. We will also describe our experiences in landscape planning and fishery management. In all these NorWat activities public involvement has been essential.
GOPP workshop encourages participation

The so-called GOPP (Goal Oriented Project Planning) workshop is a useful participative planning method that can be applied in many ways and during different phases of a project: for example in creating a preliminary outline of the project, in making a detailed project plan and in updating project actions.

In general, the purpose in a GOPP workshop is to define what is the desired future situation. When the objectives are clear, a detailed action plan to achieve each objective can be made. We can call this process also objective-oriented planning. Typically, a so-called logical framework is created as the output of a GOPP workshop and a hierarchy of objectives is set:

<table>
<thead>
<tr>
<th>Overall objectives</th>
<th>Higher level objective to which the project is intended to contribute in the longer run.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project purpose</td>
<td>Justification of the project. Describes how the customers’ or beneficiaries’ situation or position has been improved after the project. There should be only one purpose per project, and it should be presented in one sentence.</td>
</tr>
<tr>
<td>Project results</td>
<td>Outcomes that the project will have achieved by its completion date. Outputs are produced by undertaking a series of activities.</td>
</tr>
<tr>
<td>Indicators</td>
<td>Each outcome or project result is described with one or more measurable target values.</td>
</tr>
<tr>
<td>Activities</td>
<td>The work to be carried out by project staff; begins with a verb and describes concrete activity.</td>
</tr>
<tr>
<td>Assumptions and risks</td>
<td>Pre-conditions: what is required for the project to start. External factors that may delay or prevent achievement of project objectives.</td>
</tr>
</tbody>
</table>

The idea in a typical GOPP workshop is to invite a wide range of partners, consultants and advisors, end users and beneficiaries and possibly also financers and other supporters to a meeting where a project outline and future work are jointly discussed. The objectives of this kind of GOPP ‘Formulation workshop’ are usually:

- to incorporate all partners’ and stakeholders’ views and knowledge to make the best possible project plan
- to enable all partners to contribute to the contents, aims and actions of the project
Good Practices in Northern Watercourses

- to build trust and confidence among the partners and participants
- to commit all participants to the project and its objectives
- to lay the foundation for fruitful and productive cooperation and working relations
- to jointly create a detailed plan of actions

GOPP phases in a nutshell

The main purpose in a GOPP workshop is to bring together different stakeholders to discuss problems, objectives and strategies. All key information is brought together and a consensus is sought.

Participants in a GOPP workshop sit in a half-circle facing a “working board”. Everybody can see each other. Participants write on cards their opinions or perceptions of the issues being discussed. Cards are hung on the wall or on a large paper sheet (e.g. kraft paper) treated with special spray glue in front of the participants’ eyes. Cards can be moved around as issues are being grouped.

Participants sit in a half-circle in order to see each other and the cards hanging on the wall. (Photo: Aimo Pellinen)
The facilitator of the workshop has many roles during the meeting: she/he is the host, the consultant, the tutor and the chair of the meeting. She/he provides all necessary material for the workshop: wall paper, cards for writing, spray adhesive to hang the cards easily on the wall, pens etc.

The facilitator clarifies the objectives of the meeting and also sets out the outcomes and agenda of the workshop. Her/ his role is to be an external activator and question maker – the participants in the workshop should provide the answers. The facilitator also explains the “rules” of the workshop. The rules are written on cards and are hung up one by one on the wall where they remain during the workshop. Typical GOPP rules could be:

<table>
<thead>
<tr>
<th>Write clearly</th>
<th>Think frankly</th>
<th>Only one matter/ issue per card</th>
<th>All ideas are equally important</th>
<th>Write down real/ distinct issues</th>
<th>Avoid abstract or broad concepts</th>
</tr>
</thead>
</table>

**A relaxed kick-off towards the workshop objectives**

At the outset of the workshop all participants are introduced. A nice way to do this is to ask everybody to write his/ her name on a card and to draw something about oneself, e.g. a nice memory from the last summer or last weekend. It is important to create a relaxed atmosphere. At this stage participants should also state what they expect to get out of the workshop.

**From obstacles to a problem and objective tree building**

Very typically the participants are first asked to focus on the problems to be solved. In a brainstorming process they write on cards all obstacles or challenges that could cause problems for project implementation. Cards are hung on the wall and all of them are gone through so that the meaning of each block is fully clarified to everybody. All obstacles are grouped and their importance is defined. A so-called problem tree can be built when the cause and effect of each obstacle is identified.

The problems are then turned into positive objectives. As a result an objective tree is formed. After that the project outcomes or results – intended to have been achieved after successful implementation of the
project – are described with measurable indicators. Risks and external factors are also assessed. Now that all analysis work is done, it is time to agree upon practical activities, i.e. who is going to do what and when.

**Definition of an action plan**

In order to reach each result or work package all necessary activities are listed. Next step is to formulate detailed actions, define partners’ responsibilities, establish the schedule and estimate the costs (person days) of each action. The result of all of this is a detailed action plan to which all partners and stakeholders can commit themselves.

Thus all partners’ interests are met in such a way that the interests of the project as a whole can be advanced. In addition, the whole project consortium has now discussed concerns related to the project implementation and looked for solutions to the problems. As a result all partners should now have confidence in and ownership of the plan.

**GOPP experiences in NorWat**

In NorWat we applied the GOPP approach during the last year of the project when planning the contents and structure of this final publication, the Good Practice Manual. Moreover, GOPP workshops gave us a valuable tool for self-evaluation. What have we done well and what could have been implemented in a better way in the project?

The first three-hour workshop was held among the Finnish NorWat partners and the second one during a transnational conference in Sweden. Our objectives in the two GOPP workshops were to identify and to list:

- those actions, activities, methods, outcomes, experiences and results that were considered successful and valuable for further dissemination.

- problems and obstacles during the implementation of the NorWat project. These obstacles were planned to be turned into positive challenges and objectives, i.e. lessons learned.

In order to identify the key issues, the participants were asked to vote for the most important outcomes of the NorWat project.
Participatory Approach and Community Development Hand in Hand

Scottish, Norwegian, Swedish and Finnish co-operation in action in a transnational GOPP workshop. (Photos: Varpu Savolainen)
After the workshops their outcomes were analysed, and issues were grouped under preliminary titles. This process gave the basis for the Good Practice Manual, and drafted its first structure and contents. Participants of the workshop were able to have their say in the final product which was seen as important.

One of the weaknesses in our workshops was that not all stakeholders, beneficiaries or even project partners were represented. Thus, we may have not heard the “voices” of all groups. Participants in our workshops, however, were asked to “take the position” of a missing stakeholder and try to think of issues from his/her point of view.

We realised from these workshops that we should have used this method earlier in the project. It turned to be an effective, intensive and time-saving method, but also at the same time very enjoyable. The partnership seemed to be even stronger after these participatory sessions.

Results of the brainstorming were written on cards, hung on the wall and then grouped under some titles. After that the participants voted for the most important issues. (Photos: Varpu Savolainen)
Partnership and participation was successful in Finland

Experiences from the Finnish pilot villages were very positive

Community development actions were implemented in two pilot villages, Lehtola and Lannevesi, along the Saarijärvi watercourse in Central Finland. The approach to this work was holistic and integrated. The Forestry Centre of Central Finland took the lead responsibility for the activities but worked closely with other partners and stakeholders throughout the whole process. The needs of the local people and land-owners played the key-role from the very beginning to the implementation of practical actions.

Several steps in community development work

The participatory approach in the community development activities in Saarijärvi villages was such as follows:

1) Several “village evenings” were organised. The needs of the inhabitants and other interest groups were explored and listed.

2) All relevant background material (for example village plans, history, old photos) was studied.

3) Conclusions about “real” development needs were made, based on the background material and the meetings with local people.

4) Important issues were identified up during this process: questions and challenges related to the landscape, nature, water protection, jobs, road network, and protection and management of the shore lands were given a high value. Growth and extension of bushes along the watercourse was seen as a major issue. The traditional openness of a rural cultural landscape was disappearing. Land-owners also considered various nature or environment protection programmes difficult and
somewhat negative. They were uncertain about the allowed management practices in their shore lands and forests, for example. This is why the shore areas were left for the thickets and bushes to grow and expand.

5) Map based and landscape analyses were made. Further details about the methodology of the map-analysis are described later.

6) Different background material and official documents were systematically collected, including information on protected areas, forest areas of special value (criteria according to the Finnish Forest Act) and planned zones. Very close cooperation with different organisations and authorities was essential at this point; e.g. the town of Saarijärvi, University of Jyväskylä/Institute for Environmental Research, Jyväskylä University of Applied Sciences/Institute of Natural Resources, ProAgria Rural Advisory Centre of Central Finland, and local association of forest owners took part in the project.

7) Important hot-spots in the pilot areas were jointly identified. The planning efforts were focused especially on these key-areas. All target areas were photographed. Map-analysis revealed those areas where both water protection, nature protection, landscape issues, entrepreneurship and the needs and wishes of the local people were coincided. In other words, there were multiple interests in the management of these areas.

8) Detailed management and development plans were made for these key-areas by utilising participatory methods.

9) The plans were implemented in practice which proved to be very important for the success and credibility of the project.

*Examples of concrete actions and results in the pilot villages*

- Local forest workers were hired to implement practical landscape management work. The gateways to the village, water-related landscapes and the near environs of the local entrepreneurs were the “hot spots”.
Participatory Approach and Community Development Hand in Hand

• A logging machine with special equipment for wood fuel treatment (small wood, thinning residues, whole trees) was employed for clearing the shore bushes, and collection of thinning residues, tree tops and branches. Different experiments and studies about the energy value of the fuelwood were also made to help the entrepreneurs plan their future work and employment.

• Water protection and restoration actions were made. For example an artificial sludge basin with a limestone dyke was built in the pilot area where there are a lot of drained peatland forests. The aim was to reduce the acidity of the melting waters and the amount of sludge sliding to the main watercourse. Also a eutrophicated and paludificated lake, located in the middle of the pilot village, was restored. The aim was to improve the quality of its environment by creating a special wetland area. Both target areas are to be used as training sites in forest owners’ training courses.

• Water protection training courses were arranged for the local people and landowners.

• Special environmental subsidy plans were made for local farmers in the pilot region.

• Advisory and consultation events were organised for individuals and groups.

• A special stream and forest vegetation day was arranged for the local primary school pupils.

• Wildlife and special habitat management plans were made for the protected shore areas, in close cooperation with the Central Finland Regional Environment Centre. Land-owners learned how their shores and protected areas can be managed. These plans were also implemented in practice.

• Village landscapes were restored, views to the watercourses opened and water protection issues promoted.
Good Practices in Northern Watercourses

- Forest landscapes were managed and improved. New forest environmental subsidy plans were made.

- University and vocational school students were hired as trainees. Also a few theses were carried out during the project.

- Local entrepreneurs were employed and local people became more active in environmental issues.

10) Conclusions (at this stage there is still some work to do on the project)

- Openness and genuine cooperation with the local people is extremely important.

- Holistic and integrated approach is a key-issue in these kind of community development tasks. It is important to forget the organisational and administrative borders, and think and act widely.

- International cooperation broadened some attitudes and gave new information and viewpoints to the work.

- As long as there is only a plan without any visible actions, there is not too much positive feedback nor local support available. Practical work is very important to gain the appreciation and confidence from local people.

- Close cooperation between different partners (here for example the Forestry Centre and Environment Centre) has been very fruitful, and has helped to improve the somewhat negative attitudes towards environmental issues in the area (e.g. the establishment of Natura2000 sites was not an easy process).

- Landscape, water protection, living, close environment, entrepreneurship, agriculture and other sources of living in rural areas are all linked with each others.

- The local people are an important source of information and other resources. New and innovative ideas arose through their participation and innate knowledge.
The process of landscape management planning in the Finnish NorWat villages.
Watercourse as a resource in a small rural community in Finland

A case study in the village of Lehtola, Finland

The village of Lehtola is located in the western part of the municipality of Saarijärvi, about 10 km away from the municipal centre. It is a typical Finnish rural village: its population base is declining, its school and shops have been closed, and due to the restructuring of the primary industry people have had to find new sources of income and livelihood besides the traditional ones. There are about 230 inhabitants in the village, of whom 26 % are over 65 years old. In the municipality of Saarijärvi the proportion is 20 % and in the whole country 15 % (Statistics Finland 2006).

The Saarijärvi watercourse makes the Lehtola village stand out from many other more or less remote Finnish villages that have faced the effects of structural changes. The Saarijärvi watercourse runs through the village and is a popular canoeing route. Locally it is considered to be the best canoeing route in Southern Finland.

A mosaic of lakes, rivers and rivulets

The watercourse is altogether ca. 80 km long with a mixture of lakes, river stretches and rapids. In the village of Lehtola the watercourse is rather narrow and river-like. 5 out of the 22 rapids in the whole watercourse are situated in Lehtola. Most of the farming activities have concentrated on the river shores, which has created the basis for the valued cultural landscape in the village. The watercourse has had a significant effect on the inhabitants’ lives at all times. It has been an important source of livelihood to the people, but the nature of that effect is changing.

As one of the NorWat activities, a master’s thesis was prepared about the significance of the Saarijärvi watercourse for the Lehtola villagers. 12 inhabitants of the village were interviewed in so-called focused theme interviews. The target of the interviews was to raise the awareness of local needs, experiences and thought especially relating to the watercourse. Interviews undertaken by a master’s student of geographic were used as
reference material especially in the latter part of this article. Using the interviews it is possible to draw a picture of the relationship between people and the watercourse and the social and socio-economic dynamics related to the watercourse. This can help in future development actions.

**Challenges facing the village**

The future of the Lehtola village depends on several issues and trends. The first one is agriculture. There will be no return to the past small-scale farming. The primary agricultural production will be a source of livelihood in the Lehtola village only to a couple of households, instead of almost one hundred in the post-war period. Commuting and working outside of the village is thus common. This means that there has to be something in the village that makes people want to continue to live there.

Also the area where it is feasible to commute daily is limited: it is a twenty minute ride to the centre of Saarijärvi, but almost an hour and a half to Jyväskylä, the provincial centre. This means that the development of work places in Saarijärvi and its neighbouring areas is also important to the village of Lehtola. The third major challenge for the vitality of the village is finding new sources of livelihood in the village itself. The development of tourism may open some new possibilities.

**The watercourse is of value itself**

These issues reveal the significance of the Saarijärvi watercourse to the Lehtola village. It is the single most important factor that distinguishes Lehtola from other declining villages. To some extent it is what all the villagers relate to. During the history of human settlement, the watercourse has always served people in different ways. For example, it has been an important travelling route, and has also served as a timber floating channel and thus as a source of extra income to the villagers.

For the villagers the watercourse has also a great symbolic value, which is why many of those who had moved elsewhere did ultimately come back. Some new ways of utilising the watercourse have been developed to compensate for the decreased number of jobs in primary production. These, in most cases, relate to tourism services. However, most of the inhabitants do not have a straight economic connection with the watercourse, and among them the watercourse is valued for recreational opportunities and its aesthetic values.
At the same time, many villagers feel that the lack of economic benefits from the watercourse is a result of municipal and regional policies as well as of changing times. Since the landscape is valued so highly by the authorities, it has been protected in different ways. The villagers feel that this limits their opportunities to develop new sources of income.

Mutual relationship between people and the watercourse

The relationship between the watercourse and people works in both directions. The watercourse shapes the lives of the people living on its shores, but people’s actions have also shaped the watercourse. One of the most topical questions related to the watercourse is that of water quality. The waters in the Saarijärvi watercourse are naturally rich in humus and nutrients, but loading from anthropogenic sources is also notable.

According to many studies, agriculture is the main source of nitrogen and phosphorus loading and thus the eutrophication of the watercourse. Despite that the inhabitants generally blame the upstream peat production for the worsening of water quality. It is interesting how the villagers stay “loyal” to this traditional agricultural industry and assume that the current restrictions on agriculture are already so harsh that it cannot still have a significant impact on the water quality.

Despite being a somewhat “hot” topic in Lehtola, some NorWat activities were carried out to improve the water protection from agricultural activity. An agronomist student made her bachelor’s thesis on the effects of personal consultation and the payment of the special environmental subsidies. For the farmers in the region, she also prepared a handbook about protection zones in agriculture. She also personally advised interested farmers.

Water quality is a multifaceted matter

The water quality issue is an ecological as well as a social issue. Water quality has straightforward effects on the use of the watercourse for recreational purposes. Those households that get extra income from tourism also claim that poor water quality has effects on the impression that the place leaves on tourists, and on their willingness to return. The water quality also impacts on the recreational use of most of the inhabitants.
Concrete and visible actions were made

In Lehtola village, the most visible actions in the NorWat project were related to the river landscapes. The riverbank bushes were cleared in several places in the village, which exposed the landscape to people’s view. The river views are a good example of how wide cultural and societal structures affect the relationship between people and nature. There would be no especially valuable landscape without the river, but what make the landscape especially valuable are the effects of agriculture.

Due to the changes that have taken place in agricultural practices during the past few decades the valuable views have been blocked by willow and alder bushes. When the cattle were allowed to graze on the shore lands such a problem would not occur. Local people consider an open view to the watercourse to be a part of the very nature of the place, an indication that the place is still alive and that people living there still care about it. This kind of relation to nature is very typical in rural areas: it is related to the traditional ideology in which man’s duty is to cherish and cultivate the land.

The landscape management planning and practical activities implemented in Lehtola, are described in details in the next chapter.
Community development in action in Finland

Case 1  Landscape management planning in the Lehtola village

Several discussion evenings and hearings were arranged for the inhabitants of the Lehtola village in Saarijärvi, Finland. During these participatory events, the local people raised questions related to landscape management along the Saarijärvi watercourse and rapids. In the 1970’s the traditional, rural cultural landscape was dominant. Open fields and meadows were extending to river and lakes. Now the landscape suffers from thickets and bushes.

The Lehtola rapids in the Saarijärvi watercourse belong are Natura 2000 sites. The area has been designated as a nationally significant and valuable landscape. It represents the special natural and cultural features of Central Finland rural areas. These landscapes have a great symbolic value.

How to manage the protected areas?

The landowners in Lehtola village, however, have been uncertain about how they might manage and care for the valuable shore areas. There has been a strong wish to do something to maintain the cultural values, but at the same time there is both a lack of clarity and understanding of what are allowed actions.

In 2004 the villagers’ opinions, wishes and needs were surveyed in a questionnaire related to the village planning. The results showed clearly that the villagers prize the nature and beautiful landscape. Many see the community spirit and quality of living in a small rural village as very important, and wanted to maintain and improve its vitality. Also newcomers are welcome to the village.

Thus, the Forestry Centre of Central Finland responded to the request of the local people and prepared a landscape management plan for the community as a part of NorWat activities. At the same time, issues related to water protection and habitat management were taken into account.
Various background information, such as Natura 2000 sites, other protection sites and status and town planning situation, were gathered and analysed.

In fact, the landscape management plan of the Lehtola village was just “the tip of the iceberg”. By the same token, it was also a question about water protection and habitat management. The landowners were personally advised about the legal restrictions and opportunities on their lands. All management actions were planned in details prioritising the most valuable or sensitive sites, as described below.

From desk research to personal contacts and implementation of practical work

The landscape was analysed in both summer and winter time. The “node sites”, rapids and other watercourse shores, long extending views and vistas, beautiful individual targets, roadsides, views to the fields and meadows and the silhouettes of the hills were examined. In this way, the most important landscape features were identified and the most essential sites for works were located. At the same time, the biodiversity and water protection sites were charted. The analysis of the whole was made according to these facts. Prioritising the most important sites made the practical management work more achievable and effective.

The land-owners of the most important sites were contacted personally and permits for the practical work were applied for. At the same time, the land-owners were given information on the planning and the project. After these discussions a holistic landscape management plan and a habitat management plan were made on a voluntary basis.

The targets of recommended management actions were marked on maps. Two forest workers were hired to do the clearing work which was supervised by the Forestry Centre’s expert on habitat management. Also a local energy wood processing machine was employed and collected the brushwood and logging residues. This work was successful and welcomed by the villagers. In fact, the whole NorWat project gained positive credibility through the landscape clearings. Another important output was received in wood energy entrepreneurship. A local entrepreneur was encouraged to calculate the profitability of energy wood harvesting and as a result of this he started to work in this sector.
Case 2  A holistic approach in the Lannevesi village

Lannevesi is one of the biggest villages in the town of Saarijärvi (in 2003 ca. 620 inhabitants). In the central part of the village there are about 200 full-time and 65 part-time residents. People have lived in the area since the Stone Age, but the history of the settlement is known since the 1550ies.

The village was chosen as one of the NorWat pilot villages for several reasons. It is surrounded by lakes. Local people are very active and wish to develop their environment. In addition, the municipal authorities presented Lannevesi as a suitable target area for diverse development activities related to all three NorWat themes: community and land use development, watercourse restoration and water quality issues, as well as environmental education. Agriculture and forestry, fish farming, rural tourism and other small-scale entrepreneurship are typical characters of the village.

Participatory methods were used for all community development activities in Lannevesi. The Forestry Centre of Central Finland took lead responsibility for these actions, but worked across organisational borders in all issues and phases.
Participatory Approach and Community Development Hand in Hand

The river Kalmujoki before and after the landscape clearing. (Photos: Seija Tüttinen-Salmela)
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**Versatile background information was collected**

Very extensive desk research was implemented to provide a detailed overview of the exiting situation and development needs of the village. A wide range of background material was collected: history of the village, “straw poll”, various briefings and reports, old photos, old aerial photos, maps, habitat surveys, forestry management plans, information on landownership, special high-value habitats (according to the Forestry Act), conservation programmes, endangered species, rural tourism enterprises and other enterprises.

Several meetings were held with the local people and other interest groups (authorities, other relevant organisations). Local people came out with several suggestions for developing their village. There were many concrete needs identified in the questionnaire and during the village meetings: more facilities for leisure time activities, maintaining the current services, developing cross-sectoral cooperation, landscape management, utilising the “tacit knowledge” of the local people, more building sites, construction of a walkway through the village, and better transportation services to the town centre.

Informative articles were written in local newspapers, and many presentations were arranged to different audiences. Analysis of the winter and summer landscape were made. Also biodiversity, water protection and condition of the rural/ agricultural landscape were analysed, after which the target areas were prioritised for work.

In all 45 forest owners, farmers and other land-owners were personally contacted. The biodiversity of “agri-environmental” sites were monitored, and land-owners were informed and activated. Challenging and problematic targets were listed and detailed information was collected in the field. The most important targets were found and voluntary landscape plans and special habitat management plans were made for both forest and agricultural areas.

**Plans were implemented in practice**

Plans have already been implemented in practice in the most important areas. For instance, landscape clearing work has been carried out according to the landscape plan. Two forest workers have opened views from the road towards the lake and fields, and the cultural landscape was restored and preserved by clearing the thickets around fields and pastures. In addition, traffic safety was improved by clearing road sides.
Typical landscape in Lannevesi in early summer and in winter time. Winter landscape exposes more than the green summer landscape. (Photos: Seija Tiitinen-Salmela)
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and intersections. Separate forest plots in the middle of agricultural land were managed by thinning.

International seminars, thematic meetings, video-conferences and other interactions, enabled by the NorWat project, have given new ideas and viewpoints for the development work. A final informative village evening will be arranged at the very end of the project, but fruitful involvement with the village and its people will continue after the project. NorWat will hopefully be a catalyst for many positive changes.

Water quality issues and school cooperation were on the working list

In addition to the community development practices (Theme 1), also watercourse restoration and water quality improvement work were carried out in the environs of Lannevesi village. Environmental education activities were also implemented in the same area. Case Rahkosenpuro is described in detail in the educational part of this publication, and the case Vellipuro in the watercourse restoration.

Before implementing practical work in the streamlets Rahkosenpuro and Vellipuro, versatile background information was collected: information about drained peatlands and other forestry practices in the streamlet’s catchment area, landownership in the area, conservation programmes, special high-value habitats, information from the forest management plans etc.

In Rahkosenpuro environs, close to the Lannevesi village school, a special landscape management plan was made. In addition to the landscape needs, the nature of the stream and its shores, environmental education needs and safety of the children were taken into account. For instance, decayed trees were cut as a preventative action. People living nearby made firewood of those trees and also took the residues away. A long-term agreement was made with the nearby agro-forestry school, the students of which will carry out the necessary clearings along the shores of the streamlet, according to the landscape plan, every three years. In the near future, a special nature trail will also be established.

As one measure of water quality improvement, a training course about stump lifting and planning of protection zones was organised for the local entrepreneurs and forest owners. In addition, a survey of current wastewater treatment systems of ca. 120 houses and summer residences was carried out in Lannevesi village. The aim was to encourage the necessary renovations in private houses.
Case 3 Planning of a new residential area in the Lannevesi village

Since 1952 there was a saw-mill on the shore of the Lake Summasjärvi in the village of Lannevesi. After some changes in its ownership and finally after a fire in 1985 sawing activity ceased. There are no buildings of the saw mill left, either.

The area is very central in the village of Lannevesi and is nowadays owned by the Town of Saarijärvi. Now the site is reserved for housing purposes. Spatial land use planning of this area took place as a part of NorWat activities. The work was carried out in close cooperation with the villagers who are interested in this shore area.

A map from the former saw-mill area in the village of Lannevesi.
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Special characteristics and challenges of the planning area

A shoreline master plan on the shore areas of the Lake Summasjärvi was implemented in 1998. Building rights for eight detached houses were reserved. As the town owns the area, it can sell the lots and give building permits without any further process.

The environmental impacts of the former saw-mill have been studied several times, for example during the years 1985, 1990 and 2005. The ground is not so contaminated that it needs to be cleaned in any special ways. There is some chlorine phenol absorbed in the ground but the concentration is so low that there is no danger of groundwater contamination.

At present, the saw-mill area is more or less open sand field, similar to a gravel pit. Behind the area the terrain rises steeply. The saw-mill site is restricted to the road. The shore area works as an important recreational area for the Lannevesi villagers. A "fish hut", a boat launching site, a roller boarding ramp, a play field and a swimming site with facilities like dressing huts and barbequing place have been built.

An aerial photo of the former saw-mill area in 2002.
Objectives of the spatial planning

There is no need to prepare a detailed local plan for the new area, but a proper spatial plan is important as an instruction for the new builders. By careful spatial planning the new residential area will be inviting and functional and the road network will be properly laid out. It is also important to take into account the needs of other villagers and the public recreational area.

The spatial plan of the area was prepared by a local architect after careful field studies, analysis of various background information (e.g. topography, flood height and ground water information) and after several negotiations and discussions with the representatives of the Lannevesi village association. The plan gives guidelines for the building sites and the road network. A 3-dimension model of the area has been constructed in the winter of 2007 and has been presented to the villagers in a public village meeting.

Lessons learned

Engagement with the villagers was essential throughout the whole planning process, as the site is an important recreational area. It was also important that the planner was an experienced and highly-qualified person who immediately understood the challenges and special needs of the area. Thus the planning work progressed very well and the final results met the objectives of the town of Saarijärvi.
Public involvement in Finnish fishery management

Introduction to the inland fishery system in Finland

Recreational fishing is the most important nature activity in Finland. About 40 per cent of the Finnish population, i.e. almost 1.9 million people, take part in fishing events at least once a year. Instead of household needs, leisure-time fishing for recreation is the main reason for fishing activities. Fishing with various kinds of rods has become increasingly common, whereas the traditional net fishing is decreasing especially amongst the younger generation.

The catch of recreational fishing accounts for about a third of the total catch of fish in Finland, and in inland waters its share in the catch is almost 90%. The annual catch of recreational fishing is about 50 million kg, and almost half of this is caught by nets. In quantitative terms the most important species of fish are perch, pike and roach.

The fishery industry comprises fishing at sea and in inland waters, aquaculture and fish trade. The sector is of great economic and social importance especially in sparsely populated areas like in the Finnish Archipelago area, and in Eastern and Northern Finland.

The annual catch of professional fishing in inland waters has been about 5,000 tons, which is less than 5 per cent of the catch from the sea. However, the value of the catch from inland waters is over 20 per cent of that from the sea, because it consists mainly of high value fish used for human consumption. Professional inland fishing is particularly important in northern and eastern Finland. The main species is vendace (Coregonus albula) but also pikeperch and whitefish are important species.

Fishery legislation in Finland

Finland’s fishery system is based on the Fishing Act which regulates the institutional organisations of fishery system, fishing rights, fishing arrangements and management of the fish stocks. The concept of the optimum sustainable yield is essential. Also the regulations of fishery management are important in a country where waters are largely privately owned.
The fishery regions and joint ownership of private waters are special and typical to Finnish fishery legislation, but not commonly known in other EU countries. The fishery region is a typical Finnish institution. Somewhat similar organisations exist in Sweden, but they do not have similar public duties as the fishery regions in Finland.

**Fishery regions in Finland**

In Finland lakes and rivers are privately owned and the ownership is based on land property. The fishery association system is based on this property formation representing collectively all water owners, the so-called shareholders, in matters related to fishing rights, for example. The fishery associations also have duties towards fishery management. The fishery associations have a long history in Finland, and were established under the Fishery Act of 1951. The fishery associations form the major parts of the so-called fishery regions. These are larger areas for fishery management purposes and other tasks.

The water areas used to be owned by the local farms in a village. Nowadays, however, this ownership is scattering and continuous parceling out of land has increased the number of private owners. Many water and land owners no longer live in local villages. As well as private people, companies and municipalities own water areas.

The ownership of waters is very complicated, and the boundaries of associations are impractical for sustainable fishery management. The present fishery associations face many problems: they are too small, they are scattered, the shareholders or their representatives are ageing and the urban owners are not motivated to participate in the association’s activities.

According to the Fisheries Act of 1982 Finland was divided into 11 provincial Fishery Districts which are subordinated by the Ministry of Agriculture and Forestry. These districts in turn consist of 222 fishery regions. The fishery regions have many features of a public authority. They represent an intermediate level of public administration but they are not an official part of the government.

The members of the fishery regions consist of fishery associations, as well as clubs of recreational and professional fishermen. The fishery regions are made up of all groups who are interested in fishery management. The tasks of a fishery region include making local fishing regulations, collecting data on fishing and supervising fishing. The most important task
is preparing the fishery management plan for the fishery region’s lakes and rivers. The planning process is very essential to manage the interaction between different interest groups and also affects on the contents of the management plan.

**Case description on the fishery management plan of the Saarijärvi fishery region**

The Saarijärvi Fishery Region is situated in the middle of Central Finland. The water area of the region is about 170 km². The waters are typically made up of a mosaic of lakes, rivers and rapids.

The Saarijärvi Fishery Region consists of 23 fishery associations which have in average 448 (30–1600) shareholders. This means that there are over 10000 shareholders in a relatively small water area. Professional fishing is insignificant here – there are only two part-time professional fishermen.

The main problems in the Saarijärvi Fishery Region are similar to many other water areas. The fishery associations are small and scattered. Only a few shareholders, less than 1 %, take part in associations’ activities. Recreational fishermen and other interest groups that are not shareholders have limited opportunities to participate in decision-making.

**Participatory approach in fishery management planning**

The management plan of a fishery region offsets out the principles of fishing regulations and management of fish and freshwater crab stocks. There are many different opinions about the use and management of fish stocks and water areas. Many different beliefs also affect on people’s opinions.

A new fishery management plan was prepared for the Saarijärvi Fishery Region as one of the actions in NorWat. An agronomist student did the main work and background research as his bachelor’s thesis. The planning process was supervised by experts of the Fishery Region itself and the University of Jyväskylä/ Institute for Environmental Research.

Participatory planning methods were used. The idea was to listen to all interest groups and to take their viewpoints into account in the whole planning process. Through this close collaboration and bottom-up rule, the plan was believed to be more acceptable and of better value to its users. Another aim was to develop the participatory planning process as
a working tool for fishery regions. This kind of planning method was new in the fishery regions of Finland.

The steps in the participatory planning of Saarijärvi Fishery Region were as follows:

1) Questionnaires and interviews

Several questionnaires and interviews were made to collect background data about fishing, fish catch, and fish and freshwater crab stocks. Also economic data was collected. The questions were either open or structured or combinations of both.

In the answers of the fishing associations, the rights and fishing opportunities of the shareholders were emphasized. The clubs of the recreational fishermen felt that they are not heard in the decision making processes.

2) Group methods

Workshops and SWOT analysis

Joint workshops were arranged for different stakeholders. In the first workshop shareholders (i.e. water area owners), recreational fishermen, professional fishermen and members of other interest groups discussed fishing regulations and management of fish stocks.

The participants jointly carried out a SWOT analysis (Strengths, Weaknesses, Opportunities and Threats) of the Saarijärvi Fishery Region. Good fish stocks and the large number of fishing areas were considered as strengths of the region, whereas poor crab stocks, lake regulation, poor water quality and the large number of fishery associations in the fishery region were seen as weaknesses.

As threats in future, the participants considered the inaction of shareholders, the lack of fishing interests among young people, and different fishing regulations of different fishery associations even within a same lake. The latter could lead to over fishing. Cooperation, incorporation of fishery associations and improving water quality were seen as opportunities for better future.

Different future scenarios

In the second workshop, the future of the fishery in the Saarijärvi fish-
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ey region was discussed with the help of different scenarios based on the publication of Laitinen et al (2005). The following scenarios were presented:

*The growth-oriented fishery scenario*
- There is strong growth in both recreational and professional fishing.
- Fishing tourism is increasingly important.
- The fishery enterprises are larger than before, and they work closely in networks with other areas in Finland.

*The local fishery scenario*
- Local traditions are emphasised.
- Consumers think highly about local products.
- Moderate growth takes place in recreational, household and professional fishing.

*The tourism-oriented fishery scenario*
- The demand for fishing tourism services grows significantly.
- Fishing licenses system and fish stock management support mainly recreational fishing.

*The environmentally oriented scenario*
- There are strong regulations and precautionary principles in fish stock management.
- Fish catch is used in the local markets.

The growth oriented and local fishery scenarios were seen as most desirable. The most probable scenario, however, is the local fishery scenario.

3) Information dissemination and communications

The plan was presented on four occasions. One of the events was directed to the representatives of the fishery associations, to the recreational fishing clubs and to the fishery and environmental authorities. In this event the data on the fishery region and the draft plan were introduced. The guidelines and the recommendations of the plan were discussed. In the second event the plan was officially approved at the fishery district meet-
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Two events were organized for all interested people. In these public events, the main results of the background studies for the new plan as well as the contents of the plan were presented to the audience. There was the opportunity for those attending to ask any questions from the experts.

The experiences from the participatory approach were positive. The planning process increased dialogue and collaboration between different interest groups, improved the fishery region’s internal communication, and changed ways of thinking and acting. The new fishery management plan 2007–2012 of the Saarijärvi fishery region will be implemented from the spring of 2007.
Participatory planning approaches in River Reisa

Bottom-up rule is necessary in environmental improvement projects

Local people, such as land owners, farmers, relevant NGOs (non-governmental organisations) and other interest groups are typically invited to participatory planning meetings related to environmental activities. In the NorWat project there are several occasions where the local public has been involved. The two typical forms of communication in these situations are:

1) The professional planner/officer arranges local information meetings and hearings and makes the necessary introductions.

2) The professional planner/officer takes the “lay people’s” feed-back and opinions back to the higher level planning authorities.

Usually the planners restrict their roles to the arrangement of simple local hearings, and are satisfied with only this contribution. This is considered to be a satisfactory and adequate input towards the principle of participatory planning. But actually, it is only half of the process. The planner has a responsibility but also opportunities to fit in the demanding, diversified and specific grass-roots interests with water resource planning. Unfortunately however, this task has very often been ignored.

In this part of the handbook we try to contribute towards this challenge with our experiences from NorWat actions. In the beginning, also some theoretical background is given.

Very typically, there are several hidden reasons and motivations behind the environmental planning, e.g. issues related to waters, that get in the way of the “true” participatory approach.

A) The general principle of planning being straightforward, but remote and alien:
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Slettset and Billo areas have been among NorWat target areas.

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- In the “central level planning process”, the planners are always remote from the planned objects and groups. The planners’ mind is not in tune with the individual minds of the target groups. Here it is very typical to ambiguously communicate: \textit{the planning is good for you, but not exactly “you”}.

- In this way the planner tries to teach participatory planning, but in practice is rejecting it. The consequence is that in centrally planned projects many social and environmental objectives differ from the local perceptions and local aspirations.

B) We think that the water resources are easily perceived and understood, but in fact they are very diverse, even chaotic:

- River systems and ecosystems represent an extremely wide range of natural varieties, within the watercourse itself but also in its environs.

- Rivers and their ecosystems are related to a very wide range of resource management practices, land use types and cultural issues with various local modifications.

In other words, each river or watercourse is very different and needs a unique approach. The riverside people have a right to state their opinions and feelings, and the planner should be ready to hear comments such as “\textit{this unique river, my planner, at my place, you do not understand, you are not living here…}”.

"The planning inquiry code” in Norwegian NorWat actions

Recognising the facts described above, the Norwegian NorWat team has applied a so called “Planning Code” in some of their workshops and local field work in upper and lower valleys of the River Reisa. A guideline booklet was developed with the support of the professional planners and it was modified by local people to fit their planning needs.

The “Planning Code” consists of some concrete questions that can increase constructive and creative participation of local people. Often this approach is a supplement to the Multiple Use Matrix, that can also be introduced to the local people. The Matrix can be completed jointly at workshops or individually by each person, from his/her point of view.
The fact that the draft plan normally already exists when the public is invited to participate, has been taken into account.

Answers to key-questions through a bottom-up process

This investigation procedure has shown to be a useful tool in the hands of NGO’s, riverside landowners and local interest groups in general. The method facilitates active bottom-top feedback during participatory planning processes.

The planner him/herself should share his/her ideas with the target groups, enabling them during their own study groups (without the planner present) to ask themselves and their possible sources four key questions (see below). In this way, they can gradually formulate the local definition of the planning challenges, as a base for feedback to the planner.

1) What has already happened in the field and in the administrative handling of the case?

Sub-questions (inside the study group, or individually as a landowner):

- When and by whom did the official planning process start?
- Where can we find those ideas or pre-studies that might have been performed before the official planning process started?
- Which other groups or stakeholders have been involved, and what kind of feedback has been given by them?
- Have any political decisions already been made?
- If yes, which of these decisions correspond with our aspirations and how?
- Which decisions do not correspond with our aspirations, and may even be illegal or too binding from our point of view?
- Which of the decisions are already finally settled, and which are not?

2) What is happening just now?

Sub-questions:

- Which office or officer in the political and administrative system is running the case?
- Where can we find the updated planning documents?
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- Where can we find the work documents and draft plans – or are they available to the public?
- Where and what are our allied stakeholders or interest groups?
- What is the schedule of the planning process and when will decisions be made?
- Should this planning process be different from the present situation and how should the modifications be promoted?

3) What will happen in the future according to the official plans?

Sub-questions:

- What are the formal and official objectives and tasks in the plan?
- Is an Environmental Impact Analysis (EIA) enclosed?
- What can we learn from the EIA?

4) What would we like to happen in the future? Do we need to change the official plans?

Sub-questions:

- Are there any contradictions between our desires and the official objectives in the planning?
- If so, how should they be solved?
- Can we find a compromise?
- Or are there chances for a consensus, and if so, by which of the parties?
- Or are some of these contradictions (or conflicts) politically, economically or ecologically unsolvable?
- Should we demand further EIA or additional inquiries?
- Which items in the EIA should we stress and formulate?
- How should we act from now on?

How to motivate local people to participate?

The impetus and motivation for local participation in the planning processes arise simply from local engagement, enthusiasm, aggression or curiosity – and a mixture of these – related to the following questions:
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1) What kind of public or private planning and action has already (or has not) taken place before we have been made aware of it? And what has been the economic, social and environmental motivation?

2) What is happening (or not happening) just now, in this case and in the environs?

3) What is going to happen (or not to happen) according to official goals or plans?

4) What ought to happen (or not happen) according to our perceptions and knowledge about the case?

The immediate impetus for local engagement and action will always be anchored more in some of these four questions than in others. Action and feedback may arise from only one of the sub-questions. For instance, questions such as: “Which political decisions ahead of planning should have been settled, but are still not settled?” or “Why is there such a big difference between public official objectives and our local objectives?” may work as catalyst to participation.

The fire place at Holmen riverside camping area. (Photo: Øystein Dalland)
**Listen to the stakeholders!**

All four questions and their sub-questions run together in a logical sequence related to the planning progress and future prospects. The idea is to keep the planning informal, private and discrete and to find a balance between the “planner and the planned”. Key activating questions from the local people’s point of view are “What has happened before we entered the scene?”, “What should rather happen?” and “How can we fill the gap when our private goals or solutions differ considerably from the official planning goals or solutions?”. A professional planner should be willing to listen to the target groups and also to negotiate with them. There is the inevitable element of double meaning and dilemmas inherent in all environmental planning: *good for you is not fully good for just “you”*. The planner should also have the courage to reveal his/her shortcomings. All participants benefit from this kind of open discussion. For example, the local people will understand the balancing position of the planning officer between the political power and local people, “the cry from below”. For an interested reader ‘the social learning theory’ (see e.g. Illeris 1974 and Bateson 1977) may be worth studying further. The slide show of the town planning of Storslett is available on the attached CD-ROM.

*Mollis waterfall in Reisa National Park. (Photo: W. Offerdal)*
Participatory planning and mutual learning triggers, Norwegian cases

Seven participatory planning cases (2004–2006) of the NorWat project in Norway are described in the following chapters. In all these cases the so-called “participatory planning inquiry code” contributed as a trigger for local feedback and improvement of the official plans. Mutual learning is an essential element in all these examples.

Three of the described cases are closely linked to the original NorWat Theme 1 (*Sustainable Land Use Management to Protect Water Quality and to Promote Community Development*):

1) The Bilto/Rognli riverside cultural landscape protection dilemma. (In Upper Reisa Pilot Area).

2) The runoff pollution from regional landfill area at Galsomelen.

3) The Reisa estuary impact of the Rotsund fish farming accident
   In the other three cases it is largely a question of river restoration activities (Theme 2)

4) The Holmen-Slettset/Tørffosslandet case
   (in Upper Reisa Pilot area)

5) The Kildal bridge restoration case (in Lower Reisa Pilot area)

6) The Styggøya restoration site (in Lower Reisa Pilot area)

The last case presented here has elements of being both a cultural landscape task and river restoration task (Themes 1–2).

7) “The traditional hatchery” in the Reisa valley

All these cases have, however, inherent strong elements of experienced learning and practical communication approaches. The described cases are therefore also contributions to the Theme 3, environmental education and awareness on waters and related social information.
Reisa Valley offers many interesting study sites.
Utilisation of the participatory inquiry code in concrete case studies

The aim of reporting the following seven Reisa River cases is to highlight the approach of “The environmental participatory inquiry code” in practice. It is too complex to summarize fully all feedback comments to all sub-questions. Therefore, the focus is on the key questions and their feedback. These questions have had a special trigging effect on the public engagement and action progress. In each case, the key questions vary. At the first example (1), however, we will summarize several sub-questions and their feedbacks, in order to show the method in details.

The trigging effect towards participation and plan progress is not at all achieved by asking the target groups to simply fill in the inquiry forms. The idea is to run an ongoing dialogue during the planning process. The questions and their feedbacks will in this way be internalized in a mutual way. The planner him/herself should make his/her own reflections to each question. Similarly, the target group (for example a riverside institution or a landowner) should react to the questions raised.

In some of the cases formal workshops and hearings have been undertaken as a part of the NorWat project, the minutes from which have taken care of the feedbacks. In most cases, formal hearings have also been performed. See the description of each case below.

At the beginning of each case, a brief description of the area and case and its water planning relation is presented. Then, based on the sequence of inquiry questions, a set of typical action trigging comments given by the target groups are given. In some cases NorWat project members themselves have been representatives of a target or stakeholder group. In these cases NorWat participants have represented local public or local river tasks towards the central administration or planning officers.

The seven examples below also illustrate the important professional positions of the riverside people. They pick up and address the diverse ecological and human factors of each unique river section.
Case 1  The Rognli-Bilto river erosion case

Erosion and ignoring of erosion were triggers for planning and action

Rognli is the innermost habited farm in the Reisa valley close to the Finnmarksvidda plateau and Reisa National Park. This site, the Sappen-Bilto farm cluster, or a small village, is a key area for the Kvean-Sami Norwegian cultural meeting. The agricultural site is old, but more land was cultivated as a part of restoring the northern regions after the second world war.

In 1948 the farmer and traditional hunter Mr Berner Jensen Bilto was granted a permit by the State forest to buy a stretch of the riverbank terrace (ca. 70x400 m) for cultivating, provided that he leaves a birch tree belt beside the river for erosion protection. So he did, but unfortunately the erosion went on, undermining the shelter belt and nowadays even threatening his barn, also originally located by the advice of the public agricultural officers.
Several times during 50 years Mr. Bilto applied for erosion preventing stone banks, and finally the funds were allocated. Unfortunately, the local priorities were changed from Bilto to other properties. During the same period, the budget for riverbank tasks was reduced, and the criteria for funding were changed in favour of flood prevention tasks only.

The cultural riverside agriculture in the Reisa valley has, however, gradually been regarded as an important resource itself, representing the Kvaen-Sami-Norwegian culture. It is question about a unique pioneer fringe settlement area in the North, and also an aesthetic buffer zone of cultural landscape values close to Reisa National Park. The semi-open riverbed landscape was even claimed to be one of the qualifications in the national protection scheme of the Reisa River in 1981.

The case reveals the contradictions between these central objectives over time. As a solution for the problem, the NorWat project members, the farmer and village boards have together succeeded in including the Bilto riverbank landscape protection as a task in the Norwegian state master plan for river landscape restoration at Reisa 2006–2010. Mr Bilto’s the comments and arguments were documented. The key questions in this participatory approach were more or less historical: ‘What had happened? and What had not happened?’

The exercise was a dialogue over two years (2004–2005) between NorWat staff members (agro-officer and national coordinator), the farmer and the Water engineering authorities (NVE). The historical documentation kept by the concerned farmer was the catalyst for the whole process.

Since the Bilto case introduces the planning inquiry method to the reader, we will go into some details in the questions, their sub-questions and the answers.

What has happened?

Sub-questions

- When and by whom did the official planning process start?

*Answer by Mr. Bilto:* “In 1948, when State owned riverside land was sold to me here at Bilto, I (Mr. Berner Jensen Bilto) was promised that riverside agro protection schemes would be implemented. Seven times since then I have reminded the water authorities in writing of that promise. About ten years ago, the central decision was
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made on the issue, but unfortunately local politicians here in Nordreisa changed their priorities and used the money at far less urgent localities downstream. The new restoration plan of NorWat/ Reisavassdraget here at my farm in Bilto has in fact such an old background, and I hope my story will push the case.”

• Where can we find those ideas or pre-studies that might have been performed before the official planning process started?

“NVE (Water engineering authorities), state water authorities, Narvik city, the county and municipal agricultural offices have documents, maps, calculations and decisions showing the background information.

In addition, the river protection authorities in Oslo used the cultural landscape memories of settled villages and farmlands in upper Reisa valley as one of the reasons to exclude the River Reisa from water power development, and later as a positive feature of the buffer zone of Reisa national park. Now that more and more of my soil is sliding into the river, all these stated qualities are undermined. People in this region will get depressed and perhaps leave this Kven –Sami cultural fringe in Troms.”

• Which other groups or stakeholders have been involved, and what kind of feedback have they given?

“The neighbour farm and its meadows in the same farm cluster as Rognli, received protection status during the 1980s. All parties, including state water engineering authority NVE, find it appropriate to regard the whole river section in front of Bilto farm cluster as a traditional riverside farmland of historical value. If not, the river very soon will undermine both the meadows at the upstream and the downstream farm. The riverside artificial embankments will be eroded.”

• Are there any administrative or political decisions done until now?

“Except for the latter decisions (see above), we still want to see a practical updated restoration plan for our riverside meadows. This would be a compromise between river hydrology and cultural landscape protection. We have received project plans for the required erosion protection works with financing for the year 2006 and practical plans to be fulfilled in 2007.”
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• If yes, which of these decisions do correspond with our aspirations and how?

“The latter (see above) do correspond with our aspirations, achieving both a cultural riverside landscape protection and a reasonable riverbank stability at Bilto, a key area of landscape values and cultural-tradition in the Reisa valley.”

• Which decisions do not correspond with our aspirations, and may even be illegal or too binding from our point of view?

“The ruling and settled Government strategy gives permits for strict “natural river” restoration schemes only. If this principle is followed strictly, other important multiple use objectives will not be achieved, for instance maintaining livelihoods from traditional riverside farms in the north. Compromises are needed at least in settled villages and farm clusters. In addition, the Norwegian parliament’s annual budget allocations for riverside tasks have been far too small for these purposes.”

• Which of the decisions are finalised, and which are not?

“I hope that the budget allocations will increase (due to the implications of climate change) and that the criteria for funding will be broadened. I also hope that the historical documentation on this case at my property will change the ruling tendency of refusing or delaying the work which needs to be done.”
Case 2  The Runoff Pollution from regional landfill area at Galsomelen

The terrain establishes the facts and the solution

Galsomelen is a riverside birch forest terrace 200–800 m from the Reisa river, 3 km from its outlet. Since the 1980’s a municipal landfill site is located here. Since the 1990’s the site has been used as a regional landfill for Northern Troms county. Until 2005 it also received 40 % of the dry residual waste from the city of Tromsoe (ca 40 000 inhabitants).

The distance from the centre of the landfill to the level of the Reisa river is about 200–250 m. The terrace has surface layers of sand above unstable submarine clay. The formation is an ice front deposit. Upstream marine clay is deposited in the former postglacial fiord. At a similar terrace formation 1 km to the north, a big clay slide occurred in 1986. Recently minor clay slides (heights 10–15 m, width 30–60 m) have occurred at the southern margin of the formation. Rivulets are draining the terrace towards north and south through ravines of the River Reisa.

Sampling during NorWat field trips (2004–2005) revealed substantial heavy metal and pyrene water pollution at the northern rivulet. In addition, the rivulet catchment was actively grazed by sheep. Nearby, there is also a steep gravel mine with dangerous slopes inside the area close to the public delivery area. Neither the landfill area nor gravel mine are fenced according to current instructions.

In 2004 Reisa river was declared to be a nationally protected salmon river. This means that all land use and water quality are to match this status. Also the European Water Framework directive was gradually introduced in Norway.

In spite of this, and in spite of the pollution findings, the regional landfill company published extension plans which means doubling the landfill size and capacity. The landfill owner had also made an environmental risk assessment, stating that no surface runoff pollution was present around the landfill. It also stated that the landfill was run according to instructions.

However, several shortcomings were revealed during municipal hearings and subsequent NorWat investigations. These were related to sampling and runoff water-tests, geological mapping as well as shortcomings in the whole case made for the landfill extension.
The county environmental authorities gradually became aware of the situation and put forward several orders and claims. The landfill owner was ordered to install a double runoff filter at the sorting house and to make considerable improvements in monitoring the runoffs. Substantial improvement related to bad smell problems were also ordered. However, the landfill owner did not comply with these and other time limits, but has now (autumn 2006) fulfilled some of the ordered improvements.

The earlier landfill at the same site does not have the obligatory double lining and is not controlled for any leakage. The “what should happen”-conclusions reached by the NorWat team are:

- No extensions at this site should be allowed because of the persistent pollution runoff risks
- The old landfill should be monitored and isolated, or completely removed.
- The existing landfill should be closed, monitored and isolated.
- A new regional waste deposit solution should be found, so that the location of such a site should be distanced from protected salmon rivers and other waters.

What is happening just now?

Applying the planning participatory inquiry code to this case, the environmental action trigging question with its sub-question was: “What is happening just now?”

Sub-questions

- **What is happening in the field?**

  NorWat field trips in July 2004 revealed very high heavy metal values (Pb, Cu, Ni, As etc.) in rivulet water near the landfill area. Hundreds of sheep were grazing by the brook, draining to Reisa river. There is a hikers’ rest place downstream, also utilised by roadside tourists. Drinking water is taken from the brook.
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• Which office or officer in the political and administrative system is running the case?

Central state pollution authorities (SFT) introduced sharpened national regulation in 2005–2006. This means closing of all residual waste landfills before 2009. Due to this information, the county and municipal environmental authorities tightened the landfill control and claimed improvements in the risk assessment.

• Where can we find the updated planning documents?

The landfill owner and manager distributed a risk report and draft plans about the planned extension. They also joined 2 field trips to the landslides and polluted brooks.

• Where can we find the work documents and draft plans? Are they open for the public?

NorWat staff and environmental organisations (such as neighbour boards, local agro-boards etc.) repeatedly asked for updated central and county case documents, and were last included on the mailing lists.

• Where and what are our allied stakeholders or interest groups?

The following allies were listed, contacted and informed:
– Snemyr village board
– Kildalen and Reisadalen landowner association
– Reisa River Association
– Nordreisa sheep farmers
– Troms county environmental department
– Troms county agricultural department
– Ministry pollution authorities (SFT)
– Nordreisa municipality (landfill owner)
– The landfill manager/company (Avfallservice A/S)

• What is the timescale for the planning process and when will the decisions be made?

A time table for the planning process has been drafted. The historical background of the case has been investigated and analysed as part of the NorWat subproject “Galsomelen landfill runoff”. The 50-page-report is available in Norwegian.
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- Should this planning process be different from the present situation and how should the modifications be promoted?

This sub-question is linked to the next main question “What will happen?” It shows the opportunities for immediate actions to stop or change the present planning position. The NorWat team with its stakeholders considered whether to pursue an immediate action by informing the police. Following consideration, the sanction procedures of the county environmental administration were trusted.

Unfortunately, the progress of the case is still delayed, and the county environmental department has been short of field staff to monitor the case.
Case 3  The Reisa estuarium impact caused by fish farming accident

NorWat and fishermen diving to the depth of the Rotsund village fish infection case

Due to serious fish disease, fish farming activity was far from normal for a couple of years in the River Reisa. During 2005 the activity could be normalised in the western parts of the Reisa fiord estuaries.

For two years, fish farming had to be reduced almost to zero inside a broad zone from Lyngen to Finnmark border. This caused salmon farmers substantial economic loss. ILA-infection (Infectious Salmon Anaemia) spread widely from the salmon farm “Nordreisa Laks” in Rotsund village to 15–17 other plants. At “Nordreisa Laks” infected carcasses were not properly removed during summer and early autumn 2003, causing alarm along the Troms and Western Finnmark coast and salmon rivers. It is not documented, if ILA infection spreads from farmed salmon to wild river salmon, but the case highlighted the need for much stronger control, both to prevent ILA spreading and salmon escapes from the farms.

Instead of obeying the order of the district veterinarian to slaughter about 100 tons of newly infected fish, the farm awaited the situation, and then hid a vast amount of carcasses. This was in excess of 100 tons in nets at the bottom of the river close to the farm.

In July 2003 two local fishermen, however, discovered fish fat clusters floating on the fjord surface in the sheltered sound. They informed the governmental coastal office immediately, but unfortunately this office did not react. Colleagues at an extraordinary meeting in the Nordreisa wild fishing board were astonished and agreed to investigate themselves what had happened, having in mind the local ILA infection discovered in May. In September they hired a diver, a boat and a submarine camera. At the bottom they discovered enormous quantities of salmon carcasses held down to the bottom wrapped in nets.

This incredible story was published in the local media. Subsequently the supervising authorities became aware of it and ordered removal of the dead fish. In the meantime and during the next weeks about 15 other fish farms were infected. This accident represents one of the biggest fish cultivation scandals in Norway ever.

In spite of this, the fish farmer continued to break the law. Carcasses were lifted up but unfortunately tons of the waste had spread to fjord...
Fish farming has traditionally been very active in the spectacular Lyngen-Rotsund sound area, close to the Reisa delta/estuarium. Two years ago the area was closed because of irregular activity and serious accidents. (Photo: Øystein Dalland)

water because of holes in the lifting nets. In addition, the fish farmer did not transport the 26 tonnes of carcasses raised to the combustion plant as instructed but to a cheaper place, namely a municipal landfill area in another county. The bad-smelling open container was found during an occasional snow scooter trip. However, the illegal container was left for another 2–3 months before finally being transported back for combustion.

The case had revealed weak environmental readiness and poor security procedures. But instead of simply blaming all the parties, Nordreisa community initiated a “learning by experience”-project, coordinated by the local “Naeringshage” (Local Small Business Association) and acted in cooperation with “Prosjekt Reisavassdraget”, from 2004 also including NorWat.

Two workshops were arranged with a large number of participants, one for the local wild fishermen and one for the fish farmers in Northern
Troms. The results of both workshops were later reported by the above mentioned projects. The ultimate report with recommendations was addressed to the Nordreisa municipality, the salmon farmers association, the coastal ministry directorate, the environmental department in Troms county, and to the ministry directorate of pollution in Oslo. The key question here was “What should happen?”.

The above-mentioned “Rotsund report” (2005) was seen as very useful in the further national improvement of the environmental safety plans in the north. It can be applied in planning integrated use of the northern waters for offshore oil industry, shipping, fish farming, and nature protection, for instance.

Finally, the owner of the salmon farm in question was found guilty in a court of law and received a heavy penalty.

The trigging key question sequence that the local fishermen put forward was: “What has happened?”, “What is happening now?”, “What will happen under to official strategies?”, and “What should rather happen according to the local perceptions, documentations and investigations?”
Case 4  The Holmen-Slettset / Tørfosslandet restoration case

Liberation of local knowledge provides a good solution

NVE, The Norwegian Water and Energy Directorate was planning to open a 1.2 km flow channel west of the main course of the River Reisa at Holmen bridge. Two public events were organised. A very concerned farmer at Slettset repeatedly intervened and finally declined to cooperate at all. He did not give any reason for his behaviour.

During a field visit, NorWat staff members made contact with him. The farmer advised:

“This plan means that a new riverside embankment is built at my meadows. However, the river might still overflow onto my land during extreme floods. This happened to my father in 1955 with disastrous effects. A new artificial embankment closer to my house and other buildings will also dominate the landscape.

You should rather investigate the possibilities of re-opening flow channels on both sides of the river along a longer stretch of the river bends upstream the bridge. By doing so, we will achieve even better salmon habitats and still better flow control in a natural way, without impacting on my property alone.”

The farmer’s experience and knowledge of the River Reisa course movements during decades was utilised. In this way, the farmer supported professional planners with facts that led to a more holistic and ecologically sound approach.

Aerial studies and subsequent field trips to the opposite side of the river revealed an old flow channel. This had been ignored during the planning process before listening to the farmer above.

The trigging key question in this case was particularly “What should (rather) happen?” contrasting the solution according to the ruling “What is (officially) to happen?”. By analysing the message from the official planners (“This is good for us all”), the farmer revealed a risk of inevitable double communication: “The officially planned task might harm your farm”. The farmer happened to turn his experienced knowledge of the river into a creative and constructive dialogue by presenting his new proposal. Later it was integrated in a modified official plan.
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The Holmen-Slettset restoration site, lower section with former flow channel visible in the foreground. See also the possibilities of opening a flow channel on the opposite riverside. (Photo: Map Aid, Sandvika)
Case 5  The Kildal bridge restoration case

Performing without warning as an occasion for mutual learning and plan adjustment

The first pilot tasks in NorWat river restoration activities in Norway were to be performed in 2004–2005 in one of the River Reisa’s tributaries. The idea was to open a flow channel in the River Kildal at Kildal bridge, to smoothen artificial riverside embankments and to construct a security embankment closer to the nearby farm.

The legal and formal plan procedure had continued for 8 months including hearings and field visits with landowners. Then the final plan was elaborated and mailed to the landowners. The main landowner (the nearby farmer) had just transferred his farm to his son, and the latter obviously felt that he had not got enough information.

In two ways he was right. By a mistake, the ultimate plan documents and information on the starting date of the practical implementation had not reached him. In addition, he had not joined the field trips during the early stages. So, the son was astonished to meet machines and engineers in his riverbank forest during the first day of the practical work. He insisted that the work be stopped, protesting that he had not been informed.

Instead of arguing, the planners and the engineer admitted that communication during the preceding weeks could have been better. For example, a simple phone call to the farmer had not been made. The case did not lead directly to a withdrawal. Instead, the engineers and planners stated a subsequent question: “What do you want to happen instead?”

It was wintertime and the river flow was very low at the time. The farmer was told, that it was perfect timing for the restoration work. The farmer agreed but also pointed out some arable land-lots that should be sheltered. He suggested that if some adjustments to the planned flow channel were made, he would then allow the work to continue.

After a two-hour negotiation including a joint field trip the progress of the work was protected. The task itself was somewhat adjusted in favour of the farmer. The restoration area of an Alnus riverbed forest was somewhat reduced, but in the light of this case being the first pilot example, good local cooperation was given priority.

The turning point in this difficult participatory process was the admitting strategy of the engineers and planners. By abandoning their powerful position and by listening to the farmer both parties found that they had
something to learn, directly in the field and also from the administrative point of view. All parties could say: “We have to improve our communications routines” – the son towards his father and the engineers towards the target groups in general.
Case 6  The Styggøya restoration site

Taking of small quantities of gravel from the riverbeds for household and farm purposes has long been allowed in Norway. The practice is also regulated by law. Gradually, however, these activities have expanded to illegal commercial level in many places.

The case of Styggøya restoration had the four main purposes, (a) to stop the illegal gravel mining in Reisa, (b) to reshape the gravel island, restoring also the salmon habitats for rare and endangered riverside insects, (c) to open a 1 km flow channel for flood event and salmon habitat purpose and (d) to prepare a road and riverside camp site (for short term use inside Styggøya.

The catalyst for these tasks was to achieve an agreement with the gravel entrepreneur. The aim is to get old machinery and stone deposits removed from the area. The waste material has been left at Styggøya for many years.

Styggøya, Reisa river, after the opening of new flow and fish channel. (Photo: Øystein Dalland)
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During 2002–2004 the entrepreneur, also a land owner, claimed that he has the full right to run the gravel mines according to his traditions. He also referred to informal and formal agreements with the municipality some years ago. The state water authorities had since 2004 threatened the entrepreneur with legal action, and the state was unwilling to pay all the restoration costs of impacts caused by illegal activities.

During 2005, instead of stressing the illegal aspects of the activity, NorWat and the municipality put themselves into a role of being “compromising agents”. It was admitted that that the former public control and agreements had had shortcomings. The major landowner (a relative of the entrepreneur) got some building lots as compensation, and a site was offered where the entrepreneur could leave the mining residue.

The multiple roles of the entrepreneur and the major landowner were also challenged, both being active sport anglers and members of the tourist and recreation boards in Nordreisa. So, a consensus of the common objectives gradually evolved during 2005.

The aim was to achieve a change to this ugly and harmful site of the river and to restore it to being one of the most beautiful views and fishing places on the river Reisa. At the same time the local school adopted a nearby site, the Goroso river bend for field trips as part of NorWat education activities. Thus more public eyes were focusing on the challenges.

The State Water Authorities (NVE) could start their work at the area in 2006. The entrepreneur subsequently actively supported the environmental activities at Reisa, for example the hatchery tasks described later.

As described above, stalemate in an environmental case evolved towards a practical solution and stepwise learning. This happened, thanks to the willingness of the most powerful parties to give the other party some rights. This action created a common platform for creativity and compromising. All the four key questions – “What has happened?”, “What is...?”, “What will..” and “What should...?” - were active tools in turning the case towards a positive solution.
Case 7  The traditional hatchery in the Reisa Valley

Stubborn opposing actions or providential environmental readiness?

Despite some doubts, the county administration gave in 2004 the Reisa River Association a permit for building a hatchery in the Reisa valley. It was a question of being a blueprint of the traditional ground water driven hatchery from 1930, originally built by the local farmer cooperation. The old hatchery was closed in the 1950’s. There was a strong local desire to reconstruct the hatchery. There were several supporting arguments:

- About 50 km of artificial riverbanks have been constructed to protect farmland. This had reduced the quality of the river habitats and had also caused increased stream velocity and increased riverbed erosion.

- Transfer of some 10 % of the summer water charge from Reisa to a neighbour river for power purposes.

- Significant reduction of spawning fish in the river due to net fishing at sea and previously in the river.

- The threat of Gyrodactilus spreading from other Northern Troms rivers (Skibotn) to Reisa.

- The threat of genetic infections from salmon farms in the fiords.

These five factors can all be regarded as relevant. However, quite another approach was taken by both the parties, the local fishing organisation and the county. The reconstructed hatchery was said to be a cultural memorial of the traditional knowledge and village cooperation in the valley, and as such the project was accepted.

The environmental department at the county administration stepped aside and let the agricultural department run the decision making process. The permit to continue was given, provided that a scientific monitoring project would be run before the hatchery starts operating and provided also that the environment department accept the proposal.
The ruins of the old hatchery and the brand new “old-style” hatchery in the Reisa Valley. (Photos: Ottar Remmen)
It is very probable that the NorWat connections with Finland, Sweden and Scotland and NorWat partners’ contributions as consultants and witnesses made it more difficult to refuse the project. Now that the hatchery has been built (2006), it is today an excellent resource for environmental awareness purposes, for scientific purposes and also for the claimed traditional and interpretive values.

Where was the triggering force in implementing this case? It is very likely that people were extremely motivated because of their direct and indirect memories from successful participation processes in the past. It is so called “hatchery dugnad” in the 1920’s. The Norwegian word dugnad means neighbourhood cooperation and participatory work towards a common goal. There was also a strong wish to study the past in order to achieve a modern objective: improved environmental security for the vulnerable Reisa salmon stock. The key question to speed up subsequent application and practical jobs was the local perception of the history. “What has happened?” was an essential question in this case.
A contribution towards ecological conflict understanding in Norway

The Multiple Use Matrix (MUM) is a tool for environmental planning

The approach of the Multiple Use Matrix is to expose the relations and impacts of human activities on the environment, both natural and man-made. By this method we can forecast the consequences of planned or prospective human impacts or decisions. The impacts can be studied from social, ecological or economical aspects. Different attributes of land use, activities of man and environmental impacts are identified and analysed. These are steps towards conflict understanding and management.

The Multiple Use Matrix (MUM) is a tool for environmental participatory planning. The planning site should be as well defined as possible. The target area can be a resource (see footnote 1 for explanation, p. 111) or a landscape unit such as a watershed, a village, a mountain area, a forest area, a piece of farmland, a property, an island, a lake, or even a single farm, building or organisation.

The structure of a multiple use matrix

Different land use activities in the planning or influence area are registered by field mapping and/or by public hearings. Each kind of interest or land use status is given a number and is then listed vertically as well as horizontally, creating a network matrix. The matrix has two axes where the relevant land-use characteristics or activities or social interests (“rights”) within a defined region are listed.

The matrix table enables us to analyse the symbiotic positive (+), neutral (0) or negative (-) relations between present land-uses or the different kinds of nature status, and between planned prospective land-uses or impacts and their influence on the present state of land use. See a simple example in the table below.

The matrix helps us to analyse the interaction of both present and future actions. These relations are not merely symmetrical. The impact consequences run in both directions, causing two different effects, as you can see in the table.
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By using diagonals (/) inside each square or box, we can describe how a selected land use category or interest is influencing another activity and vice versa. For example, a hiking route (#3) in the target area may have a negative impact (- in the upper line) on stream vegetation (#5) but, vice versa, rare stream vegetation may increase the value of a hiking route (+ in the bottom line).

In addition, the origin of conflicts or positive impacts, characters of reciprocity, function or power can be presented in the table. Within each square, space is available for a footnote which can be opened and described in the text related to the analysis. See the table below where the footnotes are marked in brackets, e.g. (8).

Table 1. A simple example of a multiple use matrix with interrelations (+,- or 0) and explanatory footnotes.

<table>
<thead>
<tr>
<th>Land use activity</th>
<th>1 Summer cottage area</th>
<th>2 Sport fishing site</th>
<th>3 Hiking route</th>
<th>4 An old mill of cultural history value</th>
<th>5 Rare stream vegetation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Summer cottage area</td>
<td>- / / + (1)</td>
<td>- / - (2)</td>
<td>0 / + (3)</td>
<td>- / - (4)</td>
<td></td>
</tr>
<tr>
<td>2 Sport fishing site</td>
<td>0 / / + (5)</td>
<td>- / - (6)</td>
<td>- / - (7)</td>
<td>- / - (8)</td>
<td></td>
</tr>
<tr>
<td>3 Hiking route</td>
<td>- / / + (8)</td>
<td>- / - (9)</td>
<td>0 / 0 (10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 An old mill of cultural history value</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Rare stream vegetation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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How to use the footnotes in a multiple use matrix?

The footnotes inside each square refer to explanations on specific conflict or positive effect. By using footnotes, we can also analyse the two opposite relations between land uses: “influencing” and “influenced by”. Ten such mutual relation pairs occur in the example above. The idea of this example was generated from the analysis of a NorWat target stream in Saarijärvi.

Examples of possible footnote explanations

1) A new summer cottage area planned close to the stream may cause negative effects on the fishing site: diffuse runoff, clearings of riverbed vegetation, disturbing wilderness landscape perception etc. On the other hand, the fishing site with good access and facilities in the vicinity of the summer cottage area might improve the leisure activities of children, disabled and elderly people.

2) The summer cottage area and the crossing or adjacent hiking route might be mutually harmful. It is possible that landscape elements and perceptions are disturbed at the hiking route due to the cottages. On the other hand, the traffic and the route itself might disturb privacy at the summer cottage area.

3) The summer cottage area might benefit from the nearby water mill due to increased landscape and historical values. The mill can be an interesting visiting target for the inhabitants of the summer cottages. Vice versa, the impact is more or less neutral (0).

The matrix can be applied in different phases of the planning

The analysis might also help the decision makers and advisors take into account both the specific landscape elements and also the local political priorities. The matrix may form a working tool on how to find a balance between these factors during the planning phase. The analysis can also tell what kind of details and activities should be eliminated from the actual plan.
Depending on the actual planning phase of an environmental project, the matrix table can be presented for three different target groups:

1) During early planning phase the target group is formed by the public, relevant NGOs and land owners. Many different local interests and land uses are presented in the matrix.

2) During the decision phase of a new plan the target group is mainly formed by the local political boards and municipal authorities. The aim task of a matrix is to work as a basis for decision making.

3) After the political decision (in our case either “there is a new summer cottage area” or “there is no summer cottage area”), there is the need for second public hearings. At this time the public and other local stakeholders are asked to give feedback from the previous decision. Solutions for minimising conflicts and optimising compromises are being sought.
By using this method in the planning site, we can register both the dominating strong interests but also the economically “weaker” matters. However, the latter may be socially or ecologically very important. Thus, multiple use matrix can give an important democratic input on the official EIA process (environmental impact assessment) in any region. This presumes, of course, that the opinions and ideas of local NGO’s (non-governmental organisations) and other stakeholder groups are included in the analysis. See also the example of the Styggoya river restoration site in the next chapter.

The “planning by learning” aspect of the method

It is important to understand the existence of multiple ecological niches (see footnote 2, p. 111) of the modern man. Human beings are the most dominant species in the biosphere and can impact on other species in many ways. The impact can vary from mutually positive consequences (so-called mutualism) to different combinations of neutralism towards antagonism, as can be seen in our examples. This way the multiple use matrix offers a tool of planning by learning.
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Footnote 1 – What are resources?

Resources are so-called eco-zones or natural elements that are playing fundamental roles during the life-cycles of a species. They safeguard the basic needs of the species: food and water, mobility, protection and reproduction.

Footnote 2 – What are niches?

 Niches are the role played by each species within the eco-zones or ecosystems. They are so-called ecological pigeon-holes. Niches are represented by each species’ diversified energy (calorie) intake, behaviour, movements and ecosystem modifications (impacts).

Modern man has the ability to conquer a variety of ecological niches, ranging from being a plant eater close to the solar energy circle to being a western urban fossil fuel consumer, or ranging from the role and behaviour of a small scale farmer – to the one of an urban white-collar officer.

At species level people have a so-called eco-dominant role: over other species human beings have the character of cultivating, extirpating or replacing them.

Modern man also has the ability to play many different roles simultaneously. When we are extending our own ecosystems and occupying the niches of other species, we are changing the ecological relationships between many other species.

A good example of a “man-induced” ecosystem is the ancient Mediterranean agriculture of terracing where new bushes (grapes), new tree species (olives, Citrus) and new vegetables (in stead of natural grass and herbs) were introduced.

The method is saving words and gives the planners, politicians and other stakeholders a tool to handle several social and/or environmental factors at the same time. Overlapping land use practices can be analysed within the same area, and on the other hand, two adjacent areas (or bio-regions) can be compared by means of one single matrix.

The history and origins of the multiple use matrix MUM

During the economic crisis of the 1930’s one of the first examples of ecologically based public multi-purpose programmes was introduced in some US regions. The so-called Tennessee Valley Authority program (TWA) applied regional analyses on ecological and economical factors and relations in the Tennessee Valley watershed area or ecosystem (geo-
Good Practices in Northern Watercourses

system). The anti-erosion activities (tree-planting and contour ploughing) were analysed at the same time as tasks like damming, fishery, recreation development, infrastructure, waterpower development and economic resettlements.

Several integrative and holistic approaches to environmental planning were developed more or less independently during the late 1960's and 70's, among them the Multiple Use Matrix. Gradually, human ecological conflict studies have entered the scene of planning by the introduction of legislative EIA process (Environmental Impact Assessment) as part of terrestrial or marine regional planning and management.

For an interested reader, the idea of MUM is most widely described by the Scottish professor Ian Mc Harg in his book “Design with nature” (1st ed. 1971) in the chapter “The river basin”. One of the early developers of this approach is Dr. Øystein Dalland (Geografen, University of Oslo 1969, Geoforum 1978, University of Tromsoe 2000), who has applied the method within the NorWat project.

The main advantages of the multiple use approach

1) The method brings together different opinions from different interest groups. According to the so-called minimum law of Liebig “an ecological or social chain is not stronger than its weakest link.” By utilising the matrix model, so-called “smooth” interests, such as ecological values and non-profit interests, children’s and minority groups’ opinions, are all qualified and considered in the scheme, side by side with the “heavy” economic interests and resources.

2) The method integrates time, space and human rights/interests. The method takes into consideration past, present and future scenarios.

3) The method saves words. It is a useful tool for all parties involved in the process and is also a training tool in analysis and planning, and may to a certain extent be computerised.

4) Bottom-top-method is utilised. Anyone can define and add into the matrix axis new factors and issues of their own interest.

5) The model takes care of the principle of conflict asymmetries. Complicated relationships (conflicts and mutual interests) can be analysed in a simple way.
Participatory Approach and Community Development Hand in Hand

Some limitations of the model

1) The predictability is low in cases where the model area (region or ecosystem) is vast or defined in a vague way. Thus, the studied cases and geographical territories should be well defined.

2) The predictability is low in cases where complex land-use (or interest) categories are not split up into relevant specified attributes or activities (i.e. human ecological impact factors acting in a sub-species manner).

3) The method should be restricted to regions and circumstances with various combinations of land-use and resource interests and social right challenges. It is not realistic to scan every area.

4) The method does not define priorities among conflicts or mutual interests, but gives a useful tool for political decisions concerning land use and water resource management.

Application of the Multiple Use Matrix at the Styggøya restoration site

The River Reisa is ca 140 km long (excluding tributaries), and is the second longest river in the Troms county in northern Norway. The river is affected by two power plants in its tributaries. Now the River Reisa is protected against further power plant building and other water development work. In 1986 the Reisa National Park was established, including the Norwegian part of the Halti mountain. More than 20 sites in the River Reisa have now been restored.

The Styggøya site is one of the target areas where NorWat actions have been implemented. In this part of the river there are gentle rapids surrounded by wide gravel islands and protected alder (Alnus sp) forests with some sheep grazing. The flood plain and adjacent forest have also some red-list bird and insect species. Illegal gravel extraction, artificial riverside embankments made of stones, a riverside road and polluted runoff from a neighbouring landfill site are some of the challenges that are faced in the area.
Possible restoration tasks in the future include opening of an old meandering flow channel (400–600 metres long), smoothening the artificial river embankments and the previous gravel mining areas, constructing a new roadside camp and fishing site (including for disabled people), and cleaning the landfill site’s runoff. All these actions seem to have positive effects on the river environment.

**Different restoration options were carefully considered**

The decision to choose these restoration solutions was based on an analysis of all the main land use interests and important nature sites in the area. The multiple use matrix was used as a working tool in this process where different interest groups (e.g. land-owners, state road authorities, voluntary groups) worked together.

Here in our example, there are 15 different land-uses, both marked and numbered vertically in the left side of the table and horizontally on the top of the table.
Participatory Approach and Community Development Hand in Hand

Table 2. An adaptation of the environmental participatory planning method MUM (Multiple Use Matrix with comments). Styggoya river restoration site, Reisa, Norway.

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How to read and interpret the multiple matrix table?

A form of land-use, such as an *Alnus* forest reserve at the riverbed (land-use #4) might have positive effects on another land use such as on a new camp site (#13) at the riverbed. But on the other hand, the camp site might cause negative effects on the *Alnus* forests. This may be due to increased sewage and possible disturbance of the rare bird species existing in these forests. See the relation #49 in the matrix table for mutual analysis and comments.

In the upper line within the square we focus on the active influence from the vertical listed land-use on the horizontally listed one, and give the sign plus (+), zero (0) or minus (−) depending on the actual impact. Then we put a diagonal (/) on the next line. On the 3rd line of the square we make an opposite relation analysis. Now the active influence from the horizontally listed land use on the vertically listed ones is analysed.

Footnotes can be marked on the bottom line of the squares. Footnote numbers refer to impact analysis texts where a detailed analysis of each conflict or positive impact pair can be written. For example, we can describe how the conflict or positive relation has arisen. What are the manifestations in the landscape? How should the conflict be solved?

Possible solutions in conflicts could be retreating or elimination of one or even both of the conflicting land-uses. Sometimes some compromising or optimising actions may be enough. As has already been described, in many cases political decisions are needed. Multiple use analysis can give useful and objective information for the decision makers and help them understand the complicated relationships between different interests and land-use forms.
Sorsele Eco-Municipality in Sweden: sustainable community development

In this article, we briefly describe the experiences and good practices gained in local development of Sorsele municipality. Although the process has been started already in the 1990’s, there are useful links to NorWat activities and partnership. Public participation and involvement has been essential in the project.

Introduction and background information

In 1990, Sorsele joined the “Eco-municipality” project which aims at reconciling ecological and economical thinking where economy means “housekeeping with scarce resources”. Housing, food, health, education, work and other human needs should be satisfied. We can make use of our natural resources but in a considerate way so that the “larder” is not emptied.

Sorsele municipality has concentrated on the rational use of energy, waste disposal and schools’ environmental work. This strategy also gives companies and households opportunities to act in an ecofriendly way. Setting environmental requirements for purchases and tendering actions, disseminating information and good examples about sustainable development and creating economical resources are working tools of the municipality.

The Eco-municipality project is a bottom-up process. Village communities, associations, schools and households themselves should present ideas and experiences for a sustainable society.

Study circles had a key role in the beginning

In the first action plan (1991) three objectives were outlined:

1) Increase knowledge and commitment regarding environmental issues everywhere in the society

2) Gradually move towards more environmental-friendly techniques
3) Increase the quality and processing level when using local resources

The action plan has thereafter been renewed and partially integrated in the strategic programme “Sorselelyftet” (meaning “Boosting Sorsele). This is described at the end of this article.

Local commitment is the basis for the development of Sorsele as an Eco-municipality. In total, about 1/3 of the municipality’s inhabitants have participated in different ways in the compilation of eco-propositions during the 1990’s.

In the beginning, the work was run mainly through general study circles. Each circle had a responsible organization such as a village community, a sport club or another interest organization. In many cases, the circles have led to a continuing development process, e.g. in several villages and inside business organisations. This work was not just about environmental issues, but also about how to use the resources in a more efficient way, promote the area and create jobs.

Later on, some working groups were established to go more deeply into different issues like food processing, construction and mountain management. It became clear that different parts of the vast municipality had a different understanding of which issues are the most important for sustainable development.

Schools were actively involved

Quite early in the project, pupils and staff wanted to know more about environmental issues. Since then, the schools have worked with these issues, often in practical projects together with the municipality, companies and associations. The pupils have also been excellent information channels to other parts of the society.

During the first half of the 1990’s, there was a lot of work with “general environmental information”. During the last years, the adult training work has focussed more on specific targets, also according to the interests and needs of people. For example, tourism companies are especially interested in transport and nature issues, house-owners in heating and waste disposal and farmers in food processing and bio-energy possibilities.
Other important training measures

Higher education in the framework of "Akademi Norr" has often focused on development of local resources. Study visits have been organised for the public, schools and companies. Different environmental projects and installations like district heating station, briquette manufacturing and recycling plant have been shown to people. It is very important that everybody can see what has been done locally and that this is profitable.

Many companies have developed environmental plans about their rational use of energy, and purchase and resource efficiency. Environmental work can often be seen as an important competitive factor.

Practical eco-examples in Sorsele

The environmental work at schools

All schools and kindergartens work with environmental issues and nature in many ways, according to their local environment. For example, pupils have built an ecocycle house for vegetable growing and for composting. Other schools have carried out “environmental missions” for companies and associations. Schools have, for instance, done water and acidification research for the municipality and local fishing associations. Many schools have organised information campaigns about waste and the sorting of household waste. Two schools staged an exhibition about eco-labelled products.

Waste and recycling

In 1990, 6000 tonnes of waste used to be deposited per year in landfill sites in the district of Sorsele. Today, 50 tons are deposited per year and 600 tons are burnt. The rest is returned or recycled and mainly used locally. Now, there are recycling stations, wood waste is burnt and biowaste is composted.

Economizing energy utilisation

Sorsele has during many years had a strategy to minimize the use of fuel for heating. Today all public buildings and almost all industrial buildings and blocks of flats are connected to the district heating network. There are also interests in bio-energy and wind power production.
In the mountain village of Ammarnäs, a radio network has been set up in particular to better coordinate the transport opportunities. People, who have to travel large distances, inform others using the radio relay link. Purchases can be coordinated or car-pooling organised.

Agriculture and food processing

Active farming is essential to keep the landscape open and preserve biodiversity, but also to create jobs in the countryside. The farmers in Sorsele have their own association, “Sorselebönderna” (meaning Sorsele’s farmers), that works with the processing of local primary products. Many new activities have been created around the farming activity, such as catering services, bed & breakfast and bio-energy production.

Historically, the meadows along many of the rivers have been grazed by the cattle. This, in combination with spring flooding, has created a very special environment and unique fauna and flora. Due to rationalising and reduction of farming, the share of grazed land has been reducing, and the riverbanks are becoming overgrown by weeds.

Large areas have now been cleared of weeds and fenced all along the Vindel River. Today, cattle are grazing along the Vindel River from Ammarnäs in the west to Vännäs in the east. Cooperation has been carried out also with the World Wildlife Fund (WWF). The project contributes to the preservation of a unique biodiversity, and stimulation of farming. Open traditional landscapes are also important for tourism.

Waterway restoration

The Vindel River is key in the district of Sorsele as far as biology, tourism and outdoor life are concerned. A lot of resources have been invested in the restoration of affected areas. Old timber floating constructions and culverts have been cleared up and natural habitats restored to improve fish migration and spawning. At the same time, some of the old constructions have been preserved, because of their high cultural value.

Water and fish conservation affect many people. It is therefore essential, when a watercourse is to be restored, to consult all stakeholders. People have to feel they are truly involved in the process and see the results of the actions.
Participatory Approach and Community Development Hand in Hand

Eco-compatible companies

Today, 50 companies in the district have developed their own environmental plans. The companies have in particular been able to show big improvements in their energy efficiency and the management of waste and chemicals. Sami communities work actively with environmental adaptation in energy, economy and guarantee of product quality. An interesting detail is that the Gran Sami community started using horses in reindeer herding instead of motor vehicles.

Positive experiences from the eco-municipality work

Sorsele was one of the first municipalities in Sweden to start working proactively with environmental issues and for a sustainable development in a broad meaning. The biggest profits of the Eco-municipality are related to the attention that these issues received, and to all actions in the field of information and training. The eco-process has clearly showed that the proactive work is far more important and efficient than regulation.

Another conclusion is that the municipality alone can not change so many things. The municipality has an important role as a coordinator of the work, but it is even more important that schools, companies, associations and individuals get involved and act. A sustainable development should be based on a bottom-up approach where people are given the opportunity to influence the process.

The fact that Sorserle is a huge sparsely populated municipality has a big influence on the focus of the eco-work. The transport and energy issues are of outstanding importance. The solutions are not the same as in big cities. Local and small scale solutions have to be found, as often and as many as possible.

Many examples can be given where the connection between environment and economy is obvious and positive. Processing local products and waste, rational use of energy, active farming, tourism and reindeer herding are all dependent on the environment. Restoration of watercourses helps both aquatic organisms and fishing tourism. It is important to find and show such connections. This way, people more easily develop a positive image of environmental work as a development factor, instead of a threat that leads to problems and restrictions.
Participation and tangible results

One condition to succeed is to get people involved in the work for a sustainable development. The first step is to disseminate information and good examples. All must get a common knowledge base to start from. After that proposals can be made about what needs to be done. Tangible measures must then be applied as quickly as possible. They must be clearly useful, if possible both from an ecological and economical point of view. Environmental issues can easily become abstract raising an attitude of “I am not concerned”. That is why it is important to carry out things that have a good local connection.

A few well appreciated eco-initiatives are the local recycling plant, actions concerning grazing cattle and open landscape along the Vindel River as well as measures to preserve biotopes in watercourses. All these projects are visible, the results are tangible, they are clearly useful and they contribute to something positive for businesses and the public, as well as the pure environmental benefit.

Eco-municipality work can, at its best, contribute to a positive development with new jobs and more competitive companies, while the environment is protected for the future. Obviously, a remote northern municipality, like Sorsele, has more to win from such a development. There are a lot of resources the demand for which will be high in the future: clean and partially preserved environment, fishing waters, hunting opportunities, primary produce of renewable energy, areas for relaxing, and real winters with snow and cold temperatures.

‘Sorselelyftet’, a local strategic development action plan

During the year 2000, many inhabitants in the municipality of Sorsele took part in the work called ”Sorselelyftet” (meaning “Boosting Sorsele”) which is a local strategic action plan that is related to the regional growth plan and the objectives of EU documents. The programme focusses on increased co-operation, mustering of strength of the local resources and unique environment.

During the work process with Sorselelyftet, it was obvious that Sorsele’s assets are the unique environment and the rich natural resources, the proud and committed people, the social network and belief in the future. The weaknesses are to be found in the falling population leading to reducing infrastructure, community services and leisure opportunities.
Participatory Approach and Community Development Hand in Hand

Moreover, long distances require special solutions concerning community development and environment.

Methods and priorities for successful environmental work in Sorøle are seldom the same as in big cities. It is important that this work contributes to a positive local development and will continue after the project period.

Further information is available at:
www.sorsele.se
PART II

Many Watercourses Need Our Help – Experiences from Restoration and Water Protection Activities
Inland waters have been used for multiple purposes

Water is a very typical feature in the Nordic landscape. Inland waters cover 10 % in Finland, 8.5 % in Sweden, 5 % in Norway and 2 % in Scotland of the total area. For example, the Saarijärvi region in Central Finland, one of the NorWat target areas, is characterized by interconnected lakes, small rivers and rivulets.

Lakes and rivers have had and still have a significant role in the northern way of life. Watercourses have been utilised in transportation, in supplying drinking water, as sources of energy, as fishing grounds and places of recreation. Many of the watercourses have been utilised very extensively, and in many places human impact on this natural resource is remarkable.

The list of human-induced changes in the inland watercourses and their near environs is long. For example dredging, damming, canalization, ditching, digging, loading, regulating water level, building different constructions and filling of the watercourses have caused many harmful effects. Timber-floating with floating channels, flumes and other constructions is one of the most significant activities in northern Europe having caused many negative impacts on river and brook habitats.

There are several pressures on inland waters

There are several pressures affecting water quality. In Finland, the main “point source loaders” of inland waters have been the forest industry, municipalities and fish farming. In some areas peat production has also been a contributor. However, improved techniques in wastewater treatment in particular have decreased phosphorus and nitrogen discharges during the last couple of decades.

A bigger problem in many areas is the so-called “non-point or diffuse source loading” caused by, for example, agriculture, forestry and drainage of bogs, sparsely populated settlements in rural areas and atmospheric deposition. Regulation of lakes and rivers can also cause pressure on the quality of inland waters.
Many northern watercourses have been heavily exploited. For example, timber floating has caused significant impacts on water systems in Scandinavia. (Old photos from Swedish archives)
Good Practices in Northern Watercourses

Due to the various negative impacts on river and lake habitats different corrective measures are needed. Lake restoration in Finland dates back to the 1950’s. The measures and techniques vary from pollution and eutrophication control to biomass control, sediment removal and lake management for fishery (see Keto et al 2004). In lake restoration projects a long-term commitment to the work is necessary, and the activities should relate to the whole catchment area.

A small-scale lake restoration project was implemented in NorWat. See the case description of Käihälämpi restoration later in this chapter. Also some small-scale river restoration activities were carried out in all four project countries. Experiences were very positive, for instance using a brook restoration as an educational project. See the case description of Rahkosenpuro in the section on environmental education.

Three cases from the Norwegian pilot area along the Reisa River have been described in Part I. See cases 4–6 for further details. It is important to deal with both the technicalities of river restoration activities and the methodology of participatory approach.
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In addition to the improvement in the ecological condition, successful river restoration can lead to positive recreational experiences. (Photos: Greger Jonsson)
Application of the EU Water Framework Directive in Sweden

EU Water Framework Directive is meant to secure the sustainable use of water and good water status by 2015. In Sweden the Water Directive has been integrated into Swedish legislation and five new Water Authorities have been founded to implement the necessary work.

In the county of Västerbotten this work has started with a survey of surface and ground water as a basis for action programmes and management plans. Co-operation between authorities, companies, organisations and individuals is important to succeed in this matter.

Cooperation between organisations

Within NorWat, contacts were established early between officers at the County Administrative Board of Västerbotten, the Department of Fishery and Environment, the Vindel River Advisory Fishery Board, the Swedish Anglers’ Association, the Rural Economy and Agricultural Society of Västerbotten, the Municipality of Sorsele, and landowners. The partners decided to initiate cooperation and test practical actions and methods to meet the intentions of the Water Directive.

River Gargån, within the Vindel River water system and the municipality of Sorsele, was chosen to be a pilot area. This happened mainly because the river Gargån catchment area is practically manageable, from both a geographical and administrative perspective. Gargån was also a target area for ongoing inventories and restoration activities which could be useful also for NorWat purposes. A similar project, Forest for Water (FFW), had already started a study circle about the Water Directive with a local interest group. It was natural that NorWat and FFW started co-operation. See further information about the training course of landowners in Part III.

NorWat focused on the characterisation (description) of river Gargån catchment area. The main part of this work was carried out by officers from the County Administrative Board of Västerbotten/ Department of Environment, the Municipality of Sorsele/ Fishing Department and the Vindel River Advisory Fishery Board.
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Characteristics of the River Gargän in 2006

Basic data
Outflow area: 842 km²
Average water flow MMO: 13 m³ s⁻¹
Population density: 0.4/km²

Hydrography
Length of the watercourse: 199 km
Number of lakes >0.1 km: 114

Point sources
Purification plants: 2
Waste dumps: 4 of which 3 closed nowadays
Pits: 6
Influence N from purification plants, drain: 1190 kg/year
Influence P from purification plants, drain: 150 kg/year

Diffuse sources
Traffic, road density: 0.48 km/km²
Leakage from ground, forestry, forest clearings: N 0.27 kg/ha year
Leakage from ground, forestry, forest clearings: P <0.01 kg/ha year
Acidification sensitivity, share of land area: 3%

Water supply
Water catchments: 1
Wells: 28
Power stations: 0

Physical changes
Dams: 16
Identified culverts: 14
of which measures are needed: 7
Timber floating objects restored before 2002: 10 %
Timber floating objects identified 2002: 123,
    of which restored 51, of which restored within NorWat: 5
Ditches: ?

Land use (proportion of the catchment area)
Population centre: 0.2 %
Forest: 66.0 %
Forest clearings: 5.6 %
Cultivated land: 0.4 %
Bogs, peatlands: 21.0 %
Water: 7.2 %

Proportion of artificial land in the catchment area: 11.8 %
The results from the river Gargån characterisation are summarised in the following tables. Methods and variables largely followed national guidelines given by the Swedish National Environmental Protection Agency. Maps (GIS system) have been produced for certain data, such as basic data, hydrographs, point sources, land management and other relevant information about fish management and biological data.

A challenge in maintaining good water status

The river Gargån catchment area is sparsely populated and the impact of human activities is relatively insignificant. Point sources of pollution are few and mostly located in the lower part of the catchment area. The total input of nutrients from point sources is almost negligible compared to both natural and human caused diffuse ground sources of nutrients. The physical impact is mostly related to forestry: poorly located ditches, culverts and damage on the ground caused by logging machines.

In the past, many watercourses in the area were used for timber floating, which has left traces of old dams, stone piers, cleared riverbeds and cut-off side channels. Significant areas of the watercourse have been restored under projects between 2002–2004 and earlier.

According to Water Management Regulations the status of water should be based on an assessment of biological quality factors (fish, bottom fauna, water plants). Physical-chemical and hydro-morphological factors should only support the classification. Biological data from river Gargån is insufficient to make a complete classification possible. This is also true regarding available water chemical data. However, data from electro-fishing is available from five locations in the middle and lower parts of river Gargån. The status in two of these locations is good and in three of them moderate.

The total effect on hydro-morphology may be evaluated through a number of indicators that describe the extent of land use and the physical changes in the water courses. The share of artificial land within the river Gargån catchment area is 11.8 % which supports a good status according to basic classification criteria for hydro-morphological influence. The impact of timber floating is significant, but as a result of restoration work the indicators related to this influence should indicate a good status in most parts of the water system. However, the artificial obstacles to fish migration indicate a moderate hydro-morphological status. In the river Gargån water system there are many identified obstacles for migration but probably also some that are not recorded yet.
Although there are gaps in the basic data we can conclude that the status of the river Gargån catchment area is overall good. The need for action is relatively limited and consists mainly of locating and modifying or removing obstacles for fish migration. The future challenge for the river Gargån is how to manage the water resources and surrounding land areas in such a way that the present status can be maintained. For the local community it is a matter of understanding the value of a good water status and identifying strategies and actions to combine ecological and economic sustainable development of this natural resource.
Paleolimnology – a window to the past

Sediments tell about the human impacts on the watercourse

The Water Framework Directive (WFD) requires that the quality of surface waters is at good ecological status by 2015. The Saarijärvi watercourse is part of the water quality monitoring network in Finland. The purpose is to find out effective protective and reinstatement measures. A problem is that we do not know what the natural or so-called reference state of the lakes is. That is a very fundamental question to managers planning and setting mitigation measures.

Almost all environmental and water quality data have been collected during a relatively short time period. The first water quality analysis has been made in the 1960’s and biological analysis even later. Therefore, we have not enough understanding of how the water quality and condition of lakes have developed to their current state.

The sediment is like a history book of the state of an aquatic ecosystem. The deep basin of a lake is like a sediment trap. The deepest deposits are the oldest and are overlaid by younger deposits. When the age of each deposit is known, we can make conclusions about the changes in the ecological status of the studied lake. In the best case, we can distinguish annual growth rings in the sediment, as in trees.

Most changes are quite recent

The first changes in the lake sediment took place more than several hundred years ago. The first impacts from agriculture in Central Finland are about 4000 years old, but the biggest changes in the ecological state of the lakes have taken place during the last two centuries. In most of the lakes in Central Finland the changes can be seen as late as in the 1900’s, but there are still lakes, where there are no changes at all or they are insignificant.

Microscopic algae and animal residues are the main research targets, when the changes of a lake’s ecological state is defined. The most important targets are the residues of diatoms (Bacillariophyceae) and non-biting midges (Chironomidae). There are hundreds of different diatom and chironomid species in the lake sediment. Each species has its
own specific environmental requirements. Based on the species and their biotic communities, the state of the lake in question at various points in its history can be concluded.

**Sediment samples from the lakes of Saarijärvi watercourse**

The University of Jyväskylä/Institute for Environmental Research took sediment samples from 8 lakes in the Saarijärvi watercourse as a part of the NorWat project. The sediments were taken with a so-called Kajak sediment sampler in June and September 2005. The lakes were selected to represent different parts of the watercourse from the headwaters to downstream. It was also essential that the lakes were deep enough to maintain undisturbed sediment layers. The objective of these sediment studies was to compare the present state of the lake with its natural state, in order to define the goals of future restoration and management activities.

*Photo: Arja Palomäki*
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The physical, chemical and biological analyses of the sediment samples were made in the environmental laboratory of the institute. The water content, loss of ignition, phosphorus content and diatom and chironomid remains were analysed from the uppermost and lowermost 2 cm thick sediment layers. The upper 2 cm sample represents the present state of the lake, and the lowest 2 cm tells about the natural state of the lake, at least 100 years ago.

Naturally humic and eutrophic waters

The Saarijärvi watercourse has always been humic and relatively eutrophic, even before the significant human impacts. Changes in land use, such as forest drainage (ditching) or peat production, have not notably influenced the large lakes of Pääjärvi and Kalmarinselkä in the upper reaches of the main watercourse.

Figure 1. Proportions of diatom taxa representing different trophic status classes in sediment samples of the lakes of Saarijärvi watercourse. S = surface sample (0–2 cm), B = bottom sample (the lowest 2 cm). Surface sample represents present ecological conditions, whereas bottom sample represents the ecological conditions of the natural state of a lake, at least a hundred years ago.

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The consequences of diffuse load can be noticed more clearly in the lakes of the downstream areas of the watercourse (lakes of Lannevesi, Saarijärvi, and Mahlunjärvi). They used to be less nutrient-rich than at present, but were not, nevertheless classified as oligotrophic lakes. The most clear human impact and loading can be found in the small lakes outside the main route (lakes of Karankajärvi andIso-Haaranen). See the figures below.

![Bottom Quality Index](image)

**Figure 2.** Bottom Quality Index (BQI) calculated from chironomid taxa of sediment samples of the lakes of Saarijärvi watercourse. BQI values vary from 0 to 5, value 5 indicating the sediment quality of an undisturbed, oligotrophic lake with excellent oxygen conditions, and value 0 indicating the sediment quality of highly polluted or extremely eutrophic lake with total oxygen depletion and with no bottom fauna.

The information on lake history can help us in setting up the appropriate objectives for water protection and to allocate the relevant measures in restoring the lakes.

In the figures below changes of ecological condition in eight different lakes of the Saarijärvi watercourse are illustrated.

Further information is available at:
www.jyu.fi/erillis/ymtk/en/
Introduction to river restoration

In Europe, as in most places all over the world, the riverine systems have been changed due to human activities. We Europeans have exploited our riverine environments in many ways. Practices related to forestry, agriculture, water power, peat industry, housing and transportation have several impacts on our watercourses. The quality and intensity of exploitation has varied a lot from one type of water use to another, and different activities have been particularly practiced in different regions and at different times. The changes in the rivers and tributaries have typically taken place gradually over many centuries, but the most radical period of human impact took place between 1850–1970.

Many rapids in the Finnish Lake District were already exploited heavily in the early 1900’s. Dam, mill (left) and flume of timber-floating (right) in the Jyränkoski rapid (Valkeala, 1909). (Photo: Photograph library of the Finnish Environment Institute)
There is a need for restoration measures

Severe exploitation has caused many kinds of harmful effects on our riverine ecosystems. There are several examples of negative influences on environment and fisheries:

- the habitat and flow pattern has been simplified
- natural landscape has been changed
- terrestrial-aquatic linkage has weakened
- retention capacity has decreased
- the pool-riffle-sequence has been broken
- side-channels have been dried
- biological diversity has diminished
- the life-cycle of migratory-fish has been broken
- recreational use has become more difficult.

*Dredging for agriculture, forestry and water power has radically changed the river channel and the riparian zone and reduced biological diversity. The river Komujoki (Vitasaari) one year after dredging in 1994. (Photo: Anssi Eloranta)*
As a result of extensive watercourse utilisation, there are lots of low-producing and ecologically damaged riverine ecosystems in many places in northern Europe.

**Towards natural or undisturbed status**

The river restoration can be defined as returning to the natural or undisturbed state of the riverine ecosystem. This does not mean that the watercourse looks after the restoration exactly as it did before the damage was done. The goal is, however, to make the result as close as possible to the former natural river system. Restoration activity aims to improve ecosystem’s structural and functional diversity. Restoration is understood as an active, non-recurrent and a relatively massive measure, whereas management is a continuous action, based on a relatively small one-time effort.

It is only in the 1990’s that river restorations became prominent in helping the recovery of the degraded water bodies. In earlier restorations, for example in the 1970’s, there was not sufficient ecological expertise available. Many of these early river projects have needed later improvement. In the present decade some international agreements have assigned new challenges to the restoration activity. For instance, restoration is understood as an important method to meet the targets of EU Water Framework Directive.

**All restoration projects are different**

The sizes, tasks, funds and procedures of river restoration vary between projects and between countries. Typically, there are ecological, recreational, scenic and conservational objectives in a restoration project.

There is no international classification for different river restoration projects, but in Finland they are grouped into four types:

1) Obligation restoration of timber floating channels: Main target in these projects is to repair the negative impacts of former timber ting and to remove harmful floating constructions.

2) Mandatory restoration of fisheries authorities: Typically the project area is a single rapids or a longer course of rapids with national level importance.
Early restoration schemes were treated with suspicion by local residents. Successful examples, however, increased their trust and river restoration became one of the most popular forms of water engineering. The Huopanankoski rapid (Viitasaari) before (above, 1993) and after (below, 1996) restoration. (Photos: Anssi Eloranta)
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3) Voluntary brook restoration: These projects typically include small-scale work in small rivers and are undertaken by different groups of people. The main tools are spades, wheelbarrows, rakes and saws and other simple tools.

4) Other restorations (e.g. catchment restoration, environmental river engineering, fishway technology).

A check-list of good practices in all restoration projects

The combination of different measures is regarded as the core of a restoration project. In general, the ecologically-grounded measures form the prerequisite of success. Naturally, the existing conditions and the specified targets of the project affect the selection of necessary measures. Only rarely can the restoration measures be chosen solely on an ecological basis. Usually, it is a question of compromising between the needs of different water users.

Despite the differences in each restoration project, there are “golden rules” that are worth following in all restoration projects. The restoration measures should:

1) aim to attain the original nature of the river type
2) improve the whole ecosystem, not only the life-conditions of a few fish species
3) help the ecosystem to heal itself by initiating beneficial processes of changes
4) include only the most necessary measures for enhancing re-colonisation
5) use all-year-round solutions
6) monitor and change methodology, if needed.

Typical restoration measures used to include building of spawning grounds and hiding places for the salmonid fish of different age, diversification of water flow and depth conditions and reconnection of drained parts of the river channel. In addition, supplementary measures have been used, such as protection of river banks and constructions against erosion, suction and dredging of harmful sediments, building of different fishways and by-passes, renovation of culturally valuable buildings by riverside, and control and planting of instream and riparian vegetation.
River restoration projects vary in their sizes, main tasks and practical procedures. Voluntary brook restoration (above) are small-scale, low-cost and valuable for raising public awareness of the problems of the riverine waters. The aims of catchment restoration (below) are for example to remove fine sediments and obstacles caused by forestry operations. (Photos: Anssi Eloranta)
Water-mosses belong to the key-species of the riverine waters. For faster re-colonisation of river flora and fauna wide patches of river-mosses should be left on the river-bottom. The river Viivajoki (Kannonkoski, 2000). (Photo: Anssi Eloranta).
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Both large machinery and human effort are needed in river restorations. Boulder placement (above, Ruijankoski rapid, 2002) and spawning nest building (below, Kivikoski rapid, 2006) are the dominant measures in Finnish restoration projects. (Photos: Anssi Eloranta)
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The importance of the supervision in the practical implementation cannot be overestimated. The Tuhmakoski rapid (Saarijärvi, 2006). (Photo: Anssi Eloranta)

Implementation phase of a restoration project is the key for success or failure

Practical implementation of the restoration measures is one of the most critical phases in the restoration procedure. The general instruction is to work from upstream to downstream during a period of low water. Normally, both large machinery (e.g. excavators, dumper truck) and small-scale tools (handwork) are used in the same project.

The quality of the supervision in the practical implementation work is seen as more and more important. It is possible to design a great restoration plan, which can, however, fail due to poor control during the field work.

Until now, quite a lot of restoration work has been done in the riverine waters in Finland, Norway, Scotland and Sweden. Restoration research has produced diversified information and the scientific background to the practical projects has become stronger. More attention has been paid to the design of restoration measures, to the restoration practice in the
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field and to the arrangements of valid monitoring. The financiers of the projects also demand more information on the effectiveness of restoration measures.

In this manual we want to give some examples of new restoration measures and thus, hopefully, improve the restoration procedures and their results in the northern watercourses. Some cases and their outcomes are described.
River habitat restoration experiences in Sweden

Practical experiences in a floating channel restoration

Human activities such as constructions for timber floating have significantly affected wild fish populations in many watercourses in the northern hemisphere. Rivers have been cleared of most boulders, and they have been canalized and dammed for timber floating during 1850–1970. After the end of the timber floating period in rivers several restoration projects have been initiated – primarily in smaller tributaries.

Earlier river restorations only emphasised fishery goals, such as providing good fishing pools and easy casting places. Now river restoration projects aim to return rivers to near natural or undisturbed states. Ecological evaluation of practical restoration is made by an integrated interdisciplinary research project.

The Rivers of Vindel and Piteå are heavily exploited as a result of former timber floating

The Vindel River and Piteå rivers in Northern Sweden have been affected by timber floating. These rivers belong to the four national rivers protected against further hydropower exploitation in Sweden. The total length of timber floating channels in these rivers were 3 000 km during 1930’s. During the 1950–1960’s gravel and boulders were dredged by caterpillars from the river channels onto the riparian zone. Approximately 800 000 – 1 000 000 cubic meters of rocks and boulders have been removed from the river bed. The ecological condition of the rivers has been improved by the restoration project.
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Sometimes large machinery is needed for the restoration work. A special excavator bucket has been designed for river restoration. (Photo: Daniel Holmqvist)

Also lighter tools are needed. These have been designed specially for spawning ground restoration. (Photo: Daniel Holmqvist)
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How was the restoration done in practice?

1) Planning period

Before restoration the dimensions of all floating constructions are documented. Planning period also includes photographing, electro fishing surveys and studying suitable reference areas, if existing. Old aerial photographs give information on the history of the riverbanks.

All restoration measures are intended to reinforce the natural structures and function of the river in question. Modern restorations also emphasise the need for good conditions for spawning areas for trout (*Salmon trutta* L.). Careful planning is necessary.

2) Timing

All work is aimed to be done during low-water periods. However, no restoration is undertaken during the spawning season on well known spawning areas for trout and salmon (*Salmon salar* L.)

3) Equipment

Excavators of different sizes and numbers are used in practical restoration work. Environment adapted oils and gasoline are used. A qualified supervisor leads the work and all excavator drivers are certified for restoration work. Their knowledge in biology, environmental issues and health and safety is tested.

4) Moving stones and dredging material

In many cases side channels of the river are opened and dredging material of all sizes is spread in the channels. Broken parts of rocks and boulders are placed under the water surface for aesthetic reasons. The natural mosaic structures of river channel are returned with shallow and deeper sections.

5) Cultural values

Constructions of timber floating with high cultural-historical values are left for educational and museum purposes after having negotiated with the cultural authorities and local people.
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6) Restoration in the spawning areas

In spawning areas restoration is done by hand with special tools, often at the same time as the excavation work. Riverbeds with suitable gravel and water velocity are restored by raking existing and remaining gravel together. Spawning grounds are often built between two or more stones functioning as stream concentrators.

7) Results

Results of river restorations include broader rivers, more varied shorelines and bottom topography, as well as more extensive areas for fish, bottom animals and plants. River restoration is also an important method for attaining the objectives of the EU water framework.

This stone pier has been preserved for cultural reasons. Notice the cut stones. (Photo: Daniel Holmqvist)
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Canalized tributary before restoration (above). The same canalized tributary after restoration (below). Notice the difference in width and water velocity of the river. (Photos: Daniel Holmqvist)
A stone pier has closed the side channel of the river (above) and the same place after the restoration (below). (Photos: Daniel Holmqvist)
Semi-circular culverts to help fish migration

Road crossings cause several problems for water biota, mostly for migrating fish. But it is also a problem for aquatic insects that may drift downstream if a sudden change in water quality appears, and then find it impossible to return due to the culvert that stops the re-migration. Typical examples are insufficient water depth in culverts, clogging of culverts with rubbish and sediment, outfall barriers, excessive water velocity, lack of resting pools above and below culverts, harmful turbulent flow patterns and overgrown vegetation.

The ways of preventing these problems can be very simple, but still effective. In the following example from the River Vindelälven in Sweden, the objective was to reconnect the disrupted migrating route of water biota so that the migration is possible almost year round. The results have been very positive.

Solution A: Lower the present culvert

The existing culvert is lowered so that the downstream fall disappears and a deeper water level within the culvert is created.

Solution B: Building of the culvert pools

Artificial pools are constructed downstream and upstream from the culvert by replacing stones and boulders in the stream channel. Downstream replacement raises the water level and covers the bottom edge of the culvert.

Solution C: Semi-circular culvert

The semi-circular culvert replaces the circular culvert. Sometimes it is possible to simply cut the standard circular culvert into two pieces and then remove the artificial culvert bottom. This type of culvert needs, however, a very careful and thorough foundation in soft soils, such as in peatlands.

Semi-circular culverts are also industrially manufactured. One culvert of the length of 17 metres and of the diameter of 2 metres costs about 5300 euros.
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There is a migration problem for fish because of the culvert (above). Water level in the culvert has been raised and a good passage for fish has been created (below). (Photos: Greger Jonsson)
Fish have difficulties in this kind of culvert (above). Water level has been raised by locating stones downstream from the culvert (below). (Photos: Greger Jonsson)
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Examples of semi-circular culverts at the streams of Kvarnbäck and Holmtjärnbäck. (Photos: Greger Jonsson)
Towards better restoration results in Finland

In the following case descriptions we introduce some useful, good practices discovered and developed during the river restoration projects in Central Finland. The main “architects” of these solutions are Mr. Anssi Eloranta, the fish biologist and Mr. Matti Pitkäjärvi, the master builder of the Central Finland Regional Environment Centre. The articles are written by Anssi Eloranta.

**Case 1  A casting place for fishermen**

Fishermen and nature-watchers need places, where it is easy to cast bite or fly, rest and just enjoy the environment by looking around at the rapid area.

**Solution A: Natural boulder**

We should prefer natural solutions rather than artificial ones in the river restorations, whenever it is possible. A good primary solution is to move a flat, beautifully formed boulder in a suitable place in the rapids. If it is too far from the shore-line to the boulder and the water is deep, some extra stones can be put in place for steps to reach the boulder. The size and location of the boulder and stones depend on the variation of the water level.

**Solution B: Casting pier**

If the stream channel is wide, deep, fast-running and popular for fishing, and it is located in the cultural landscape, the building of artificial piers is recommended. These constructions are also necessary for disabled people using wheelchairs.

First, we make a rectangular log-box resembling the model of an old supporter construction used in timber floating. The difference from the traditionally built log-box is that here there are clear gaps between each log layer. This allows the water to flow inside the log-box and thus also
The old timber-floating wall (above) in the Simunankoski rapid (Laukaa, Central Finland) was demolished and replaced with two casting piers (up right).

The landscape became more natural, and the nursery areas on the shore received enough water. (Photos: Anssi Eloranta)
Good Practices in Northern Watercourses

A box for a pier was made of old telephone poles (above). The log-box was filled with stones and then anchored into the river bottom. One corner was directed against the current. The box was also equipped with long girders. Finally, the construction was boarded and safety structures were added. (Photos: Anssi Eloranta)
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gives the aquatic animals shelters. After building the log-frame it is lifted by tractor or digger into the water and anchored tightly into the river bottom. The anchored frame is then filled with stones of different sizes. The final phase is to lift and fasten the girders between the shore and the log-box, and cover the whole construction with boards. Thresholds around the construction improve its safety.

It is important to seek a good location for the pier, so that one can cast in many directions. The idea of the gaps between logs of the frame is to make it possible for young fish and animals to hide in the crevices of stones. This type of pier makes the netting of the catch easier in the calm downstream side of the box.

Case 2  Tube-transportation of spawning gravel

Sometimes it is only possible to transport spawning gravel by lorries or tractors to the riverbank. For example, steep bank slope, sensitive conservation interests or housing can prevent access of vehicles to the shoreline of the riverine water.

Solution: Gravel tube

A special gravel-tube was developed and built in the Kalmukoski rapid in Central Finland. The riverbanks were so steep, that the gravel cars or tractors whilst loaded with gravel could not access the river valley. Because of this the spawning gravel was transported and stored up on the riverbank about 30 meters from the shore-line. Then a big funnel of plywood board was built and attached tightly to a plastic tube of 20 meters in length and 200 mm in diameter. Spawning gravel stored on the riverbank was carried into the funnel in a tractor’s scoop.

Then gravel ran through the tube into a scoop of a digger. The gravel is then placed in the spawning ground with the appropriate profile. This method is quite slow and suitable only in very difficult conditions. If the slope is too gentle and if the gravel material contains a lot of fine and wet grains, blockages are quite common. Pouring a small amount of water into the funnel can help prevent blockages.
The funnel-tube is fulfilled with the spawning gravel during the restoration work of the Kalmekoski rapid (Saarijärvi). The man behind the funnel is spraying water into the funnel in order to improve the gravel's run into the tube.

(Photo: Anssi Eloranta)

Gravel is usually loaded into a scoop or a storing place in the lower part of the tube.

(Photo: Anssi Eloranta)
Case 3  Prevention of frazil ice and its harmful effects

In wintertime, most of the Scandinavian rivers are covered totally or partly with ice. Conditions where the river channel is heavily-dredged, long, lakeless and steep, lead to a situation where the water current is fast-running and turbulent, and becomes easily super-cooled in early winter. During sharp frost, ice-crystals start forming in the surface of water, especially in the lower parts of the rapid. The crystals of frazil ice join together and cling to different solid particles (e.g. stones, plants). The formation of frazil ice can be very rapid and can cause much harm for local people (i.e. ice-dams).

Solution: Careful placement of boulders is essential

The main task is to change the conditions so that the formation of normal ice-cover begins before frazil ice. Important measures are, for example, slowing down water velocity, decreasing turbulence and increasing the water volume. Sometimes a return to the natural width of channel can decrease the problems of frazil ice.

It is seldom possible to completely prevent frazil ice formation. In spite of this, the successful placement of boulders and stones make a network of pillars, which support ice cover. After a sheltered ice-arch has been formed, ice-cover cannot sink down against the river-bottom. Observations made in Central Finland have shown that a mass of frazil ice attached to the river-bottom melts within a few days.
Frazil ice is usually formed in supercooled water in the lower section of the long, lakeless rapid course. It is called “bottom frazil ice”, if it clings to stones or mosses of rapids, or, “surface frazil ice”, if it clings to the edge or below the ice cover below the rapids. The Piikakoski rapid (Uurainen) in 2005. (Photos: Anssi Eloranta)
Careful placement of stones and boulders (left) can sometimes completely prevent formation of frazil ice. Even if the restoration does not remove the problem of frazil ice, restoration stones can prevent ice-cover sinking down against the river-bottom (right). The Virtalankoski rapid (Keuruu). (Photos: Anssi Eloranta)

Case 4 Visibility problem of culverts

Headwaters can be important spawning and nursery areas for migratory fish. Unfortunately, forest road constructions, especially culverts, have cut connectivity between headwaters and lower parts of rivers. Culverts became very common, when the timber-floating was finished in the riverine waters and the wide network of the forest roads was built in the mid-sixties. Now there are many thousands of culverts in Central Finland alone, for example.

Overgrown vegetation is one of many problems related to culverts.Bushes and twigs can cover an opening of a culvert so badly that adult
Water insects flying upstream do not see the opening. Especially, if the road behind the culvert is wet and covered with asphalt, insects can make a mistake and start following it instead of the water channel.

**Solution: Awareness of culverts and clearing of vegetation**

Generally speaking, it is important to improve the knowledge of the general public on problems of culverts. Integrating needs of water flora and fauna into the planning, design, construction and maintenance of roads is also necessary. It is easier to do this before and during the installation of a culvert than after it.

*Vegetation and bushes can conceal the opening of culverts and block or even totally disturb the passage through it (left). Bad visibility can mislead adult water insects out of the river channel (right). (Photo: Anssi Eloranta, picture: Simo Yli-Lontinen)*
Many Watercourses Need Our Help

Problems concerning the visibility of culvert openings do not need major efforts. Clearing work of overgrowing vegetation has to be done once or twice a year. It is also recommended that a wooden or stone “platform” is built in the culvert for the passage of otter and weasel.

Poor visibility, low water level and many kind of rubbish can cause difficulties for migration. Unfortunately, bridges and culverts are also typical garbage places in the populated areas. The brook Köyhänoja (Jyväskylä). (Photo: Anssi Eloranta)
Case 5  Electric lines and river restoration

Narrow passages (i.e. rapids or other riverine areas) of the water courses are typical locations for bridges, water pipes, and electric- and telephone lines. In the worst cases for example in Central Finland, more than 10 wires and lines can cross a river channel. These constructions often spoil both landscape and habitats of flora and fauna.

Electric and telephone lines cause many harmful effects on the river environment. High trees can cause electric arc or discharge and falling ones can break the lines. The line-owners tend to leave a wide and cleared buffer-zone on the both sides of the line. These protective measures damage the beautiful view of the area and reduce the ecological diversity.

Solution A: Hiding the lines

In valuable environmental areas a modern solution is to bury lines and cables underground. Replacing an old overhead line with an underground one is more expensive.

Solution B: Mitigation the buffer zone of lines

Instead of expensive underground solutions, other ecologically friendly alternatives can be difficult to apply. Safety regulations need to be followed, but at the same time as many natural features as possible should be left within the riparian zone of 20–30 meters. Some natural shore vegetation, small groups of bushes and some native tree species are recommended to be left in this zone.

Old, tall trees are often in danger of falling onto the lines. Usually they are cut down by the owners. Better solution would be to cut the top of the tree. The trunks then gradually die and lose their bark. Together with the low-growing, living trees and bushes they form a more diverse, productive and natural ecosystem than the cleared zone.
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Different open-air lines decrease environmental values especially in important landscape areas. In the Huopanankoski rapid (Viitasaari) electric and telephone lines were undergrounded, removed and combined. (Photo above: Aarno Isomäki, photo below: Anssi Eloranta)
Old, tall trees are important elements of landscape and ecosystem, but they are also a risk to electric and telephone lines. A good compromise is to remove the top of the trees. The Riekonkoski rapid (Saarijärvi). (Photo: Anssi Eloranta)
Case 6  Migration problems in the Saarijärvi watercourse

The Saarijärvi watercourse is one of the five main watercourses in Central Finland. Heavy exploitation (dredging, damming, water regulation, ditching) has considerably modified it. During the last 15 years modified rapids have been returned to a more natural state. By the end of the year 2007 all eleven (11) rapid areas in the main channel will have been restored. The prospects for productive spawning and nursery areas are therefore good.

See the table below describing the working schedule in the rapids of the Saarijärvi watercourse. The rapids are located in the areas of four different municipalities: the towns of Saarijärvi and Äänekoski and the municipalities of Karstula and Pylkönmäki.

Unfortunately, this is not enough to recover the broken lifecycles of migratory-fish. A good outcome also needs good water quality, safe migrating routes and feeding areas. Restoration is only as good as the weakest part of the whole lifecycle.

Table 1. Restoration schedule of the rapids in the Saarijärvi watercourse.

<table>
<thead>
<tr>
<th>Rapid Name</th>
<th>Restoration Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kiminginjoki (Karstula)</td>
<td>permit 2006 (restoration 2007 *)</td>
</tr>
<tr>
<td>Kouheroistenkoski (Pylkönmäki)</td>
<td>permit 2006 (restoration 2007 *)</td>
</tr>
<tr>
<td>Heijostenkosket (Karstula, Pylkönmäki)</td>
<td>restored 2000</td>
</tr>
<tr>
<td>Tuhmakoski (Saarijärvi)</td>
<td>restored 2006</td>
</tr>
<tr>
<td>Kalmujoki (Saarijärvi)</td>
<td>restored 2006</td>
</tr>
<tr>
<td>Lehtolankoski (Saarijärvi)</td>
<td>restored 2003</td>
</tr>
<tr>
<td>Muittarinkoski (Saarijärvi)</td>
<td>restored 2006</td>
</tr>
<tr>
<td>Riekonkoski (Saarijärvi)</td>
<td>restored 1999</td>
</tr>
<tr>
<td>Leuhunkoski bypass (Saarijärvi)</td>
<td>preplanning 2006; removal of timber flume 2006</td>
</tr>
<tr>
<td>Majakoski (Saarijärvi)</td>
<td>permit 2006 (restoration 2007 *)</td>
</tr>
<tr>
<td>Summaskoski (Saarijärvi)</td>
<td>restored 1999</td>
</tr>
<tr>
<td>Hietamankoski fish pass (Saarijärvi)</td>
<td>preplanning 2006</td>
</tr>
<tr>
<td>Naarakoski (Äänekoski)</td>
<td>restored 2003</td>
</tr>
</tbody>
</table>

*) permit and funding are in place, implementation depends on water conditions.
Good Practices in Northern Watercourses

The original migrating route from the feeding lakes (e.g. Lake Päijänne, Lake Leppävesi) up to the lower part of the Saarijärvi watercourse is reconnected with four fish passes. There are still two obstructions, the dams of the Hietamankoski and Leuhunkoski rapids, closing the migrating route totally in the watercourse. Both of these dams were built in the 1960’s. Full benefit from the river restorations cannot be achieved before overcoming these obstacles.

Solution A: Technical fish passes

Because of the high hydraulic heads (9–14 meters) and lack of building space in the environs of the water power plants the most likely solutions for the fish passage in Hietama and partly also in Leuhunkoski, are technical fish passes. A consultant (EcoResearch) presented their alternatives for fish passes in early December 2006.

The principal compromise for the Hietamankoski rapid is the so-called Denil fish pass in the lower part and the Borland lock in the upper part of the fish passage. This solution also enables recovery of more than 90 % of energy lost in the fish pass. In the Leuhunkoski rapid, the principal solution is a more natural bypass in the lower part and the vertical slot fish pass in the upper section.

Solution B: Fishery policy

The recovery of the broken lifecycles is difficult work and takes a long time. Even if water quality, migrating routes and nursery areas manage to recover, the lifecycle does not function unless all its parts work well. Fishery policy in rivers and especially in lakes is now the most restrictive factor for restoration success. In the Saarijärvi watercourse over-effective fishing by gillnetting, trolling and casting now prevents sufficient migration of smolts and mature fish between the feeding and spawning areas. The problem has also been described in Part I in the case of Saarijärvi Fishery Region.

In the action plans for the near future, the fishery regulations need to be established in relation to the whole water system of the Saarijärvi watercourse, and not within several small fishery associations. These aspects have now been taken into account in the new fishery management plan 2007–2012 of the Saarijärvi fishery region. For further information, read also the article about Saarijärvi fishery region in Part I.

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The Leuhunkoski dam and water power plant (above) totally close the migration route in the Saarijärvi watercourse. A timber flume, in the left side of the dam, was demolished in November 2006. The old river bottom of the Hietamankoski rapid in the lower part of the watercourse has been spoiled by the dam and water power plant (below). (Photos: Anssi Eloranta)
Over-effective fishing both in lake areas (above; Lake Mantojärvi) and in riverine waters (below; the Kapeenkoski rapid) still remove too many mature migratory-fish before their first spawning run. (Photos: Anssi Eloranta)
The best solution to open the original migrating route is to remove the old dam and to restore the river bottom. The Kotakoski dam (Kuhmoinen) was first blown up and then demolished by an excavator. (Photo: Anssi Eloranta)

Solution C: Terminological dilemma

The terminology of passage through obstacles is sometimes unclear and illogical. A bypass is a flexible and logical main term. It can be defined as a man-made or exploited water-channel, that makes it possible for aquatic fauna to pass various constructions or natural obstacles.

This main term can be sub-classified, for example, according to a user group or to a method of construction. A fish pass (fishway, fish ladder, fish passage) is a usable term, if the bypass has been built only for fish. A bio-way or bio-pass is more correct, if the target is to help all groups of the water fauna. In the future all the bypasses should be designed and built as natural or semi-natural passes as often as possible.

The use of these terms becomes more complicated, when it is discussed, if the bypass is nature-like or technical. A Denil bypass made of wood or stone is seldom nature-like. It is essential, that the natural or semi-natural bypass imitates a natural brook or rapid as much as possible. Regular dimensions and artificial material are typical for a technical pass, as distinct from the natural bypasses. The use of the term fishway or fish ladder is nowadays correct only in the context of technical bypasses.
A vertical slot bypass in the Kuhankoski rapid (above) is a typical technical pass. A beautiful waterfall of the Korvenkoski rapid was saved by building the first Finnish quarried semi-natural bypass (below). (Photos: Anssi Eloranta)
Case 7 Evaluation of the socio-economic influences of restoration

Generally speaking, river restorations are understood to be useful and also monetarily sound projects. They are also important in achieving the targets of the EU Water Framework Directive. However, we have limited understanding of the ecological, economical and social influences of river restoration. The Ministry of Agriculture and Forestry of Finland has identified increasing the understanding of the benefits of river restoration as one of their targets by 2010.

Different groups have been interviewed

A pilot project evaluating the socio-economic influences of river restorations was started by the Central Finland Regional Environment Centre in 2001. Target groups have been village communities, owners of riverside lands, clubs of recreational fishermen, canoeists, as well as fishery regions, fishery associations, tourist enterprises and practical river restorers.

The results of this project have been published in four articles. The results emphasise the importance of interactivity, transparency and good communication in all phases of river restorations. The majority of interviewees felt that their opinions have been taken into account fairly well or well in these projects. They also understood the different phases of the restoration procedure. Canoeists and tourist enterprises were the most critical groups.

Restorations have several positive influences. For example, the importance of fishery, and recreational and cultural-historical values are increased. Housing comfort and conditions of local tourist businesses are improved. Generally speaking, there have been less negative influences of restorations than were expected. The most typical problem has been in identifying a boat route through restoration structures. The wider the water channel is, the easier it is to find a compromise acceptable to different water users.

Significant economic benefits

From the viewpoint of tourism only, most restorations done in Central Finland have also been very profitable. 14 tourist enterprises estimated that river restorations have increased their annual turnover with about
Owners of land and summer-cottages are very worried about the effect of restoration on the high levels of water. Above: A summer-cottage by the Ruukinkoski rapid (Karstula) during the spring flood. Below: Canoeists are usually the most critical water user group in terms of river restoration. Problems increase a lot, if the mean water flow is below 20 m³/s. (Photos: Anssi Eloranta)
Most of the interviewees considered that restoration measures changed landscape positively. The Sahakoski rapid (Viitasaari) after restoration. (Photo: Anssi Eloranta)
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150,000 € (or have capitalized with about 2,000,000 €). This payback to businesses approximates to the total investments put into all the river restorations in Central Finland by 2006.

The results have also proved that the restoration projects raise values of many less material things. An interesting detail in the results is that most of the visitors and local people regard the scenic changes of the river channel and the return of the evocative sound of rapids as a very positive thing.

This pilot project in Finland shows clearly the importance of measuring the socio-economic impact of the restoration projects. There are several ways to improve the current situation of a more or less vague concept of the socio-economic impacts of the river restorations. First, a socio-economic analysis of perception should be made in all large restoration projects. The methodology should be developed and standardized to allow comparison. There are needs, for example, to develop a simple cost-effective method for estimating both ecological and non tangible benefits.

Further information is available at the Central Finland Regional Environment Centre: www.ymparisto.fi
Water protection activities in the Saarijärvi watercourse in Finland

Water quality in the Saarijärvi watercourse is seen as a problem. The waters in the region contain a lot of humus and nutrients, partly for natural reasons but also due to human impact. Agriculture is the biggest source of non-point loading, but forestry, fish farming, human settlements and peat industry also have their effects. The regulation of the lakes with changing water levels in the Saarijärvi watercourse is also detrimental on water quality. As always in nature, water quality is a complicated issue where many aspects interact with each other.

Improving water quality in the Saarijärvi watercourse was one of the aims of NorWat. The challenge was taken up by local people and town authorities in all meetings and hearings. The issue was taken into account in all actions of NorWat: community development, landscape management, restoration work and environmental education.

A handbook about the protective buffer zones in agriculture was prepared during the project. Interested and willing farmers were also personally advised on water protection issues. Forestry issues were even more focused, mainly due to the wide expertise in the NorWat network, the Forestry Centre of Central Finland being the leading organisation in these activities.

In the next three cases, some of our forestry-related water protection actions are described.

Case 1 Vellipuro – a sludge basin with a limestone

Vellipuro is a small streamlet emptying to another small rivulet called Konttijoki. The area is centrally located in the Saarijärvi watercourse. The streamlet was chosen as one of the target areas of NorWat after having negotiated with the environmental authorities of the Town of Saarijärvi. Also the local fisheries organisations were involved from the outset.

Agriculture, forestry practices such as silviculture and soil preparation and drainage of peatlands, and atmospheric deposition and acidification cause major pressures on the streamlet’s water quality. Vellipuro runs through wide peatland forests that have been drained for forestry
purposes. The water contains a lot of organic humus material and is also quite acidic. This is a problem especially during spring. Melting snow and waters from the surrounding peatlands increases the acidity in the streamlet downstream. Also high levels of sludge slide towards the main watercourse at this time.

Therefore, one of the targets was to decrease the acidity (or increase the pH) of the Vellipuro waters before emptying to Konttijoki. This should also improve the living conditions of trout. Another aim was to reduce the volume of sludge or humus sliding to the watercourse from the surrounding peatlands. The Forestry Centre of Central Finland took the responsibility for the task.

The idea was to test in practice a quite new method of building a fairly large sludge basin or sedimentation pond with a limestone dyke as a filter. The waters flow through the limestone layers and will therefore be somewhat neutralized before reaching the Konttijoki. Intensive follow-up monitoring about the changes in water quality were also planned. The land owner’s role in the project is essential, not only because of the need to permit the pilot project, but also as he undertook to look after the removal of the sludge for years to come.

Monitoring the impacts of the sedimentation pond in Vellipuro brook

The University of Jyväskylä/ Institute for Environmental Research took several water samples before and after the construction of the pond at Vellipuro and monitored the impacts of the actions on water quality. Water samples were taken from two branches of the brook upstream from the pond and also downstream from it. The water flowing out of the pond was also studied.

The water analysis results showed clearly that the sedimentation pond decreased the amount of solid substances to one fifth of that of the water flowing into the pond. The decrease of nutrient content and colour value was minor, however. See the table 1 for further details.
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Table 1. The monitoring of the impact of the sedimentation pond constructed in Vellipuro brook.

Water analysis results above (stations 1 and 2) and below (stations 3 and 4) the sedimentation pond.

<table>
<thead>
<tr>
<th></th>
<th>Depth</th>
<th>Temp.</th>
<th>Solid subst.</th>
<th>Conduct.</th>
<th>pH</th>
<th>Colour</th>
<th>CODMn</th>
<th>Tot. N</th>
<th>Tot.P</th>
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<tr>
<td></td>
<td>m</td>
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<td>mg/l</td>
<td>mS/m</td>
<td>mg Pt/l</td>
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<td>μg/l</td>
<td>μg/l</td>
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<td>3.2</td>
<td>6.0</td>
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<td>20</td>
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<td>1.4</td>
<td>3.3</td>
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<td>130</td>
<td>18</td>
<td>770</td>
<td>17</td>
<td></td>
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<td>Vellipuro 3, below the sedimentation pond</td>
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</tbody>
</table>

The newly constructed Vellipuro sedimentation pond. (Photo: Erkki Rautiainen)
Step by step towards better water quality

The Vellipuro case was/is run according to the following process:

1) Negotiation with the representatives of the Town of Saarijärvi. Selection of the pilot area, the criteria being forestry and atmospheric deposition as the loading factors.
2) Field studies and water flow measurements
3) Negotiations with the land owner
4) Estimations about the compensations of land and growing stock (stand of trees)
5) Agreement with the land owner
6) Water samples (Autumn 2005) before the removal of trees and before any excavation work
7) Measuring the basin
8) Calling for tenders
9) Ordering necessary equipment
10) Removal of trees
11) Excavation work
12) Building of the limestone dyke
13) New water samples (spring 2006)
14) Demonstration of the site to interest groups (13.06.2006). There was a positive receiving and atmosphere when tangible results could be seen.
15) As a “side product” a new swimming area was created for the local people. The depth of the basin is in average almost 2 meters.
16) In future, the site will be used in the forest owners’ training courses.
17) In future, relocation of a new limestone dyke will become necessary.
18) In future, there are plans to restore the straightened parts of one rivulet of Konttijoki to the original meandering form.

Case 2 Kaihlalampi – restoration of a eutrophicated and clogged lake

Kaihlalampi is a small lake or pond near the NorWat pilot village of Lehtola. The lake has suffered from eutrophication and has gradually clogged. The problems relate also to the typical shallowness of many small lakes
in Finland and deliberate reductions in the water level of many lakes to increase arable land area. Nor has the water flow spread smoothly to the surface area of the clogged lake. This has aggravated the clogging process: in large areas of the lake there is hardly any flow at all. In addition, the traditional open landscape around the lake has gradually closed due to dense regeneration of bushes (mainly *Salix* and *Alnus sp*). Local people highlighted the Kaihlalampi problem several times and considered the pond a forbidding and depressing element in an otherwise beautiful rural landscape. Kaihlalampi is actually a very diverse opportunity not just for landscape and water quality reasons but also for its biodiversity and potential for aquatic birds for example.

The local inhabitants took the initiative to create a special wetland area on the site and to raise the water level of the pond so that the depth would be 0.5 m throughout the whole area even during the driest summer season. The process was launched in NorWat. Some people, however, are concerned that the rising water will also flood fields. In addition the summer inhabitants on the shores of the nearby lake Löytänänjärvi are concerned about the plan. So, negotiations and open discussion are still needed. In general, reinstating the old lake is seen as a very positive task. If possible, nesting sites for ducks will be built in the middle of the wetlands area.

The process was started during the NorWat project and will continue for some years to come, led by the Forestry Centre of Central Finland.

**Towards a new wetlands habitat**

The Kaihlalampi case has been run/ is to be run according to the following process:

1) Village evening at Lehtola village: introduction to the sub-projects of NorWat, local initiative to restore Kaihlalampi
2) Several field trips to Kaihlalampi area, joined by land owners, habitat experts, environmental authorities, forest workers and excavator drivers.
3) Clarification of landownership in the area
4) Invitations to the first planning meeting
5) The introductory meeting of the restoration project
6) Opening of the landscape by clearing bushes
7) Water level observations in the summer 2006

(N.B. This summer was exceptionally hot and dry in Finland.)
8) After necessary measurements and after having received the permit for raising the lowest water level a bottom dyke will be built.
9) Channelling of water throughout the whole lake/wetland area.
10) Building of nesting sites for ducks.
11) After some time, follow up studies, re-clearing of the bushes and other reconstructive measures will be implemented to maintain the improved conditions.

Case 3 Rahkosenpuro – improving the water quality

Training course about stump lifting and water protection

The streamlet of Rahkosenpuro is one of the NorWat pilot sites. The stream flows to the lake Summasjärvi. In the upstream areas of the stream there are a lot of drained peatlands with several objectives that need reconstruction or re-ditching in the near future. These tasks will be carried out for forestry reasons. The soil is fine, mostly silt. All these aspects impact on the water quality of the Rahkosenpuro stream. Especially in the springtime the colour of the water is somewhat fuzzy.

In the downstream areas of the stream, just before the cultivated fields, there was a forest regeneration site where it was intended to lift stumps for wood fuel purposes. In recent years, stump lifting has become more common in some forest areas, due to bio-energy needs and objectives. At the same time, there was also a soil preparation site just beside the regeneration site.

Due to these circumstances, a water protection training course was arranged in the above forest regeneration site. The target groups were stump lifting and soil preparation businesses. The training course was held in late summer and was attended by eight persons.

The training itself was delivered in the field and contained short, informative and promotional presentations about the issue. At the same time, the participants could see a typical site in practice. Water protection issues were discussed, and the width and location of the protection zones were jointly specified. Tuition was offered by the experts from the town of Saarijärvi and the Forestry Centre of Central Finland who also organized the training day.
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Kaiblalampi before and after the clearing of the bushes. (Photos: Seija Tiitinen-Salmela)
The impacts of the stump lifting area on water quality

The University of Jyväskylä/Institute for Environmental Research monitored the impacts of the stump lifting on the water quality of the Rahkosenpuro brook. One of the three study points or sampling sites was situated upstream from the stump lifting area and two sites downstream from it. The samples were taken after the stump lifting work in the end of August 2005. In one of the sites below the stump lifting area, the water quality was monitored for an extended period before and after the stump lifting work.

The water quality of Rahkosenpuro varies within broad limits depending on season and the magnitude of runoff. The colour of the water is significantly brown due to the amount of detritus. In this study, the concentration of total phosphorus varied from 20 to 200 μg/l and the amount of solid substances from 4 to 180 mg/l during the monitoring period.
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The impact of stump lifting on water quality remained minor. Only the concentration of solid substances increased to some extent from the upstream study point to the downstream one. The colour value was even lower below the stump lifting area compared to the upper study point. The concentration of mercury (Hg) was small all along the course of the brook. Obviously the stump lifting did not cause leaching of mercury from the soil. See further details in the table below.

Table 2. The monitoring of the impact of the stump lifting area in the drainage area of Rahkosenpuro brook

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<th>Temp.</th>
<th>Solid subst.</th>
<th>Conduct.</th>
<th>pH</th>
<th>Colour</th>
<th>CODMn</th>
<th>Tot.N</th>
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<td>29</td>
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Cooperation with the Norwegian Water and Energy Directorate

Restoration of the impacts of former gravel mining at Styggøya

The Styggøya case and its planning phases are described in further details in Part I. Here we only make a short list of the technical aspects of the work. As has already been described, the Reisa River belongs to the national river protection scheme in Norway.

The restoration tasks at Styggøya are related to decreasing or eliminating the impacts of gravel mining and riverbank construction. The aim is to obtain better flow control and natural hydro-geological processes.

The tasks at Styggøya are
• Delimitation and recovery of areas influenced by previous human impacts, mainly river gravel mining
• Retreat of upstream erosion prevention embankment
• Establish an inlet threshold and reopening of a flow channel along the right riverside

All gravel mining will be ended, and the area will be accessible for outdoor recreation. The river will come in closer contact with its banks and its flow plain alder (Alnus sp.) forests that are rich in terms of biodiversity. The virgin residuals of the gravel island are habitats for several red list insect species. These areas will be identified and protected during the restoration.

Further information about technical details is available from Halvard Strand at has@nve.no. Further information about environmental planning aspects and participatory processes is available from Øystein Dalland at o-dalla@online.no

Restoration of the Høymelen site in Kildal river tributary

The Kildal case and its planning phases are described in further details in Part I. Here we only make a short list of the technical aspects of the work.
The Kildal River has a catchment area of 239 km². A medium flow is about 100 m/s. The Kildal River tributary is about 25 km long, and since 1960 is regulated for a water power production by a 30 m high dam about 10 km upstream from the Høymelen site.

The land owner organization of Kildalen had initiated a fish management scheme for Kildal river, cooperating with NorWat and State Water Authorities. There was, however, no formal limit of winter minimum flow in the river. Accidents have occurred several times during wintertime when machine or turbine repairs have caused more or less dry river downstream from the power station.

The tasks at the Høymelen site in Kildal river tributary were
• Re-opening of an old river meander that was closed because of previous flow embankment constructions.
• Lowering of the riverbanks at inlet and outlet areas.

The idea was that the water flow in the new meander will have natural variations. This will facilitate the migration of such fish as arctic char, sea trout, brown trout and salmon. Also the landscape and the main rivercourse at this section of Kildal river will be restored. Later on, supplementary tasks at minor meanders are planned between Høymelen and the upstream Kildal bridge.

The riverbank forests are alder (Alnus) dominated with willow (Salix) fringes. The lacustrine flora and fauna in the locked meander was found to be rather trivial, bird life however rather rich with several duck species and waders. Canoeing and fishing are a potential in the area.

New possibilities in the near future

The task was to open a ca 500 m long river stretch. The old, artificially constructed riverbanks were lowered by 1–1.5 m both at the inlet and outlet areas. The slopes were smoothened for agro-transport purpose, across the new openings. Rocks from the former constructions were utilised for stabilising the riverbeds and the inlet and outlet areas. The adjustment of inlets and outlets had to be done in two steps.

After 2009 the 50 year-old water power agreement will run out. Then the Kildal river restoration tasks will meet a new situation. The new water power agreement is expected to imply a more ecological water flow scheme according to the EU water frame directive.
Good Practices in Northern Watercourses

Further information about technical details is available from: Halvard Strand at has@nve.no

Further information about environmental planning aspects and participatory processes is available from: Øystein Dalland at o-dalla@online.no
Conglass Water habitat rehabilitation project at River Spey in Scotland

One of the NorWat objectives was naturalising watercourses to restore and enhance riverine natural habitats. As a part of the NorWat activities, a water habitat improvement demonstration project was implemented at Conglass Water in Scotland.

The Conglass Water is an important salmon and trout rearing tributary within the River Avon sub-catchment of the Spey. The Conglass Water suffers from a range of man-made habitat problems, including culverts, forestry, erosion and over grazing by livestock, which are impacting the fish populations. The aim of this project was to identify a range of habitat problems and provide and develop practical remedies to improve them. Monitoring of fish stocks was also included.

Partners in the project included Crown Estate, Moray Council, Tomin-toul Angling Association and Spey Fishery Board.

Habitat Survey

A walk up habitat survey was conducted by Crown Estate staff and identified the following areas for remedial habitat work:

- Ruthven Farm: overgrazing leading to severe bankside erosion and lack of riparian woodland.
- Croughly Area: commercial coniferous plantation shading the river and riparian fencing in poor condition.
- Glenmulliach Burn: three forestry road culverts preventing fish access.
- Blair na Marrow: bridge apron creating fish access problems at low flows.

See the following map (p. 194) for further location details and photos of each problem area.
Glenlivet Estate
Conglass Water - Rehabilitation Project

The sites of Conglass Water Rehabilitation project.
Habitat Improvement Works

- Crown Estate finalised costs and plans for fencing in the Ruthven area. Both banks were fenced to exclude livestock for approximately 4 km of river length. Water troughs were included to reduce the need for stock to access the burn for drinking water.
- Forest clearance in Croughly area was completed and it will be included for demonstration visits in the future.
- A local contractor was contacted to remove the Glenmulliach Burn culverts and to replace them with clear span bridges.
- Moray Council maintain this road bridge and developed a plan to improve fish access across the bridge apron.

Monitoring

Fish populations’ monitoring was implemented by Spey Fishery Board research staff. Electro-fishing surveys were completed at two sites (Ruthven and Glenmulliach) on the Conglass Water and a further site located above the bridge apron on the Blair na Marrow. Depletion surveys were completed at each of these three sites.

Timed electrofishings were conducted on the Glenmulliach Burn at three locations: below the culverts, above the first culvert and above all the culverts.

Conclusions

Habitat improvements on the Conglass succeeded well and the planned works were completed. Monitoring through fish and invertebrate surveys should allow changes in the respective populations to be assessed now that the habitat works have been completed. Improvements in bank side vegetation and stability are generally long term and take time to establish so no immediate change in the flora and fauna may be apparent during the timescale of the current project. However, collecting current data will provide a valuable resource for comparison in the future.

Removal of the culverts has lead to a more immediate change allowing adult fish to access upper spawning areas in the Glenmulliach Burn. Improvements were measured in fish monitoring in 2006. The work will continue in 2007.
Improving fish access in Conglass Burn, Scotland

Badly designed and constructed culverts on forestry tracks were removed from the Glenmulliach Burn, a small tributary of the River Conglass to facilitate fish passage. Where required the removed culvert was replaced with a clear span bridge to allow vehicle or pedestrian access. A series of metal baffles were attached to the base of a large culvert underneath the A939 road to improve fish access to the Blair na Marrow Burn.

Culvert Design and Fish Access

Maintaining fish access to streams is of paramount importance. Access is often impeded by man-made structures such as dams and weirs. Similarly, badly design culverts and bridge aprons can restrict access. Although not always creating a complete barrier to fish access the poor design may provide a barrier at certain water flows.

Problematic culverts were identified on two tributaries of the Conglass Burn: the Glenmulliach Burn and the Blair na Marrow Burn.

Culvert Removal in Glenmulliach Burn

Two culverts were identified along this small tributary of the Conglass. Electro-fishing surveys indicated that good trout numbers were present in the lower reaches but absent or in low numbers above each culvert.

The culverts were placed across the burn for forestry vehicle access. The lower culvert (photo on p. 197) was removed completely since it was no longer required for vehicle access due to changes in forestry management. However, pedestrian access was still a requirement and a simple footbridge was installed as a replacement (photo on p. 198). The bridge was constructed from timber logs obtained during clear-felling of the adjacent forest. A platform was then added using dressed timber and hand rail.

The upper culvert (photo on p. 198) was left in place after an assessment of the upper reaches of the Glenmulliach Burn indicated that it did not offer suitable habitat for fish. Vehicle access was still required in this area and to replace the culvert with a open span bridge of suitable strength would have been costly.
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Electro-fishing surveys were carried out prior to the culvert removal and afterwards. Some supplementary stocking of the burn with sea trout fry was also carried out to boost stocks. However, access for adult sea trout was only available in autumn 2006 so follow up surveys in autumn 2007 will indicate if spawning has been successful.

**Culvert Modification: Blair na Marrow Burn**

The Blair na Marrow Burn is an important sea trout spawning burn and electro-fishing data indicate very good juvenile densities. Access to the burn is through a culvert under the A939 road. This culvert is of corrugated steel pipe and concrete platform construction (photo on p. 199). Water depth through the pipe during low flows is low (typically <10cm) which may restrict fish access. In addition water velocities may also be problematic during higher flows due to the constricting effect of the pipe.
Lower site after culvert removal. Forestry vehicle access is no longer required so a simple foot bridge was installed to allow pedestrian access. Timber logs were sourced from adjoining clear felling and then topped with baton platform and hand rails.

Upper culvert on Glenmullich Burn. This culvert was not removed, burn above this culvert is very small and unlikely to support fish population. Costs of removal and constructing suitable replacement bridge for forestry vehicles was not appropriate.
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Blair na Marrow culvert in April 2005 before modifications (above). Culvert is constructed from corrugated steel pipe on a concrete base. The concrete apron at the lower end of the construction creates a small barrier to fish access particularly during low flows. Blair na Marrow culvert with steel baffles installed, May 2006 (below).
**Good Practices in Northern Watercourses**

*Blair na Marrow culvert with baffle installed during higher flow rates in October 2006.*

*Blair na Marrow baffle. Constructed of galvanised T-bar steel and bolted to concrete base. Baffle height was 305mm and baffles were placed at approx 2m intervals.*
Thus fish may struggle to access the burn at certain flow conditions and if this occurs during the key spawning period then juvenile production could be compromised.

Galvanised steel T-bar baffles were bolted into the concrete base of the culvert, Figures 5–7. Baffles’ dimensions were 305 mm height with a base of 229 mm. Steel thickness was 51 mm. 14 baffles were bolted into the pipe section and they were 600 mm wide. Two 1800 mm baffles were bolted onto the lower bridge apron to focus the water flow and help guide fish. In addition, this more focused flow will help scour a pool below the apron.

Initial discussions on the positioning of the baffles had proposed placing two baffles on the right hand side followed by two on the left hand side of the pipe and so on. However, during construction it was noted that the concrete plinth became thin at the edges of the pipe and all baffles were then placed in the middle.

Inspection of the culvert during low flows indicated that the depth was greater after baffle installation. During higher flows (photo on p. 200) the effect was very positive with good opportunities for fish to rest behind a baffle during its migration. The lower baffles were an attempt to focus the flow and to provide a more positive stimulus to guide migrating fish. This worked to some extent but an improved design would be more effective.

The concrete apron is wide and even with the two baffles the water spreads out considerably. To improve this, the installation of two further baffles running from the downstream end of the pipe to join with the existing baffles is suggested. This would provide a more definite channel for the water particularly during lower flows.

Lessons learned

- Close liaison and good working practice established between Fishery Board and local Council
- Education on better culvert design provided to civil engineers and contractors.

Further information is available from:
Bob Laughton, Spey Fishery Board: www.speyfisheryboard.com
Andy Wells, Crown Estate: www.glenlivetestate.co.uk
Graham Dunlop, Moray Council: www.moray.gov.uk
Monitoring fish populations in Conglass Burn, Scotland

Electro-fishing monitoring programme

To assess the effects of habitat enhancements and improved fish access in the Conglass Burn and tributaries an electro-fishing monitoring programme was established. Electro-fishing was carried out for population density estimates using methodology prescribed by the Scottish Fisheries Co-ordination Centre (SFCC, 1998).

Each site was approximately 100m² and marked out using ropes at either end and as far as possible each site contained a range of fish habitats. Electro-fishing commenced from the downstream end, to and from across the stream, until the full site area was fished. Species present were recorded. The fork length (tip of nose to the V of the tail) was recorded for all salmonids along with a small sample of scales for age determination. After analysis all fish were returned to the site. Each site was electro-fished three times to allow a depletion estimate of population to be determined.

Details of the habitat available within the site including water depth, flow type, substrate type, riparian vegetation, land-use etc., were also recorded along with a photographic record of the upstream and downstream limits and the general site surroundings. This also allows accurate re-orientation to survey sites in the future.

The data collected at each survey site was entered into the SFCC electro-fishing database. Population density and mean length for each age class of salmon and trout were calculated.

A series of timed fishing were also carried out to determine distribution and species composition in the smaller burns draining the area. On each stream electro-fishing was conducted for 10 minutes within a variety of habitats. Data was compiled as catch per unit effort (CPUE). Again all fish captured were identified, measured and scales sampled before return to the site.

Three fully quantitative survey sites were examined on the Conglass Burn and the Blair na marrow Burn. A further three timed sites were established on the Glenmulliach Burn.
Electro-fishing was used to survey juvenile fish populations within the Conglass burn.

All juvenile fish were anaesthetised, identified, measured and scales for age determination collected. Fish were then allowed to recover before release back into the survey site.
Good Practices in Northern Watercourses

Lessons learned

- Data requirements need to be fully assessed and well planned before embarking on study.
- Collection of enough data to indicate trends is costly and time consuming.
- Long timescale is required to show any change in riparian habitat providing benefits to fish populations.
- Short term survey, i.e. before and after, should provide indication of success when access problem is removed.
- Fish populations may not be the best indicators of change and need to be coupled with other monitoring programmes, including invertebrates, water quality, photo surveys, vegetation and habitat surveys.

Further information is available from:
Bob Laughton, Spey Fishery Board
www.speyfisheryboard.com
Improving riparian vegetation in Conglass Burn, Scotland

Farm stock (eg. cattle, sheep) can have detrimental effects on river banks if left to graze unchecked. Stock fencing and watergates were constructed along 4 km of river bank either side of the Conglass Burn to prevent animal access and allow natural vegetation to develop. Supplementary planting of native trees species was also completed.

Riparian vegetation plays an important part in the health of a river and the wildlife within. When vegetation cover is lost, soil and stability is also lost through increased erosion. This results in a loss of wildlife habitat and reduced biodiversity. In many areas farming practices which allow grazing close to riverbanks has increased the loss of riparian habitat. This coupled with a seemingly wetter climate has increased the likelihood of damage to riverbanks. In order to redress this trend fisheries management has focused on removing stock grazing from riparian areas and encouraged supplementary planting of riverbanks with native tree species.

Fences, watergates and native trees

Post and barbwire fences were used and installed at an appropriated distance from the river bank (minimum distance typically 5m). Installation also took natural features into account. For example, flood and wetland areas were included within the fenced area when ever possible. Watergates were used to exclude stock at watering points but allowed access for drinking water. Watergates were constructed of wood and suspended across the river on tensioned wire. The gates were designed to float during periods of high water and then drop back into position as floods subside.

Existing native tree stands were also enclosed to protect them as a future seed source. Supplementary planting with native Scottish species was also carried out.

Pre-fencing survey of riparian habitat was carried out and plans are to repeat survey after 5 and 10 years. Fixed point photographing to illustrate habitat change was also carried out prior to works. Similarly invertebrate and fish surveys were conducted within the fenced area and will be repeated in the future to determine any change in fauna.
Good Practices in Northern Watercourses

Eroded area on the Conglass Burn, River Spey (above). Fencing and watergate installed near Ruthven Farm on the Conglass Burn through NPP Project (below).
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Fencing was extended to include good areas of existing natives species such as juniper and also to include floodplain and wetland areas. Fence constructed from post and wire. Barb wire used on upper run. Designed to exclude farm animals but not deer (above). Fencing installed typically 5m from water course (below).
Lessons learned

- Good planning for fence line and watergate position is essential.
- Close liaison with local farmers and development of agreed fence line and plans is essential.
- Regular inspection of fence and watergates is required along with provision of budget for fence maintenance to ensure the fence is kept stock proof.
- Utilise native tree species for supplementary planting.
- Plan and incorporate suitable pre-fencing surveys for habitat, flora and fauna. Ensure these are conducted using recognised repeatable methods.

Further information is available from:
Bob Laughton, Spey Fishery Board  
www.speyfisheryboard.com  
Andy Wells, Crown Estate  
www.glenlivetestate.co.uk
Monitoring invertebrate populations in Conglass Burn, Scotland

An invertebrate monitoring programme was established prior to habitat works being undertaken on the Conglass Burn. The data will provide baseline information against which any change through changing riparian vegetation can be compared in the future.

Invertebrate Monitoring Programme

Assessment of freshwater macroinvertebrate communities can produce a useful, general measure of stream health and productivity and, since juvenile salmonids eat macroinvertebrates, can provide an indication of prey availability. Many aquatic invertebrates have specific habitat requirements, including a limited range of water chemistry and these species can be used as biological indicators to broadly assess the status of the water.

To assess the current status of the macro-invertebrate communities within the Conglass Burn a monitoring programme was established. The data collected will provide a baseline against which any change through the effects of the riparian habitat enhancements can be monitored.

Field sampling

Sampling was based on standard 3 minute kick sampling methodology. A 25 cm diameter kick sample net with a 1 mm mesh was used at all sites. Sampling at all sites was conducted in riffle-type habitat. Sampling covered the whole width of the stream. The net was held vertically, downstream from the sampler’s feet and resting on the river bed. The sampler disturbed the river bed vigorously with the heels, by kicking or rotating, to dislodge the substrate to a depth of about 10 cm. Dislodged invertebrates were washed into the sampling net.

A further 1 minute period of hand sampling was carried out at all sites, searching on and under stones and rocks for attached invertebrates such as molluscs and cased caddis. Samples from kicking and hand collecting were preserved together in 70 % Industrial Methylated Spirits (IMS) in sealed plastic containers.
**Good Practices in Northern Watercourses**

**Invertebrate identification**


Specimens were identified to the appropriate taxonomic level to provide a biological assessment of water quality using BMWP (Biological Monitoring Working Party) and ASPT (Average Score Per Taxon) scores. A measure of productivity was obtained by a total count of invertebrates in each sample.

**BMWP and ASPT Indices**

These scores were primarily developed for identifying organic pollution, but they are widely used as indicators of general stream health. Biological Monitoring Working Party (BMWP) scores were calculated for each invertebrate sample from each site. The scoring system is based on the pollution sensitivity of each invertebrate family. The scale is 1–10 and a score of 1 is allocated to the most pollution tolerant families and 10 to the most pollution sensitive. The BMWP score is the sum of the group scores for the sample. The ASPT (Average Score Per Taxon) score is the average score for each group present in the sample.

Low BMWP or ASPT scores indicate possible pollution, high scores indicate good water quality. A simplified version of the Scottish River Classification Scheme used by SEPA (Scottish Environmental Protection Agency) is set out below.

| Simplified Scottish River Classification Scheme as used by SEPA. |
|----------------------|-----------------|---------------|----------------|
| Class | Description | BMWP | ASPT | Comments |
| A1 | Excellent | ≥85 | ≥6.0 | Sustainable* salmonid population |
| A2 | Good | 70–84 | 5.0–5.9 | Sustainable* salmonid population |
| B | Fair | 50–69 | 4.2–4.9 | Salmonids may be present |
| C | Poor | 15–49 | 3.0–4.1 | Fish may be present |
| * If other environmental variables are suitable |
The physical nature of the watercourse and the sampling effort of different individual samplers can influence the BMWP score. ASPT is viewed as a more stable and reliable index of pollution.

The number of scoring taxa is also an indicator of water status. A fall in the number of taxa is a general index of ecological damage, including overall pollution encompassing organic, toxic and physical pollution such as siltation, and damage to the habitats or the river channel, (General Quality Assessment of Rivers, Environment Agency website).

Invertebrate sampling, three minute kick samples were used followed by an additional one minute of collecting invertebrates from rocks etc. Six sites were sampled.
Samples collected

Macroinvertebrate communities were sampled from six sites in the River Conglass. All sites were productive with diverse invertebrate populations. The water quality at all sites was excellent.

Lessons learned

- Samples can be collected, quickly and cost effectively, and very little specialist equipment is required.
- High quality data is produced on invertebrate communities and water quality.
- Expertise is required to fully identify and assess data collected. This can be costly.
- Good baseline data is achieved for comparison with future samples.

Further information is available from:
Bob Laughton, Spey Fishery Board
www.speyfisheryboard.com
Risk management of fish farming in Finland

The Finnish Game and Fisheries Research Institute produces scientific data for example about fisheries. Enhancing sustainable use of natural resources, and maintaining biodiversity through research and aquaculture are also part of the institute’s remit.

The main task of the aquaculture unit is to maintain the genetic diversity of the endangered indigenous Finnish fish populations. This is carried out through aquaculture when other conservation methods cannot ensure the aim. One of the central fish farms or aquaculture stations is located in Laukaa, Central Finland. NorWat partners have visited the station.

In the following text some examples of the Finnish risk management activities in fish farming are described. They are good practices that can be applied in other countries.

Aquaculture stations have an important preventive role

The Aquaculture Stations of the Finnish Game and Fisheries Research Institute use the latest knowledge and methodology in maintaining the native, valuable fish stocks. There are 12 indigenous species or morphs of fish in aquaculture, and over 70 differentiated strains or populations that are specific to a certain water body.

The risk management of fish farming consists of many sectors:
• hatcheries, their location and categories
• transportation limits
• quarantine procedures
• reserve stocks and genes

The protection of threatened fish species or very important fish stocks, like salmon stocks, is extremely important, and the aim is to minimise if not eliminate all risks. A gene bank is used for storing the milt of the most important fish stocks. As a part of the protection procedures fish stocks are located in different fish farms.
In fish farming there are risks in spreading of fish diseases and fish parasites. Exceptional weather conditions and technical problems may also cause risks. Typical protective and preventive methods are related to hatcheries location, transportation limits and quarantine procedures.

A part of the quality management plan

The idea of the risk management is that it is a part of the quality management plan which describes how the organization works and implements quality control operations and procedures. Also areas of applications, roles, responsibilities and authorities are defined. The purpose is that all risks are identified and managed.

Further information is available at:
The Finnish Game and Fisheries Research Institute
www.rktl.fi/english/
Wastewaters in rural areas, Finnish experiences

The treatment of wastewaters in rural areas has a remarkable impact on the environment

Millions of people also in the Northern Periphery Area live in houses that are not connected to centralised sewage systems. This means that their wastewaters must be treated 'on site'. In very many cases these treatment systems are obsolete or otherwise inefficient. This is why many residences from summer houses to permanent homes cause environmental problems in several sparsely populated areas.

For example in Finland, many of the rural residences – permanent homes, summer cottages or saunas with no centralised sewage systems – have a large contribution to the eutrophication of rivers, lakes and also the sea. The phosphorus load into the water bodies from people outside the sewer networks has been 6–8 times higher than that from people “connected” to sewer networks.

New legislation to improve wastewater treatment in Finnish rural areas

The environmental legislation concerning the wastewater treatment in rural areas has recently been tightened in Finland (Onsite Wastewater System Decree (542/2003) came into force on 1.1.2004). Minimum standards for wastewater treatment and the planning, construction, use and maintenance of treatment systems have been described.

According to the new decree the waste water cleaning capacity should be sufficient also in secondary residences like summer houses. Moreover, now the owner of a property must know how the wastewater treatment system of his/ her property works and how it is used and maintained. Property owners need to make a wastewater treatment report or a plan of constructing or renovating the system. It is hoped that the new legislation will lead to a reduction of total phosphorus load and thus to improvement of water quality.

See further information at the website of Finland’s environmental administration: www.environment.fi
A survey in the pilot village of Lannevesi

The sparsely populated Lannevesi village in the town of Saarijärvi is a typical example of a rural area where houses are scattered and mostly not connected to the municipal sewage networks. Many residences are located within a very short distance from the lake or other watercourse.

A detailed survey of the wastewater treatment in Lannevesi village was carried out during the autumn 2006. The study area was predefined by the authorities of the Town of Saarijärvi. The survey area was ca. 4 km long (from the north-west to south-east), the maximum width being ca. 2.8 km in the direction of west-east. There are 121 properties in the study area, 14 of which have a separate sauna on the shore. In addition to detached houses, farm houses and summer residences, there is a small primary school with 56 pupils and a building of the local youth association used daily by ca. 50 people for free-time activities. There is also small-scale industrial activity in the village (a garage and a car dismantler) and an old renovated water mill used for different festivities in summertime.

There is also an important ground-water area and a municipal water supply establishment in the village. Annually about 70 000 m³ of water for household consumption is pumped to the water system of the town. Due to its location between lakes, its multiple activities and the town’s preliminary plans to build a joint sewerage systems, Lannevesi village was an interesting and challenging target area. There was a clear need for the survey, and a village level report with recommendations of future actions was written. This was done in close co-operation with the “Rural Wastewater Treatment Project in Central Finland” (see www.jamk.fi/jatevesi), the experiences of which were utilised.

The survey is hoped to lead to renovations of many sites and also to the establishment of a joint sewage treatment system in the village. The survey was carried out by a trained person who was using a special questionnaire form. The surveyor’s checklist and the form (wastewater treatment report) are available as Appendix 1A and 1B of this manual. All property owners were met personally and all sites were visited.
Many Watercourses Need Our Help

Installing new waste water treatment systems is topical in many rural places. (Photo: Nina Pimiä)

Evaluation of the condition of the septic tank takes place in the field. (Photo: Katja Oksala)
PART III

Watercourse is an Excellent Resource for Environmental Learning
Educational and interpretative material about watercourse resources

The overall NorWat project aim was to find and disseminate information on new ways to make the best use of watercourses for the benefit of local sustainable community development. Watercourses are important to the many communities that live alongside them, and the project aimed to link the environmental, social and economic interests of watercourses.

Environmental education (theme 3) is one of three themes that aimed to raise awareness of just how important a watercourse can be to a local community. In order to increase people’s knowledge, understanding and appreciation of watercourses, Theme 3 focussed on two main groups.

The first group was primary school children. Some work has previously taken place with primary schools in Scotland in relation to the River Spey. Children form the local communities of the future and, as a result of the project, will be better informed in terms of wise management for the future of watercourses whilst understanding all the demands on the resource. It was also felt that by concentrating on children they may be inspired to seek careers or pastimes involving watercourses.

The second group consisted of current users of the watercourse, including fishing ghillies, countryside rangers, canoeing instructors, and land managers. These groups of people use watercourses on a daily basis, and also meet and inform many other people. They are ideally placed to pass on information and help to educate both local communities and visitors. Getting these river users to meet will enable them to understand each others work, and how the watercourse can be important in several different ways. This should mean that conflicts and problems between user groups can be resolved more easily.

Scotland took the role of lead partner for this theme with two sub-themes: primary school education and adult training.

Objectives in school education

The participating primary schools in four countries were to study their local watercourse in terms of ecology, employment, culture & recreation. This was to be interactive across the four countries.
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The main objectives were:

- Develop the awareness of primary school children within and between the four countries of their local watercourses as a community/global resource both now and in the future (in terms of environment, economy and culture).
- Run a “School Goes To Fish” component so that primary school children can visit a Hatchery and/or natural habitats and/or participate in management fishing or respective actions relevant in the region in question.
- To produce a Best Practice Model of linking primary school children in the NPP area with their local watercourse and watercourses and communities in other countries.

Objectives in adult training

This involved developing and running the curriculum and educational structure of a further training course related to northern watercourses. The main objectives were:

- Develop and plan a curriculum and educational structure of a further training course for those utilizing and/or managing the watercourse in their work.
- Run and test the somewhat tailored training courses in each of the four participating countries.
- Produce a Best Practice Manual/Model of the course structure, contents and organisation for wider application in the NPP region by utilising and summing up experience gained during the test courses.

Main tasks in environmental education and training

The main tasks for Theme 3 overall were the formation of a transnational thematic working group, the preparation and publishing of a “Best Practice Manual” to be used for wider application, and to run a transnational thematic seminar in the River Spey area of Scotland.

Each sub-theme had its own specific tasks which were set out at the beginning of the project. The main tasks for the school education were the planning of the environmental education programme related to the
Outcomes in environmental education and training

The detailed descriptions of the activities that took place over the duration of the project show that a lot of work has been carried out. Many of the original tasks have been addressed and completed, although some have not.

A transnational thematic working group was established with representatives from each country. Regular meetings were held by video conference. Most other communication took place by email, with some telephone conversations. This communication between members of the working group proved effective. The group, although not always the same members, also met face-to-face on several occasions in different locations, giving opportunities to improve contact between countries.

All the work carried out has been summarised in this document. This will help others to see what can be done and provide information on how to carry out certain activities in environmental education.

At the end of the NorWat project a transnational seminar will be held in the River Spey area of Scotland in conjunction with a celebration and summary of the entire project. Children from all four countries will also meet up at an International School Camp.

In all four countries school children have gained valuable experience of their local watercourse, in ecological, cultural, social and economic terms. Unfortunately teachers did not get the opportunity to meet as often as was planned in the original tasks. Training courses for watercourse...
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managers and users were set up in two countries. These proved to be informative and useful.

**Overall important messages**

Communication – is very important in a project like this. It requires good communication between individuals within a country, and good communication between countries. The contact between pupils and teachers from different countries did not happen at the level that was envisaged. Meetings between teachers did not happen as frequently as planned, and as a result communication between them and their pupils was limited. This was the case both within and between countries. The ways in which pupils communicate needs to be decided by the teachers. This is a very time consuming activity, but what contact did happen was very positive and children were pleased to receive information from children in other countries. Communication through the transnational thematic working group was successful.

Commitment – is also extremely important. Schools and teachers need to be committed to carrying out the work. The other organisations involved need to be committed to helping the schools, facilitating the resources and coordinating the project. Without committed people a project such as this is more likely to fail to fulfill its aims.

Resources – good resources are very important in a project like this, for the planning stage and for the activity stage. Teachers in Scotland had access to a dedicated River Spey resource which helped them to plan and carry out their activities. Having this resource also reduced the time needed for teachers to plan the project work. The other three countries would have benefited from having such a resource. Financial resources are also important, as many of the activities cost a lot of money. Schools do not usually have access to such funds, and so only with a project such as this can they benefit from the funding and carry out this type of work. It is important to consider what will happen after the end of the project to ensure that children keep learning about watercourses. Resources should be made available that will enable the schools to continue in their learning about watercourses after the project is completed.

Working with experts – the children have benefited from working with a wide range of experts from within their local communities. Many of the activities carried out could not have been done without expert help and knowledge. This in turn helps to educate adults to the fact that they
Good Practices in Northern Watercourses

need to put time into helping children learn. Children also gain experience of working with people that have different interests and responsibilities with regard to the river.

Learning by doing – activities that involve practical work by the children themselves, where they can actually try something out, perform a task, or work out information for themselves, is far more likely to make a lasting impression on them and remain in their minds. It is important to bear this in mind when planning activities. It is also beneficial to have an end product for each activity, e.g. a DVD, so that the children have something to show for all their hard work.

School curriculum – it is important to have activities that fit with the school curriculum. Teachers will find it easier to prioritise the work and to carry it out if it is part of the curriculum. Activities that do not fit well with the curriculum are more difficult to fit in and are less likely to take place.

Working with different groups – the sharing of understanding between groups with different responsibilities and interests towards watercourses is particularly valuable. This leads to increased awareness of others using the river. Although it is easier to work with and educate children, it is also important to concentrate on adults as they are the current generation who are managing and utilising the river. Overall there is much less education of adults than there is of children. However, education of adults through this project has shown that they are interested in learning and that there is a demand for this type of training.
Resources for environmental education in Scotland

The River Bank is an excellent educational tool

Both Aviemore and Craigellachie Primary Schools had the use of a ‘River Bank’ resource box to help them in their studies of the River Spey during the NorWat project. The River Bank resource box was produced during a previous River Spey project, and was partly financed by the Highlands and Islands Special Transitional Programme. It contains a wealth of information about the environment, culture and history of the River Spey, lesson plans for teachers and equipment for field trips to the river.

Environmental education boxes have proved to be a valuable educational tool in Scotland, for formal education in schools and also for voluntary groups. The more recent resources have provided interactive material such as CDs as well as books, videos and other teaching or educational material. The River Bank, for use in the River Spey catchment, builds on this concept and provides a wealth of stimulating, formal and informal educational material about the River Spey and its tributaries. The primary aim of the River Bank project was to develop, distribute and encourage use of an environmental education resource for children in primary and secondary school. So there are adequate links between the River Bank contents and the 5–14 school curriculum.

A selection of educational resources connected with the River Spey

The River Bank is an environmental education resource which brings together the natural history, geography and cultural history of the River Spey catchment. The aim was to collate a selection of educational resources for teachers, youth leaders and children, which highlight the wealth of natural and cultural history connected with the River Spey.

These resources help children to understand how the lives and well-being of all the river users (including themselves), both in the past and today, are inextricably linked by the river. They also help to explain how the river has shaped the landscape around them and how the river has influenced the movement and settlement of people.
Good Practices in Northern Watercourses

Due to the volume of material, the River Bank is contained within two boxes, with an additional canvas bag containing field equipment. The boxes are easily transported by 2 people.

Structure of the River Bank

The River Bank comes with a User’s Guide, which suggests how the resource can be used. There are sections devoted to planning, with lesson plans and worksheets, based on the 5–14 curriculum guidelines. This enables teachers to select a relevant package and begin teaching without having to spend hours in preparatory work. The resources enable general themes to be discussed using real-life examples from the River Spey catchment. Contents of the River Bank resource box can be found in Appendix II of this manual.

Creation of the River Bank

The initial contract for the River Bank project was completed in March 2003. The contractors were an experienced teacher and an ecologist. This contract produced one completed River Bank resource box, a User’s Guide with links to the curriculum, and recommendations on how the River Bank should be used, piloted and managed. The first River Bank was piloted in Aviemore and Craigellachie Primary Schools. Both found the resource very useful, even though they only had it for a short period.

Teachers and Ranger Services in the River Spey catchment were invited to a presentation on the River Bank. This involved a trip to the River Spey to take part in some of the activities described in the resource and a look at the contents and how they could be used. This session was very successful and confirmed a demand for the resource from the people who would be using it.

It was decided that another three River Banks would be required to achieve coverage of the catchment area. This was based upon each school having use of a River Bank for a term every 2–3 years. The production of these River Banks was carried out by the same contractors. Schools and ranger services in the Spey catchment were sent letters informing them that the River Bank was ready for use and who to contact in their area for information and to book the resource.

Various educational workers from the Spey Fishery Board, Highland Council, Moray Council and Scottish Natural Heritage look after a River Bank. They are responsible for booking it out to schools, and checking the contents on its return.
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Teachers can make the most of the clean waters in the River Spey catchment and the provision of ranger services, by organising a class visit to a river or burn. Resources relevant to the planned lessons are detailed within the lesson plans and field equipment for sampling in rivers such as nets, identification keys, trays, pH paper and worksheets are provided along with lesson planning for before and after the visit. Issues of risk and safety during fieldwork are also covered within the user’s guide.

The areas covered in the River Bank are:
- River Heritage (past and present)
- Natural History and Biodiversity
- Landscape and River Systems
- Field studies
- Expressive arts – interspersed within the 4 above topics covering some aspects of drama, movement, music and art

The River Bank resource box and its contents. (Photo: Pete Moore)
Use of the River Bank during NorWat

Both Aviemore and Craigellachie Primary Schools have used the River Bank in their studies for the NorWat project. The River Bank was invaluable for the planning of the project work. Teachers went through the existing lesson plans and extracted from them what they wanted to do. The River Bank is an especially great resource for books, as it is not usual to have access to so many specialist books in a school. It is also a good staff resource.

The River Bank was the first resource used in planning the 3 year project, and it made the whole project easier to tackle. Teachers were able to carry out more and better activities as less time was spent finding the basic information. As well as project planning, the River Bank
Watercourse is an Excellent Resource for Environmental Learning

was used during almost every activity carried out as part of the project. The River Bank is very user friendly for both teachers and children and, although applicable to the 5–14 curriculum, is at an ideal level for 10–12 year olds.

Management of the River Bank

Managing the River Bank is a large and ongoing task. The resource requires evaluating on a regular basis, updating of resources, and replacement of items that become lost or worn. Each River Bank spends very little time with the people that manage them, and are out in schools for most of the year.

After each school has used and returned the River Bank all the contents are checked before it is sent out to another school. This can take a long time as there is a lot of information contained in the River Bank.

Lessons learned

In creating the River Bank it was important to plan how many River Banks were required, what the demand was for such a resource, who would manage them, how they would be updated and the contents renewed. The required budget for the development of the resource was underestimated, and it cost more than was expected. All the items contained in the resource box should be branded with a logo. The contents have to meet curriculum requirements, and they have to be easy to use and not cause too much work for teachers.

In managing the River Bank it is important to establish committed owners or managers to spend the time checking boxes, delivering to schools and publicising them. Given existing resources, this is too large a task for one organisation and so several organisations are working together in order to carry this out.

When using the River Bank it is helpful that the teacher can extract the relevant material, then photocopy lesson plans and worksheets to have their own copy. There is a lot of stand alone information in it that can be used for numerous projects.

Good classroom management is required when the River Bank is used. If the children have free access they may take a long time to carry out the allotted task, and not put the items back in the correct place. The
use by children can be managed by placing items on tables and allowing the children to circulate around them.

It would be a good idea to make the River Bank interactive, with all lesson plans and worksheets in an electronic format, although still with book and other resources. The boxes are heavy, but teachers understand that they have to be to accommodate all the material. Making some parts of the River Bank in an electronic format could reduce the weight.

It would be useful to expand the amount of artistic material and local historical information that is contained in the River Bank.

Both schools would have found the NorWat project very difficult without the River Bank. It is a brilliant resource and both schools would like to have it in their schools on a permanent basis.

The River Bank resource box has been part-funded by the European Union under the Highlands and Islands Special Transitional Programme. It forms part of the River Spey Catchment Management Project. Other funding partners include: Spey Fishery Board, The Highland Council, Moray Council, the Cairngorms Partnership, Moray, Badenoch & Strathspey Enterprise, Sportscotland, Scottish Natural Heritage and the Scottish Environment Protection Agency.

Further information is available at:
Scottish Natural Heritage: www.snh.org.uk
Spey Fishery Board: www.speyfisheryboard.com
Highland Council: www.highland.gov.uk
Moray Council: www.moray.gov.uk
Fish goes to School in Scotland

Salmon life cycle in the classroom

School pupils at Aviemore Primary School and Craigellachie Primary School became hatchery managers in the classroom, looking after salmon eggs in a tank until they hatched into alevins and then into fry. The fry were then released into the river.

During late January and February, the Spey Fishery Board Biologist and bailiffs went into both Aviemore Primary School and Craigellachie Primary School. They gave a ‘Salmon go to School’ PowerPoint presentation which lasts about 30 minutes. This introduced the children to the fish species and ecology of the River Spey, then focussed on the life cycle of the salmon, its struggle for survival and the importance of salmon and how they are managed and protected in the River Spey. The presentation is available on the CD-ROM attachment of this manual.

Fry from classroom hatcheries

Each school was given a classroom hatchery, consisting of a fish tank, which was contained within a table top fridge. The fish tank contains water and around 250 salmon eggs. The eggs come from the hatchery but are usually sourced from a tributary close to the school.

Atlantic Salmon Life Cycle

Salmon live at sea for 1–4 years. They then return to their native rivers to breed. In rivers in Britain, salmon spawn between October and February. 90-95% of salmon die following spawning, although some do survive to spawn again. Female salmon produce eggs which are laid in depressions called ‘redds’ in the river bed. The eggs are fertilised by the male salmon and then covered with gravel by the female. Hatching usually occurs in early spring. The young fish, alevins, remain in the redd for a few weeks. They emerge from the gravel in April or May. As they grow the young fish develop into parr. During late spring the young fish, now known as smolts, will leave the river to go to sea.
The children had to look after the eggs for 6 weeks through to March. This involved keeping the eggs at the correct temperature, below 12 °C, for them to develop into salmon fry. Spey Fishery Board staff visited the schools once a week for around one hour to check the tanks and keep them clean. The children had to work hard to maintain the low water temperatures, remove any dead eggs and record all events in a daily diary. Their efforts were rewarded when they saw the eggs successfully hatch into alevins. The alevins were kept in the tanks and the children observed their development into salmon fry.

The children from both schools released their fry back into their natural habitat during the middle of March. Craigellachie Primary School released their fry into the River Fiddich, and Aviemore Primary School released their fry into the Milton Burn. Both these watercourses are tributaries of the River Spey. The children really enjoyed looking after the salmon eggs and this was a very successful activity. Overall the children and teachers managed the tanks very well.
Watercourse is an Excellent Resource for Environmental Learning

Aviemore Primary School get ready to release fish. (Photo: Bob Laughton, Spey Fishery Board)

Craigellachie Primary School get ready to release fish. (Photo: Bob Laughton)
Good Practices in Northern Watercourses

Aviemore Primary School releasing their salmon fry. (Photo: Bob Laughton)

Craigellachie Primary School releasing their salmon fry. (Photo: Bob Laughton)
Watercourse is an Excellent Resource for Environmental Learning

Aviemore Primary School class with Salmon goes to School fish tank. (Photo: Bob Laughton)

Salmon goes to School fish tank. (Photo: Bob Laughton)
Lessons learned

This project was linked to many areas of the curriculum. These included Environmental Studies, Science, Maths, Technology, Art, language, and ICT (Information and communication technology). The project also helped with Personal and Social Development, working in groups, co-operative working, sharing tasks and responsibility.

‘Salmon goes to School’ can be linked with a visit to the hatchery and the river, to see the salmon life cycle in different ways. This project can be time consuming for staff and they must be committed to this project for it to work successfully. This project, however, captures the interest and imagination of all types of children. They found it fascinating and were very interested in the development of their salmon.

Before tabletop fridges were used to insulate the tank and keep it cool, other methods were used. Tanks were insulated to keep them cool, and frozen cool blocks added to the tank to keep the water at the correct temperature. There can be issues with keeping the eggs cool in the classroom as some rooms are very warm. The cool blocks that were used to keep the tanks at the correct temperature need to be cooled or frozen and this can be a problem as there are health and safety issues over the use of catering freezers in schools.

It should be noted that cool blocks can burst, although in the some tanks the blocks are not actually in the water so this does not cause a problem for the salmon eggs. There is also the risk of the power to the tank being switched off by another member of staff who may be unaware of the tank.

For the release of salmon fry in watercourses the main issue is health and safety. Care must be taken when taking children out near roads or rivers, or over rough terrain. Skilled people must be used. The river selected should be a safe river with accessible banks, and not a river with fast flowing deep water. Child to staff/helper ratio is best to be 1:4.

The Spey Fishery Board carry out a risk assessment prior to taking children to the river. The route from the school to the river is checked. A safe area at the river big enough to accommodate all the children is found and checked for hazards. Children should be able to wash their hands after this activity, if they have been in contact with the river water.

This project has been run by the Spey Fishery Board in schools throughout the River Spey catchment since 1995. It will continue to run. Similar programmes are widespread throughout Scotland.
Watercourse is an Excellent Resource for Environmental Learning

Further information is available at:
Spey Fishery Board: www.speyfisheryboard.com
Salmon Life Project: www.SNH.org.uk/salmonlifeproject
www.SNH.org.uk/salmoninthe classroom
Fishing trip in Scotland

A day fishing on the river with Aviemore and Craigellachie Schools

Craigellachie Primary School and Aviemore Primary School met up for the day to go fishing and to learn more about the river. The fishing trip took place in August. A local hotel donated their part of the River Avon, a large tributary of the River Spey, for the schools to use for free. More fishing was also made available on a nearby pond which is stocked with trout.

Children from both schools were mixed, and put into groups of 5–8. Different activities were set up at different locations. These were fishing, bug and beastie hunting, observations of electro fishing for juvenile salmon, and casting and tackle tuition. Each group visited the different locations to take part in all the activities.

The children were taught fishing techniques including casting for both salmon and trout, baiting their hooks and safety at the river. Several fish were caught throughout the day, both from the river (salmon parr, which were returned to the river) and the pond (trout, which were taken home by the children).

The event lasted for the whole school day. The children brought a packed lunch with them which they ate beside the river bank and the trout pond. The children really enjoyed their day and had lots of fun. As well as learning more about fishing and gaining some practical experience, the children also gained an insight into the invertebrates and juvenile fish that live in the river.

Lessons learned

This activity has several links to the curriculum. It can be linked to Environmental Studies, Personal and Social Development, Languages and working in partnership with agencies. It can also be used to demonstrate that learning is fun. It may also encourage children to take up fishing as a hobby.
Watercourse is an Excellent Resource for Environmental Learning

Aviemore and Craigellachie meet up for a fishing day. (Photo: Zoë Taylor)

All ready for fishing! (Photo: Zoë Taylor)
Good Practices in Northern Watercourses

At the river bank. (Photo: Zoë Taylor)

Pupils were shown how to cast. (Photo: Zoë Taylor)
It is important that a day of activities like this should be focussed. During this day it would have been better to concentrate on just fishing and learning fishing practices, rather than having other activities such as invertebrates and electro fishing. The children would then have been able to spend more time actually fishing. It is also important that as many children as possible catch a fish, as this will help to reinforce the fun and enjoyment aspect of the activity, and give them a sense of achievement.

Health and safety is a very important issue in this type of activity. Lifejackets should be worn by children where they are fishing or taking part in an activity that involves going in the river. Safety glasses are also recommended to be worn by the children when they are fishing. They also need reasonable clothing, including rubber boots, although this can be dependent on the weather conditions. However it should be noted that it is an important part of the development of the children that they are allowed to take controlled risks at some times. Children should be able to wash their hands after this activity, especially before eating lunch.

Transport to and from the river should be considered, including whether a small river can be accessed by a large coach. Another issue is the provision of toilets at the river. There were none available during this fishing day and this may be a problem for some children. This should be considered when planning an activity like this. The coach used for transport could have a toilet on board which could be used by the children.

As most children in the schools involved do not have their own fishing tackle, it is useful to involve people that can supply a lot of fishing rods and equipment for the day, such as a local fishing tackle dealer.

For this activity it is essential to have lots of helpers, and contributions from many sources were required. A multi-group approach is good in this activity. It helps groups to recognise that they have to put effort into encouraging the children to take part in fishing as a sport or hobby.

This activity did not take a lot of time to organise, but was dependent on a lot of groups for their help. These were three different angling associations, a local hotel, a local tackle shop, the trout pond manager, a local fishing guide, as well as staff of the Spey Fishery Board and liaison with the two schools. This activity has also been supported by SetNet (Science, Engineering, Technology and Mathematics Network).
Help was always available. (Photo: Zoë Taylor)

A trout to take home! (Photo: Zoë Taylor)
Further information is available at:
Spey Fishery Board: www.speyfisheryboard.com
River Spey Angling Association: www.riverspeyanglers.com
Abernethy Angling Association: www.boatofgarten.com
Tomintoul Angling Association: www.fishspey.co.uk/tomintoulanglingassociation
SetNet: www.setnet.org.uk
Fly tying at Aviemore Primary School in Scotland

Children and experts working together

Volunteers from the local community visited Aviemore Primary School to demonstrate fly-tying to the pupils. Each pupil made their own fly to take home. The children benefited from learning from an expert. The children also got great enjoyment out of the activity, along with a sense of achievement, and encouragement to take up a new hobby.

A morning of fly-tying was arranged by the Spey Fishery Board biologist. He invited a number of local experts to visit the school to demonstrate fly-tying to 10–11 year old primary school pupils.

Volunteers from a local Anglers Association, a fishing guide from the River Spey, and a local fishing tackle dealer assembled at the school where they took ten minutes to set up their equipment before they began the fly-tying sessions. These sessions included both salmon and trout patterns in the flies.

Imitation of aquatic insects

Fly tying is the art of making artificial lures which are then used in fly fishing to catch salmon or trout. These artificial flies are usually made of a hook with thread, fur, feathers and a wide variety of other materials. As the flies can be very small, some special tools are required for the complicated work required to produce them. A vice is required to hold the fly, and pliers, a magnifying glass and scissors are also essential equipment. There are many different fly patterns, and they are usually created to imitate different aquatic insects. Some of the large salmon rivers have specific fly patterns associated with them.

An example of a fishing fly.
(Photograph: Bob Laughton)
The class was divided into two groups. One group watched a DVD on fly-tying for beginners, then carried out some drawing and designing of flies. The other group had fly-tying instruction. Each volunteer demonstrated the technique to six pupils at a time, with two separate sessions. Following the demonstration sessions, each pupil was able to tie a fly of their own design. The two groups then changed places, so all the children had opportunity to see the DVD, design flies and learn how to tie them.

The event was a great success. The children were extremely enthusiastic. Each child had at least one fly of their own tying to take home. The volunteers also received many questions from the children about a great number of fishing and fly-tying issues. The volunteers found it hard work but very enjoyable. After the event the children wrote thank you letters to the volunteers, and reports of their work.

**Lessons learned**

This activity can be linked to the curriculum through Environmental Studies, Expressive Arts, Language, Personal and Social Development. It also gives links with people in the local community.
Good Practices in Northern Watercourses

A volunteer and a pupil working together. (Photos: Bob Laughton)

Sense of achievement as a fly is completed.
Watercourse is an Excellent Resource for Environmental Learning

A selection of flies tied by pupils.

School children tied different fly patterns.
Good Practices in Northern Watercourses

The children learned about how fishing flies can mimic the food of fish in the river, and about the different types of insect that live in the river. The children had a great sense of achievement and satisfaction, and this made the whole exercise extremely worthwhile and enjoyable. This type of activity introduces children to fishing and its importance to the local economy. It leads on to fly casting and fishing, and it could introduce children to a new hobby. If there is a safety concern with using hooks for fly-tying, small pieces of thin pipe can be used to practice on.

The volunteers found the experience very rewarding, and were pleased that the children found the activity enjoyable. The River Spey Angling Association propose to extend this type of activity into other local schools in the near future. In order to set up and run this activity successfully in a school it is useful to have a person involved that has links to the local fishing community.

Further information is available at:
Spey Fishery Board: www.speyfisheryboard.com
River Spey Anglers Association: www.riverspeyanglers.com
Abernethy Angling Association: www.boatofgarten.com
School goes to Fish in Scotland

Hatchery and river visit

Children from Aviemore and Craigellachie Primary Schools visited the Spey Fishery Board hatchery at Sandbank, Glenlivet, Scotland. They helped collect salmon eggs, saw them being fertilised, and then visited a nearby river to see salmon spawning. For the ‘school goes to fish’ element of the project, both schools visited the Sandbank Hatchery, Glenlivet. The children were introduced to salmon and the River Spey, and to the duties carried out by the hatchery.

A practical demonstration took place where the children saw large adult male and female salmon, the collection and fertilisation of eggs, the eggs being washed and placed on hatchery trays, and how the eggs are looked after in the hatchery. The children also learned about sampling salmon for scales, genetics, tagging and release of salmon back into the river.

Afterwards the children visited a nearby watercourse, the Burn of Tervie, which flows into the River Livet, a tributary of the River Spey. Here they saw habitat suitable for salmon and spawning redds, showing that salmon are successfully breeding on their own in the wild. They also saw adult salmon swimming in the water and a dead salmon on the bank, which had been caught and partially eaten by an otter. The children also carried out a practical exercise where, after being shown a redd, they surveyed an area of the river to count the spawning redds.

Salmon spawning habitat

The spawning grounds that salmon use are typically gravel beds in relatively shallow, fast-flowing water. Salmon reach their spawning grounds during October to December when the female will excavate a depression in a gravel bed by lying on her side and repeatedly swishing her tail. This action lifts the gravel and carries it downstream. This spawning site is called a redd. When the redd is about 15cm deep, the female releases her eggs into it and they are immediately fertilised by a male salmon. The female then fills the redd, and buries the eggs. During spawning the male salmon chases away other fish. After spawning the male salmon will stay near the redds in order to mate with other females, however they eventually become very weak and die.
Good Practices in Northern Watercourses

Aviemore Primary School class photo (Photos: Sue Scoggins, SNH)

Collecting eggs from adult female salmon.
Watercourse is an Excellent Resource for Environmental Learning

Filling egg trays.

Salmon tagging and scale sampling.
Good Practices in Northern Watercourses

Taking the children to visit the hatchery has been a brilliant success, as it has put the project into perspective for them. It was also very useful to be able to take them to a watercourse on the same day to see adult fish in the river, signs of predation by otter and spawning redds. This illustrated the fact that although the hatchery helps maintain salmon populations in the river, salmon are also capable of doing this by reproducing naturally in the wild.

Lessons learned

Hatchery visits can be linked to many areas of the curriculum such as Environmental Studies, Science, Language, and Personal and Social Development.

As well as a day out, the children got first hand experience of seeing their ‘Salmon goes to School’ project for real at the hatchery and occurring naturally in the river. For this activity to be successful it is best if the children have some prior knowledge of the subject before they visit the hatchery and the river. It is useful to have a talk in school before the visit, as this prepares the children for what they are going to see and learn about. The activity is good for teaching children about the animals that actually live in their local river.

The schools visited the hatchery on separate days, as the size of the hatchery means it would be difficult to accommodate very large groups.

The Spey Fishery Board carry out a risk assessment prior to the children visiting the hatchery. The children have to be watched carefully in the hatchery as there are deep pools of water and also dangerous equipment such as tanks of oxygen. Good pupil management is required.

This activity is easy to manage. The Spey Fishery Board staff, including the hatchery manager and the fishing wardens are happy working with children. People involved have to be good with children, and good at passing their message on.

Further information is available at:
www.speyfisheryboard.com
Scientific study at Craigellachie Primary School in Scotland

Fish study – data handling and graphs

Craigellachie Primary School carried out an environmental study looking at fish populations above and below a whisky distillery discharge into a tributary of the River Spey. The discharge is of warm water into the River Fiddich. Fish surveys were carried out above and below the input of distillery warm water. Salmon and trout were captured, measured and scale samples collected to determine age. A simple habitat survey of the survey sites was also completed. Pupils compiled the data and after analysis determined that fish downstream from the warm water input grew faster and larger than those in the colder water upstream.

The Spey Fishery Board biologist helped the school to plan this project. The children were split into two groups and each of the groups went on a trip to the River Fiddich on separate days. The biologist gave the children a short talk on the river bank before the survey began. Electro fishing was carried out by Spey Fishery Board staff in order to capture a sample of fish for the children to study.

The children are only allowed to observe the electro fishing from the river bank, and cannot take part in it. Electro fishing was performed over areas of different habitats such as riffles, glides, pools, tree roots and undercut banks. The children were then split into groups, with one group analysing the fish and the other carrying out a simple habitat survey. The groups then changed over so that all the children were able to do all the tasks.

Electro fishing

Electro fishing is carried out using a backpack electro fisher which is operated by trained staff. This is a standard sampling technique for juvenile fish. An electric current is passed into the river. This attracts juvenile fish into a capture net. The fish are held in suitable storage containers until they can be analysed. Afterwards all fish are returned alive to the river at the point of capture.
The fish were analysed to find out their length, species, and age class. The habitat survey was done as the type of habitat present will affect the number and type of fish caught. The children recorded the main habitat features, depth, width, water flow type, presence of undercut banks, type of substrate (cobble, boulders) and temperature.

The fish and habitat survey was carried out in two locations, one above the input of warm water and the other downstream from the input. After gathering the data the children took it back to school where they entered it into Excel spreadsheets. They children analysed the data they had collected using arithmetic, maths and graphs. This work involved the class measuring and tallying the data, putting the data into a frequency table, and then recording descriptive statistics from the data.

The children concluded that the data they had collected showed that salmon and trout grow faster in the river downstream of the distillery discharge where the water is warmer than they do in the colder water upstream of the discharge. The fish in the warmer water grow faster and are larger in length and weight for their age than the fish in the colder water. Three examples of the children’s studies are presented as Appendices IIIA, IIIB and IIIC of this manual.

**Lessons learned**

This project can be linked to several areas of the curriculum, maths, ICT (Information and communication technology), use of spreadsheets, and working in groups. The project can also be linked to pollution monitoring and control.
Watercourse is an Excellent Resource for Environmental Learning

The children really enjoyed this project. They enjoyed collecting real data, handling it in the classroom, analysing the data and finding a conclusion. It also demonstrates to the children that what is going on in a river is not always apparent from just looking at the river. A local industry, even one which is regarded as a clean industry, can have a distinct effect on the fish and the river.

It is useful if the children can practice data handling and analysis before collecting their own data, as this helps them to understand why the data should be obtained. This project took a lot of organising. Spey Fishery Board staff spent one week organising this project.

Health and safety is important in this type of project where a river visit is involved. In this case the children were not in the river itself and so lifejackets were not required. Where electro fishing is taking place children should be kept well away from the river and can only observe from the river bank. A good ratio of staff to children is essential.

Further information is available at:
Spey Fishery Board
www.speyfisheryboard.com
Studying river invertebrates in Scotland

Bug and Beastie Hunt

Children collected invertebrate samples from the river and identified the invertebrates that they found. The children found out about other animals that live in the river and how they are an important part of the ecology of the river. Both Craigellachie and Aviemore Primary Schools took part in this activity during their fishing day. Craigellachie also used the technique as part of their scientific studies.

Invertebrates were collected from the river using a standard sampling method. They were collected by taking kick samples, kicking and disturbing the river bed for one to two minutes at a time and allowing the disturbed water and other material to flow into a sampling net on the downstream side. Sieves can also be used to collect the sample, rather than a net. The net or sieve should have a fine mesh size in order to collect the invertebrate sample and not let it flow through straight through.

The material collected was placed in a large white tray, of at least 50 x 30 cm, with some water and spread out to make the invertebrates easier to see.

An identification key was used to help the children identify what invertebrates they had collected, and find out the common groups and families. The “Reference Guide to Invertebrates” used in this school project is shown in Appendix IVA. The main groups found were mayflies, stoneflies, worms and snails. The children counted the abundance of different types of invertebrates and from the numbers found made an assessment of the water quality at that location.

Lessons learned

This activity can be linked to the curriculum through Environmental Studies, Science, living things and processes, and Maths. It can also be used to produce graphs.

The children enjoyed being outside by the river, and catching bugs and beasties. It helps them to understand that there is more in the river than meets the eye. Invertebrates are a vital food source for other animals.
Watercourse is an Excellent Resource for Environmental Learning

A sample from the river. (Photos: Spey Fishery Board)

Searching for invertebrates.
including fish, and an important part of the ecology of the river. This activity can be linked to a fishing day and the salmon life cycle.

This activity does not require a lot of organisation and when the equipment is available it only takes about one hour to plan. The activity lasts for half a day, and is not expensive to run.

Health and safety is a very important issue in this type of activity. Lifejackets should be worn by children where they are taking part in an activity that involves going in the river. Reasonable clothing and suitable for the weather conditions, and rubber boots are essential. Children should be able to wash their hands after this activity. A good ratio of staff to children is required.

Further information is available at:
Spey Fishery Board
www.speyfisheryboard.com
Bradan Aquasurveys Ltd
www.bradan-aquasurveys.co.uk
Artwork at schools in Scotland

Fish on Batique, Weaving and Tapestry

Children at both Aviemore and Craigellachie Primary Schools used their experiences in the NorWat project to produce large pieces of artwork. They were helped by experts in producing these types of art.

Fish on batique

Aviemore Primary School produced a batique wall hanging showing their pictures of fish found in the River Spey.

A specialist art teacher from the local secondary school came into Aviemore Primary School to work with the children. The art teacher came to the school for 1 hour every week for three weeks. The whole class was involved in this activity.

The children looked at pictures of fish, and then designed their own fish by drawing and tracing. They used wax crayons to draw their designs onto fabric, and then the fabric was covered using inks. The fabric was then ironed to remove the wax. The individual fish designs were then placed on a large sheet of fabric. The children also helped in the dyeing process of this large sheet of fabric.

What is batique?

Batique (or Batik) is an Indonesian-Malay word that refers to a wax resistant dyeing technique used on fabric. Melted wax is applied to cloth fabric before it is dipped in dye. Where the wax has seeped through the fabric, the dye will not penetrate. Several colours can be used in this technique, with a series of dyeing, drying and waxing steps. After dyeing, the fabric is hung up to dry. It is then either dipped in solvent to dissolve the wax, or ironed between paper towels or newspaper to absorb the wax. This leaves the rich colours and lines of the pattern visible.
Good Practices in Northern Watercourses

Aviemore Primary School pupils show off their batique wall hanging. (Photo: Bob Laughton, Spey Fishery Board)

Fish weaving. (Photo: Jan Filshie, Aviemore Primary School)
Fish weaving

Aviemore Primary School also carried out a weaving project with the specialist art teacher. The Primary 6 children (10 year olds) all did individual fish drawings first to examine the different colours that fish can have.

The children then used wool to create a framework for weaving on paper plates. They used strips of different materials and weaved them through the framework in order to create a design.

The art teacher then used the individual paper plates to create a large artwork to go on the wall, with every plate representing a scale of the fish.

Tapestry of the River Spey

Craigellachie Primary School produced a tapestry illustrating the River Spey at Craigellachie.

What is tapestry?

A tapestry is a woven decorative fabric, the design of which is built up in the course of weaving. Broadly, this definition has been used for almost any heavy material used to cover furniture or walls, that is either hand woven, machine woven or even embroidered.

A local person that collects and spins wool from her own sheep, and uses it for artwork, volunteered to come into Craigellachie Primary School to work with the children. She came to the school for 2 hours every week for one term. All the children in the school were involved in this activity.

The children were introduced to working with material, weaving and spinning. The expert used knitting and weaving to work with the children to produce a tapestry of the River Spey at Craigellachie, with each child creating either a pebble or an animal to be added to the design.

The children helped the expert with the layout of the design, and then helped to join all the pieces together. The expert then added the finishing touches including the famous Telford bridge over the River Spey at Craigellachie.
Lessons learned

These artwork activities can be linked to the curriculum through expressive arts, observation and designing, and using materials and media.

It is useful to have specialist support for an activity like this. In most cases the activities would not have been carried out without the expert help. It is important that the experts are good at what they do, and are good at communicating this to the children.

The children really enjoyed these activities. They enjoy carrying out practical tasks and having an end product to show for their hard work.
Artwork at Craigellachie Primary School in Scotland

‘Journey of the Spey’ Mural

The children worked with an artist to produce drawings depicting the story of the River Spey. This artwork was then transferred to the school garden wall to create a large mural. The whole of Craigellachie Primary School got involved in this project.

This project took place over one term, which was nine weeks long. The whole school worked with an artist for two hours every week. The children had carried out the ‘Salmon goes to School’ project, and completed a river walk as a whole school prior to starting work on the mural, and so they already had some understanding of the ecology of the river.

Working with an artist

Using photographs supplied by the artist, and material from the River Bank resource box, the children studied the different flora and fauna associated with the River Spey. All the children chose an animal or plant to draw, and as the artist had thought up the concept of bubbles rising out of the river, each drawing was done within a circle. Each week the artwork was started off with the artist and then completed during class time.

Once the drawings were complete, the school board selected which ones they wished to appear on the mural. Some part of each child’s drawing was incorporated into the chosen drawings, so that each pupil in the school had their work represented on the school wall.

The paint used for the mural was masonry paint which the school had won previously in a competition. Paint brushes, plastic containers to divide the paint into, sheets to cover the grass, plastic gloves for each painter, and old clothes were required to carry out the painting of the mural on to the school wall.
The mural in progress.
(Photos: Craigellachie Primary School)

Adults helped with the painting.

Primary 6 & 7 painting.
Good Practices in Northern Watercourses

Pupil painting the mural.

Circle showing flora and fauna of the River Spey.

The bridge over the River Spey at Craigellachie.
Circle with salmon.

The finished mural.

The artist in front of the mural.
The whole community was involved

The school opened on a Saturday to help with the progress of the mural by getting the community involved. Parents, friends and neighbours were invited along to help out. Apart from this, all the painting was done by the children in class time, assisted by the artist.

The completed mural is ten metres long and depicts the River Spey running through Craigellachie. A grand opening ceremony for the mural was held. The Scottish Minister for Education and Young People came to the school to participate in the ceremony. The children took this opportunity to demonstrate the other activities that they had been working on as part of the NorWat project, such as Salmon goes to School, their science project, and communicating with schools in other countries.

Lessons learned

This project can be linked to several areas of the curriculum, including Art, Environmental Studies, Cooperative Learning, Working in Partnership and Geography. The children really enjoyed working with the artist, and working outdoors on the mural. They were all extremely proud of the completed mural. The artist also found it very rewarding to work with the children on this project.

For a project of this size and type to be successful it is essential to involve a specialist. The specialist can devote more time and effort to the work than teachers in addition to their normal school work. The painting of the mural took place during September. The best time of year to
do this type of work outside in Scotland would be the summer term, but
the children are too busy at that time of year with their normal activities
and cannot fit in this additional work. The work cannot be done later
in the year than September, due to the potential weather conditions and
short daylight hours.

It may have been better to have the artist come to the school for 2
visits a week, in order to complete the project in a shorter timescale.
Health and safety has to be considered for this project. The school asked
parents’ permission before the children were allowed to paint using the
masonry paint, and it is important to make sure the children have the
correct clothing and gloves. Insect repellent is also useful as the children
suffered from midge bites whilst painting outside.
Historical studies in Scotland

Historical study of River Spey by Aviemore Primary School

The children looked at the history of the River Spey, how it was used in the past and what jobs people had that were associated with the river.

The children used the River Bank resource box as it provides a lot on information on the history of the River Spey. Around forty children were split into two groups, and each group visited Abernethy Forest for half a day. The local Countryside Ranger took the children on the trip to the forest, and helped them out looking at the history of the river and also nature activities.

The children looked at timber logging that had taken place in the forest. They also heard how the river was important for transporting the logs by floating them downstream to the coast where they were then used in ship building. They also looked at the site of a sawmill and also a boring mill, where trees were drilled to form pipes. Pupils also looked into the various uses of the wood. Apart from ship building, a lot of timber in the area was made into pipes for sewage.

The children also looked at the life history of the freshwater pearl mussel, made leaflets about fishing on the River Spey, and looked at different types of fishing rods and how they have changed over time.

Lessons learned

This activity can be linked to History, Language, and ICT (Information and communication technology) in the curriculum. The children learned a lot about the past use of the River Spey and how this has changed to the present day.

It is useful to have help from a Countryside Ranger or other person with expert knowledge for this type of activity.

Further information is available at:
Countryside Ranger
www.highland.gov.uk/leisure/countryside/rangers
Good Practices in Northern Watercourses

Abernethy Forest – work by children. (Photo: Jan Filshie, Aviemore Primary School)

An example of written work about the boring mill. (Photo: Jan Filshie, Aviemore Primary School)
Radio programme at Aviemore Primary School in Scotland

Working with technology and the local community

Aviemore Primary School interviewed local people in the community and used recording equipment to make their own radio programme, with the help of a national radio presenter.

The whole class of 28 children were involved in this project, and it was organised by the class teacher. The children used microphones and minidisk recorders for recording their interviews with people.

BBC (British Broadcasting Corporation) Radio Scotland presenter Mark Stephen visited the school twice. He carried out a preliminary visit, and then visited again to record an interview with the teacher. Lots of equipment was involved and he brought his own specialist equipment. He explained to the children the process involved in making a radio programme. During his visit the presenter also interviewed a local fishing guide who had been invited to the school to talk about fishing equipment and demonstrate casting techniques. These interviews were broadcast on national radio in a programme called ‘Out of Doors’ about the great outside in Scotland.

The children went on to make their own radio programme, which was a diary of their work on the NorWat project. A planning process was carried out at the beginning, to organise what was to be done and who would carry out each task.

Interviews conducted by the children took place outside. A group of no more than six children carried out each interview. The following people were interviewed: a local fishing rod maker who hand crafts fishing rods from both modern and traditional materials to produce the finest salmon and trout rods, and who is rod maker to the Royal Family; a retired gamekeeper from a local sporting estate; a local man who has spent his entire life involved with the River Spey; the local authority Countryside Ranger and an expert on freshwater pearl mussels from the University of Aberdeen.
Lessons learned

The project was linked to the curriculum through Language, Personal and Social Development, and ICT (Information and communication technology).

Apart from advice received from the radio presenter, no expert help was used for this activity. The teachers carried it all out themselves. The equipment has to be both child and teacher friendly. Some problems were encountered with the equipment used, because it was not reliable.

The children enjoyed producing their own radio programme. It is important to have a final product or outcome for an activity of this kind.
Using technology in NorWat

Creation of a DVD by Aviemore Primary School

Aviemore Primary School pupils created a DVD of some of the work they carried out as part of the NorWat project. This was done with the help of a film making expert.

Aviemore Primary School pupils were visited by an expert in film making from Perth College. The work to create this DVD took place over one term and the whole class was involved. A new DVD camera was purchased in order to enable the children to carry out this activity.

At the beginning of the activity the children had to apply for the various positions required for film making, such as the camera person and editor. The children made up story boards illustrating what they were going to film. They also wrote a script for the film. Some of the children carried out the actual filming. After the filming had been done the children edited the material, added a soundtrack to the film and produced the final version of the DVD. All this work was carried out with the help and support of the film making expert, and all the work, apart from filming on location, was carried out in the school. The film making expert brought the equipment needed for editing and producing the DVD.

The DVD shows a diary, a record of the work that took place that term. It includes footage of the children’s visits to the Highland Wildlife Park, Spey Dam, Whale and Dolphin Conservation Society Centre at Spey Bay, and the Salmon goes to School project.

Lessons learned

This project is linked to the curriculum through Language, Science, Maths and Personal and Social Development. It demonstrated a positive and valid use of technology. The children enjoyed making the DVD, and having it as an end product of the project.

For this type of project to be successful it is important to have expert help at the beginning and support throughout the project. Some funding is necessary as schools may not always have the correct equipment for film making.
Visit to Spey Bay. (Photos: Jan Filshie Aviemore Primary School)

Filming at Spey Bay.

More filming for DVD.
Introduction and background information

The Primary School of Lehtola is located in a small village on the shore of Saarijärvi watercourse in Central Finland. Because of a small and even declining number of pupils, the school was closed down in 2004, just before NorWat started. Nowadays the old school-building is used as a small scale youth hostel, employing a full-time manager and 1-2 persons during the high-season. The school building stands on the shore of Saarijärvi watercourse in the middle of nationally important cultural historical environment.

Parts of the watercourse are within the Natura 2000 network. There are also many interesting traditional rural biotopes in the area. Since the 1980ies large-scale restorations have been implemented in the watercourse near the school building. Therefore, the surroundings offer excellent conditions and opportunities for teaching issues related to the aquatic and cultural environment.

Project idea

In recent years, like in many other European countries, population growth has been concentrated in the larger cities in Finland. Many smaller settlements and rural areas are suffering from depopulation. It means that in some parts of rural areas small schools cannot be run anymore. The Lehtola village school was closed in 2004.

Camp-school was seen as an interesting arena for tangible activities in NorWat project. The key idea was to arrange outdoor oriented camp-school for secondary school pupils. Camp-school on the shore of the watercourse was seen as valuable educational resource to teach issues related to map and orienteering, hiking skills, aquatic and cultural environments, social skills, international cooperation and training of foreign languages.

Another aim in the International Camp-School case was to combine new methods for teaching water-ecology. Learning from each others was essential. For example, Norwegian teaching methods and specialized
The old school building of Lehtola village is located by the Saarijärvi watercourse.
water-studying field became familiar also to Finnish pupils. Different teaching methods, combining recreation with traditional environmental education, applying “learning by doing” approach and ecological knowledge were main elements in the camp-school project. New opportunities for networking were also identified.

**Objectives of the international camp-school**

1) Network different experts and officials, schools from primary school to higher education level, regional planning officers, local people and local associations with each others.

2) Introducing and testing Norwegian water-study equipment, which are specially intended to be used in nature, and to learn about local cultural landscape.

3) To develop a holistic approach in an environmental education project.
Good Practices in Northern Watercourses

Working methods

The school-children from Norway (16) and Finland (23) aged 15–16 years were accommodated in the old primary school of Lehtola. Several skills and practices related to water were introduced. The Finnish pupils started on Monday 21.8.2006 by learning mapping skills and the concept of “catchment area”. Norwegian school-children joined the group on Tuesday.

<table>
<thead>
<tr>
<th>Day</th>
<th>Theme</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>Map as a tool</td>
<td>Introduction to the concept of catchment area. Mapping skills.</td>
</tr>
<tr>
<td>Tuesday</td>
<td>Cultural Landscape</td>
<td>Team building activities and playing. Introduction to traditional landscapes in Finland and NorWat approaches in Lehtola village (e.g. sheep, cattle and horses, traditional smoke sauna, building traditional wooden fences).</td>
</tr>
<tr>
<td>Wednesday</td>
<td>Water-related tasks</td>
<td>Working in groups (8–9 pupils): fly-tying, fishing with hook and line, fish structure, water sampling methods, water-quality studies, canoeing, monitoring methods, water organisms, water protection issues.</td>
</tr>
<tr>
<td>Thursday</td>
<td>Hiking Skills</td>
<td>Hiking in the surroundings, making food in the nature, canoeing, outdoor life and enjoyment. Visiting Finnish host families.</td>
</tr>
<tr>
<td>Friday</td>
<td>Reporting</td>
<td>Reporting and presentations about camp-school tasks in Saarijärvi Secondary School.</td>
</tr>
</tbody>
</table>

For instance, in Wednesday, during the “water day” of the camp-school, pupils went from different bases with different tasks at each base, according to a planned schedule. Two instructors were named for
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each task. They looked after the necessary equipment and showed the pupils their tasks in each site. See below two examples of water survey tasks in Lehtola.

Task 3: Water Survey, chemical water quality; instructors Jon and Jaana

Instructors’ role: Talk about local water-quality by using the water-quality map of the Saarijärvi watercourse (see the map below) and criteria for the general water quality classification in Finland. The instructor asks the pupils if they know any reasons for decreased water quality in the area.

Pupils tasks: Pupils take water-samples by pairs. They measure pH, water temperature, phosphorus and nitrogen, and mark the results on a special research form.

Equipment

• Water quality map of the Saarijärvi watercourse; laminated paper (size A4, 50 copies)
• Figure about the water cycle system (50 copies)
• A wall map of the Saarijärvi watercourse (including the whole catchment area)
• Thermometers for water and air
• Water sampler (e.g. ‘Ruttner’ x 2), sample bottles
• Water sample packages (x 2)

Tasks for the reporting-day

1) Try to find information about water-quality in Saarijärvi watercourse (www.ymparisto.fi)

2) Compare the water-quality results of the Saarijärvi watercourse to corresponding Norwegian results (case Kvannangen).

Afterwards, the Finnish pupils wrote an article about their camp-school experiences for the local newspaper of Saarijärvi. In general, the camp-school case received a lot of publicity in regional TV and newspapers in Central Finland.

Appendix V of this manual shows the Small Environmental pictionary in English, Finnish, Swedish and Norwegian. It is a result of the international camp-school in Lehtola.
Good Practices in Northern Watercourses

Camp school activities. Pupils built a traditional hence together with local villagers (above) and learned to use water study equipment. (Photos: Jaana Leppänen)
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Task 4: Water survey, aquatic animals, plankton; instructors: Arja and Sanna

Instructor’s role: Briefly describe fresh-water ecosystems: most common aquatic animals and their living environment (benthos, water-insects, plankton) and distribution. Talk about water-quality. Finally, the instructor describes and demonstrates the practical tasks.

Pupils’ tasks: Pupils take by pairs one water-sample with a plankton net. They also look under stones to find small animals to be examined by a microscope. Pupils draw and name animals that they find.

Equipment
Water analysing equipment (microscopes, plankton nets etc.)
Leaflets to leaders
White trays to examine benthos (x2), tweezers
Pencils and drawing paper

Tasks for the reporting day
Try to find from internet some examples, photos or pictures from different benthos (Trichoptera spp, Plecoptera spp), plankton (Cladocera spp, Copepoda spp) and water-insects (Gerridae spp). Transfer them to your report and give names.

Pros and cons of the Lehtola camp-school

+ Camp-school is a very good arena to study ecology (water-ecology) in a holistic way.
+ Camp-school offers opportunities to learn social and outdoor skills in natural surroundings.
+ Camp-school offers a good arena for school-children to get international experience.
+ There is enough time to do time-consuming ecological projects compared to normal school-days.
+ Curriculum has to be quite simple because of the language barrier.
+ Exchange of ideas, learning different teaching methods, utilizing joint equipment, and sharing other, often quite expensive facilities.

- Organising an international camp-school is expensive because of high travel costs. Good sources of funding are needed.
- It is difficult to find simple enough learning material, in order to teach ecology in English to “not-native-speakers” of English language. Most of the material had to be developed by the instructors themselves.
Fly-tying (above) and traditional felting (left) belonged to the group tasks of Finnish and Norwegian pupils in the Lehtola camp school. (Photos: Mira Koivunen and Jaana Leppänen)
Camp school activities. Hook and line fishing (above) is a simple example of enjoyment and recreation in nature – unfortunately forgotten by many families nowadays. Media was interested in many NorWat approaches (right). Many pupils were interviewed for example during the camp school in Lehtola. (Photos: Jaana Leppänen)
NorWat actions at Lannevesi Primary School in Saarijärvi

Restoration of a streamlet as an educational project

Introduction and background information

The Primary School of Lannevesi is located in a small village nearby Saarijärvi watercourse in Central Finland. There are three teachers and altogether 59 pupils in the “village school” of Lannevesi aged from seven to twelve years. The school building stands on the shore of Lake Summasjärvi and a small rivulet, called Rahkosenpuro, flows just beside the school-yard. The surroundings offer excellent conditions and opportunities for teaching issues related to aquatic environments.

Project idea

Almost all rivers and their tributaries in Central Finland have been widely influenced by forestry, agriculture, hydro-power and transportation. Many large-scale watercourse restorations have taken place in Central Finland since early 1980’s. Now emphasis in restoration activities is shifting from fishery based actions to multipurpose restorations of small streams and the whole catchments.

Because of the wide experience in river-restorations in Central Finland, a small-scale voluntary brook restoration was seen as an interesting task and a practical project for NorWat. Stream restoration as a part of environmental education in a primary school was the key objective. The Rahkosenpuro stream was seen as a valuable educational resource, but also as a target and tool.

Another aim in the Rahkosenpuro case was to find new methods for teaching ecology and the water-cycle. Different teaching methods, combining art with traditional environmental education, applying the ‘learning by doing’ approach and ecological knowledge were elements in this school project. ‘Learning by doing’ method was seen as important,
The streamlet of Rahkosenpuro is located next to the Lannevesi Primary School.

allowing children to participate and contribute to their near environs. This restoration project also facilitated networking many different participants.

**Key objectives of the project**

1) Network different experts and officials, schools from primary school to higher education level, regional planning officers, local people and local associations with each other.

2) Planning, implementation, testing and documentation of streamlet restoration at Rahkosenpuro and its nearby landscape. A holistic approach in an environmental education project.

3) Carrying out the learning-model and developing an educational DVD.
School children were eagerly restoring their “own streamlet” under the guidance of experts. (Photos: Jaana Leppänen).
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Working methods

The school-children from 7 to 12 years planned and implemented a real brook-restoration project with the help of experts. The smallest pupils, 7–8-year-old children, drew pictures of the brook and its surroundings, 9–10-year-old children took photos of the stream environment and 11–12-year-old pupils made a practical restoration-plan as a form of map.

As a result there was a holistic restoration plan in the form of a map. The proposed restoration actions were then implemented in practice. All the phases and working methods were documented in details in a DVD which is also available.

The restoration work itself was started in September 2005. Children were first introduced to some monitoring methods, such as electro-fishing. Pupils measured water-depths and temperatures and photographed the seasonal changes of the streamlet. In October 2005 children prepared a map of the current situation of the streamlet and its environs. The restoration work was finalized in practice in September 2006. Working tools were simple, and readily available. For example spades, handspikes, buckets and rakes were used. In addition, about 3 m³ stones (diameter 5–25 cm) and 2–3 m³ spawning gravel were needed.

Aquatic life and various fishing practices became familiar

The pupils at Lannevesi school were introduced to several skills, practices and knowledge related to water. The children learned new things such as fly-tying, fly-fishing, fishing with hook and line, ice-fishing, water sampling, water quality studies and monitoring methods. Water organisms, aquatic plants and water protection issues were also included in the school project. For further details see the DVD (The Streamlet Restoration project in the Primary School of Lannevesi).

A special ‘Environmental day’, ‘Ice-fishing day’ and a trip to local hatchery were organized. The children also participated in an international camp-school in Norway. Different methods of water studies were included as part of these events. The pupils also wrote an article to the local newspaper in Saarijärvi about NorWat actions and their experiences in the international project.
Good Practices in Northern Watercourses

Gravel and stones were needed in the restoration project. (Photo: Jaana Leppänen)

The Rabkosenpuro streamlet restoration project has connected many people and organizations in a new way. (Figure: Jan Lustig, photos: Jaana Leppänen)
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Pros and cons of the Lannevesi school project

+ good opportunities to practice new type of networking: experts from different organisations, school children and teachers, local associations
+ one already known area as a learning arena with clear ecological boundaries
+ holistic method for learning ecology and the water cycle
+ learning by doing
+ opportunity to include some parts of practical results as learning material in a DVD
+ DVD was seen a good method for documentation
+ children were very motivated to participate

- long and time-consuming project
- not enough time to produce detailed learning-material
- Due to long summer holidays at Finnish schools, some seasonal species and long-term follow-up methods are difficult to implement by the pupils.

Solutions to the problems

Time and sufficient resources are needed for the planning, material production and practical implementation of this kind of project. This process can be very useful and fruitful for all participants. Doing something for a second time is always easier!

1–2 week ‘Summer school’, e.g. in the form of a camp school, in teaching special environmental issues should be considered. Children could also be given some individual summer tasks, e.g. plant and bird observations. Results could be presented and reported after the summer holidays.

The learning project will continue

Next winter and spring-time the school-children of Lannevesi will make a special trip to the catchment area of the streamlet Rahkosenpuro. There are also plans to carry out some new activities in winter-period: net-fishing, ice-fishing and a snow-art day will be organized and documented on a DVD.

A university master thesis project on ‘A Streamlet as a Tool of Environmental Education’ has been started. The Rahkosenpuro restoration project will also be analyzed from the viewpoint of the national ‘Strategy for Education and Training for Sustainable Development and Implementation Plan 2006–2014’ and the general educational system of Finland.
Good Practices in Northern Watercourses

Case Rahkosenpuro in a Nutshell

Idea and objectives

to teach the concept of a catchment area in a new and holistic way so that 12-year-old pupils understand it before leaving the primary school.

Background

Good opportunity: the stream of Rahkosenpuro flowing beside the Lannevesi school yard; upstream agricultural and forestry lands; downstream a rather big lake Summasjärvi

Open questions

Why is the stream silting up? Why does the water level change so much?

Teaching challenge

How can the complicated entity of a catchment area be taught to different age-groups? What are suitable opportunities for different-age children? There was no holistic material available before the project.

> upstream waters – Rahkosenpuro stream– Lake Summasjärvi
> sensory experiences and impressions: touching, listening, smelling, tasting
> field-trips: floods – low water periods
> phenological observations: flowers, deciduous trees, migratory birds etc.
> hydrological observations
> water and fauna sampling (electro-fishing etc.)
> impacts of different land-use forms (e.g. agricultural ditches, culverts)
> photographic sites
> how to improve the environs and how to restore the stream?
> voluntary working days

Teaching material and methods developed

> expert lessons
> field trips
> independent observations
> teaching videos/DVD’s
> ‘Pertsa Puronieria’ or ‘Charlie the Char’ (available only in Finnish)
> Upstream waters and Lake Summasjärvi
> Wild Trout Project: educational video/ DVD about management practices (in Finnish)
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Drawing and making a map belonged to the school children’s restoration project. (Photos: Jaana Leppänen)
Field trips and thematic days

Introduction and background information

University of Applied Sciences/Institute of Natural Resources (JUA/INR) is situated in traditional cultural landscape nearby the Saarijärvi watercourse. The Institute of Natural Resources provides Bachelor of Agriculture and Forestry degree education in Saarijärvi and is actively involved in the development of rural areas. Participation in different national or international projects with partners from working life is an essential part of the studies.

The Primary School of Lannevesi is located in a small village nearby the Saarijärvi watercourse, within a reasonable distance from the University of Applied Sciences, Institute of Natural Resources. The “village school” stands on the shore of Lake Summasjärvi and a small rivulet, called Rahkosenpuro, flows adjacent to the school-yard. The surroundings offer excellent conditions and opportunities for teaching issues related to aquatic environments. It was easy to develop cooperation and joint activities between higher education students and primary school pupils, for mutual benefit and also fun!

Many JUA/INR agronomist students had important roles in implementing some of the NorWat project actions. Students worked in the project as trainees, they carried background studies, collected material, wrote reports, organised events, and some of them did their thesis or final work in NorWat. Some students had an essential role in the school cooperation. They were working as tutors of school children, and planned and prepared educational material for different events. Organizing thematic days or special events was considered a good method for teaching many issues and increasing environmental awareness.

Project idea

There was much practical grass-roots level cooperation between the Primary School of Lannevesi, Central Finland Regional Environment Centre, Jyväskylä University of Applied Sciences/Institute of Natural Resources, Forestry Centre of Central Finland, and University of Jyväskylä/Institute for Environmental Research. The benefits of this cooperation were mutual in many ways.

The aim of the Lannevesi school project was to combine knowledge about water ecology, agriculture and other rural industries and outdoor...
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life, and to teach environmental issues to young children in a new way. Agronomist students were asked to plan and arrange special activity days with different themes, and also make a report about the activities and outcomes. The key idea was that students can increase their own knowledge of the watercourse, its ecology and its potential as a source of livelihood. They also had opportunities to gain experience in organizing events and preparing presentations. For their part the primary school teachers gained support and material for teaching water ecology in natural surroundings. The variety to normal school days was also welcome.

Target groups were 7–12-year-old school-children. Main topics were related to fishing and water studies. Several thematic activity days were arranged together with the agronomist students: an Ice-fishing Day, an Environmental Day and a Fly-tying Day. The objectives were to

- network experts, different school levels (from primary school to higher education level), regional planning officers, and local associations with each others.
- to plan and implement special activity days in natural surroundings.
- to test in practice a holistic approach to a small environmental education project.

In addition, a special Stream Vegetation Day was arranged for the pupils of Lannevesi school. Children were also introduced to forest vegetation during another special day. The stream vegetation day was organized jointly by the biologists of the Forestry Centre of Central Finland and University of Jyväskylä/Institute for Environmental Research. The forest vegetation and principles of some forestry measurements were taught by an expert from the Forestry Centre of Central Finland. Also a social evening eating fish was arranged on the shore of the lake Summasjärvi.

Environmental Day in brief

Agronomist students planned and arranged the program of an environmental day for Lannevesi primary school pupils. The main theme of the day was “Life from water and along a watercourse”. The day was arranged close to the Institute of Natural Resources, allowing the utilization of the institute’s indoor facilities and its location by the Saarijärvi watercourse, in a beautiful rural environment. Also health & safety issues were carefully considered when moving by the flowing river.
The contents of the environmental day included several items: watercourse and its catchment area as a source of livelihood; polluted water versus pure water; aquatic-animals and plants; and short hikes in nearby surroundings. A special day was arranged for different classes in early June: one for 7–8 year-old children; the other for 9–10 years and the third one for 11–12 year-old pupils.

Agronomist students planned the curriculum and worked as tutors during the learning days. The first part of the day was arranged indoors including workshops about aquatic animals, plants, agriculture and environmental protection. The other part took place outdoors. So it was possible to learn the same things in natural environment and habitats.

The students planned a special route along which there where different thematic bases with various tasks. Also an outdoor lunch was organized with some bird observation, measuring water temperature and recognizing insects.

Afterwards, the students collected feedback from the different participant groups (their own instructor, Lannevesi school teachers and pupils,
and other stakeholders, such as Central Finland Regional Environment Centre), in order to develop the program for future purposes. It was jointly agreed that a similar day should be organized in every two years.

The school children also wrote about their experiences during the environmental day: Many of the pupils were describing the differences between good and bad water quality. Many wrote about fish species, little “bugs”, development of amphibians, and even their experiences about stroking a cow in the nearby pasture.

**Ice-fishing Day in brief**

The ice-fishing day of the Lannevesi primary school pupils was arranged in close co-operation with the primary school teachers, the local fishery board, University of Jyväskylä/ Institute for Environmental Research, Central Finland Regional Environment Centre and University of Applied Sciences/ Institute of Natural Resources. Both teachers and students, authorities and experts were networking.
Primary school children enjoyed fly-tying. (Photos: Mira Koivunen)
The children were introduced to the plants and animals of the streamlet Rahkosenpuro. Ice-fishing took place on the shore areas of the lake Summasjärvi. After that, fish-entrails were studied. The media was actively involved in the day program: the thematic day received coverage in regional TV news, regional and local newspapers and radio.

Fly-tying and Fly-fishing Days in brief

A special fly-tying day was arranged in the primary school of Lannevesi in early April 2006. The fly-fishing day followed in mid-May. So the children could use their own flies. NorWat project supplied the necessary fly-tying material and equipment. Children used, for example, a fly-tying vice, a bobbin, a gem, scissors, hackle, feathers and pliers. During the fly-fishing day children were introduced to fishing theory and equipment, and fly-fishing in practice. People from the local fishery association helped, which was very important especially to the smallest 7–8 year-old school children.

Stream Vegetation and Forest Vegetation Days in brief

Two special thematic vegetation days were organized by NorWat experts. During the stream vegetation day the school children were taken to the nearby Rahkosenpuro environs where pupils learned to recognize 15 different aquatic plants. The instructors also taught the children scientific names for the plants which were found hilarious by the children.

The idea in the forest vegetation day was to get acquainted with the nearby forest’s plant life. Children also learned to measure of tree lengths and estimated the cubic volume of the growing stock. The tasks were implemented under the guidance of the Central Finland Forestry Centre’s expert.

Both thematic days run by the external experts received very positive feedback. The school children and their teachers, and the instructing experts were very satisfied with this experience.

Fish meal evening on the shore of the lake Summasjärvi

A special fish evening for local people was arranged in cooperation with the local Spa Hotel Summassaari. The event was especially for children and families. NorWat project partners and students of the Institute of Natural Resources planned and implemented the program of the evening. Information was widely delivered by the local media.
Different fishdishes were served to guests (tourists and local people), fly-tying material and practices were introduced to the audience, and people were told about different fishing methods and fishdishes. The local fish processing industry introduced their own products. A playful competition for hook and line fishing was arranged for families and children. All children that participated in the fishing competition received a hook and line for themselves as a present from the NorWat project.

**Bird-Box Building Day in brief**

Bird-box building was found to be a diverse and useful project, which can easily be arranged during a normal school-day. In the Lannevesi primary school this thematic day was arranged with the help of experts and machinery originally developed in the Central Finland Regional En-
The needed raw material and equipment are simple. Wood logs or preferably pre-cut 20–50 cm long blocks are needed. The diameter of the blocks should be 17–27 cm. The most suitable tree species for this purpose are spruce (Picea sp.) and pine (Pinus sp.), but also birch and European alder (Alnus sp.) are sometimes used. Wood boards, a saw, a drill, a hammer and nails are needed.

In the Lannevesi school, the main and most laborious part of the construction work was made with the help of a special machine called ‘black woodpecker’. The machine drills the core of the wood block away and makes the interior of the block hollow. The size of the hole can be varied according to the needs of certain bird species. Then the “entrance hole” is drilled on one side of the block to a suitable height from the bottom. The size of the entrance hole also varies from one species to another.
Good Practices in Northern Watercourses

After cutting and drilling children constructed and finished bird-boxes by adding the ‘roofs’ and ‘floors’. This was done with the help of members of the local fishery association and the school teachers.

Learning about bird ecology was an important part of these construction sessions. Especially issues related to nesting were gone through with the pupils. The children from the Lannevesi primary school made altogether 250 bird-boxes in two building sessions. Bird-boxes were sold to local people. The idea was to earn some money for the journey to NorWat-camp school in Norway and to cover some costs of the camp-school in Lehtola, Saarijärvi.

Pros and cons of the thematic school days

+ networking with many different stake-holders and mutual benefits
+ school-children of different ages could successfully take part in the program
+ adding variety to normal school days and teaching methods
+ outdoor education in many subjects, e.g. fishery and water quality issues, fit well with the school curriculum
+ students proved to be a good resource for planning and organizing many events
+ organizing students gained valuable working life experiences: planning, scheduling, negotiations with different experts and clients (here the primary school teachers), presentations, material production etc.
+ the media was very interested in the school projects and thus gave positive feelings of importance to the school-children and their instructors
+ bird-box building and fly-tying days can connect handicraft training to studying ecology and fishing in a nice way

- experts are often too busy to participate in school-projects
- it is expensive for organisations to participate in school-projects – time is money
- environmental education and its promotion is usually not highly prioritised even in environmental organisations
- a lot of time is needed for the planning and practical arrangements of the thematic days
- bad weather can cause problems for outdoor education
- backup plans are needed in case of bad weather conditions
Visit to a hatchery

All 60 (aged 7–12 years) pupils from the primary school of Lannevesi visited a local hatchery. The program included an introduction to biology and life-cycle of different fish species like pikeperch (*Stizostedion lucioperca*), grayling (*Thymallys thymallys*) and whitefish (*Coregonus lavaretus*). Also the activities, operation and equipment of the hatchery were introduced to the children.
Higher education students in NorWat in Finland

Thesis work carried out in NorWat

University students took part in the NorWat project in many ways, including in the form of research work. The following master’s and bachelor’s thesis were completed during the project:

Jyväskylä University of Applied Sciences, Degree Programme in Agriculture and Rural Industries, Bachelor’s Thesis
(Library catalogue at janet.amkit.fi)


University of Joensuu, Faculty of Social Sciences and Regional Studies, Department of Geography, Master’s Thesis
(Library catalogue at joecat.linmeanet.fi)

Electro-fishing was one of Juha Piilola’s (in the front) and Tero Matilainen’s (in the back) tasks as trainees in NorWat project. Juha Piilola also made his thesis for NorWat. (Photo: Otto Rautainen)


University of Jyväskylä, Faculty of Education, Department of Teacher Education, Master’s Thesis (Library catalogue at jykdok.linneanet.fi)

Trainees in NorWat

Several agronomist students from the Jyväskylä University of Applied Sciences took part in NorWat actions as trainees or project workers. These traineeships were part of the students’ studies and thus served both students’ academic and professional needs and project’s aims.

The students had diverse and often very important roles in the practical implementation of NorWat activities. The students were naturally instructed and supervised by experts in each subject area. Here is a short-list of those actions that were carried out either partly or totally by the Finnish higher-education students.

**Organisation of an exhibition at the town library of Saarijärvi**
- the main theme was the World Environment Day
- drawings and paintings of the Lannevesi primary school pupils: nature, animals, plants and human beings

**Organisation of the fish meal event on the shore of the Lake Summasjärvi**
- applying for the permissions for the event
- marketing and advertisements and invitations
- program for the evening, cooperation with different groups

**Fly-tying, electro-fishing, fish population studies**
- working as pupils’ tutors
- assisting researchers

**Organisation of meetings between different stakeholders**
- meeting schedules and invitations, other arrangements
- presentations on some subjects
- cooperation and networking with different expertise organisations
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Advising work
- informing farmers about protection zones in agriculture
- consulting farmers about the current special environmental subsidies in EU

Planning work
- preparing protection zone plans
- applications for special environmental subsidies

Communications work
- mastering and updating internet pages
- presentations, writing reports

Lessons learned: pros and cons in the students’ participation

Students gave feedback about their participation and experiences in the project. Some of them took part also in the transnational meetings, for example in Norway, and thus gained international experiences and wider perspectives in the water related issues. Students’ overall experiences in the project were positive, but some problems turned up.

Students had some problems in project administration, reporting and communications.
> It is important to keep all the project participants updated in current issues.

Students had some difficulties in getting started in the project tasks.
> Good introduction to project’s purposes and training are important for an efficient start.

More personal instructions and supervision would have been useful in some cases. Sometimes the students felt that they were left too much to themselves. This happened especially in the summertime during staff holidays.

Students were able to participate in NorWat’s training events, field trips, meetings and other events. This was a very positive experience.
Adoption of rivers and water bodies as an educational resource

'Outdoor school' and the Norwegian way of life

A concept of “Frilufts-liv” or “Close to nature- life” is often related to the Norwegian way of life. This can be included in the school education as well. In the following text we describe some examples of the activities carried out in NorWat.

Access to nearby waters for outdoor education is of considerable value. The Goroso river bend area at Reisa river was utilised by Storslett school during the NorWat project. Now that the sites have been “discovered” they will be utilised again in future for educational purposes. At Goroso the following “mini-modules” are available for educational use:

- Upstream: a disturbed river deposit island, Styggøya
- Upstream: a river reconstruction site of Styggøya
- Upstream: a disputed land fill area at riverside slope and brooks
- At Goroso: a clay slide disaster area from the 1880ies, revealing landforms, pioneer vegetation and new local sediment areas, as well as new secondary fish biotopes.
- At Goroso: farm borders and yards revealing the changing of the Reisa river course
- Flow channels and meanders offering biodiversity, easy canoeing and field work areas.
- Riverside terraces with natural camp sites for groups of 5–15 pupils as well as valley/ mountain panoramas in front of more extensive sites for 30–40 pupils.

Environmental and cultural studies hand in hand

The traditional, flat wooden river boat called ‘Baski’ was also used as an educational resource at Storslett school. Contacts between Halti National Park Centre and the schools led to the establishment of the new river park between the bridges of Storslett.
School children have made drawings about fishing at Reisa.
(above)

Reisa river and the Mollis waterfall (right). The picture was published as the front page of the state phone catalogue in the Northern Troms Region.
Good Practices in Northern Watercourses

Trollvik and Sappen schools are both small schools, close to wilderness. The Trollvik school focused on two particular topics:

1) The Sami river landscape (place names, shoe grass mosses, fishing and hunting sites, meadows, reindeer yards and the general river nature entities from holistic Sami/ Norwegian perspectives. In wintertime, the pupils have tracked animals at the rivers, and also operated a weather station.

2) The school took a concrete challenge of restoring the river stretch in the site where the main road crosses it. The purpose was to improve the migration of the arctic char and trout. As a result of the school’s activity, the water authorities have committed to implementing this task in 2007–2008.

Kvaenangen school goes by bus to their “adopted” water areas (lake and river) in the upstream valleys. They monitor the site according to a special lake educational programme. The purchase of the field study equipment was supported by NorWat.

Environmental education also takes place at the fjord tide water river of Sørstraumen. This site is a famous cultural heritage location with reconstructed Sami ‘gambar’ (turf houses). Here close cooperation has been carried out with the Northern Troms Museum and the Halti National Park centre. As a result of their activity, Kvaenangen school won a cultural award in 2006. This school project also dealt with pine tar burning traditions at the northern rivers.

Fishing in the school

Fishing is included in every school program, but the activity and emphasis varies. Local fishing and household traditions are common themes. Fishing activities are realised in co-operation with local fishing clubs and professional sea fishermen. These activities include fly fishing and fly tying as well as restocking of juveniles in nearby lakes. Also ethic discussions on environmental crime are included in the educational programme.

Using the river in aesthetic and practical themes

The river is an excellent resource also for arts, practising household skills and physical education. These activities include river stone painting, river
music exercises, cooking food from the river on open fires, Eskimo kayak or canoe courses and ice climbing in frozen waterfalls.

An interesting and also a rewarding example of the art work related to the river was a national competition arranged by the state phone company Telenor. The competition was integrated in the NorWat activities at Storslett school. One of the NorWat project classes happened to win the whole competition. The illustrations at Storslette school received their motives from the Reisa river and its valley.

**Physically disabled pupils and environmental education at the river**

In principle, all pupils should be able to participate in common activities, environmental outdoor education, fishing trips, canoeing and other outdoor activities. Health and safety and feedback from the pupils have been taken into account in making adjustments to allow access for children with some physical disabilities to all these activities. A shared determination to overcome barriers is a key to achieving this.
The area of kvaens in Reisa Valley (above). An old hut by the Reisa Riverbank (below).
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Sami and Finnish river place names

Names from Sami and Finnish cultural bases are still commonly used in the area. A historical understanding of the settlement history related to the shifting Reisa river course in the fiord delta has gradually been received. This has based very much on recent digital mapping of the area and landscape models of the human development at the Reisa outlet. For example, Mrs B. Imerslund at Nordreisa high school has done an important job in this. Field exercises related to landscape are currently under preparation for primary and secondary school pupils.

Practical examples of education material used at the adoption sites

Here are some examples of the 10–12-year old pupils’ exercises or task sheets at the riverlet or brook. These tasks have been applied at the NorWat activities in Norway.

Pupils’ task sheets applied in Norway

Pupils’ task sheet 1: Water and its utilisation

I What do I see? – The water
1) Has the water any life?
2) Why is the lake/ river beautiful?
3) Is there something in the water or its environs that is not beautiful, or is remarkable or dangerous?

II What do I see? – The use of water
4) Who is using the water?
5) For what?
6) Can we find two ways of using the water or the areas along the water/ rivet/ brook that are compatible?
7) Can we find ways of using the water or the shores that are directly damaging or are incompatible with other uses?
8) Are there clues of previous use of the water?

III What does it mean for our school/class to “adopt” a brook or a river stretch?
9) Who owns the water?
10) Which stretch should we adopt?
The Mollis waterfall (left) in the National park of Reisa.  
(Photo: W. Offerdal)

Fishing activities.  
(Photo: Ottar Remmen)
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Pupils’ task sheet 2: How the brook is born?

> Find a well known water poem, song about rivers, lakes or brooks, story or fairy tale.
> Try to write your own poem about a small lake or river.
> Try to make an illustration, or your own story about how the brooks are running and singing.

Pupils’ task sheet 3: Where is the beginning of the brook?

> Use a map to find out where the brook and the watershed starts (somewhere at the higher land e.g. in the mountain, in the forest, or at the hill), and what kind of soil, rocks and debris the river is running through.
> Draw the river with its tributaries including your brook.
  You can find information from specialist maps such as geological ones.
> Find out or ask what “debris” means.
> If possible, find a natural pond, a moss or a small watershed to compare it with the place where “your brook” starts.

Pupils’ task sheet 4: How is the brook running? Read the following poem:

The brook runs further

Meeting rock outcrops,
gravel terraces
and the brook is excavating,
bringing gravel further down
Meeting trees, meadows, bushes
and flowers
and is floating seeds from them
to other places

Leaving soil and gravel
When its speed get slower
On the inside of its turns
- but is going on digging on the outside of its turns
The brook is
building and changing

> Look for a stretch of the brook running through debris.
> Here you can study how the brook is digging, transporting, leaving soil and sand (sediments) and how the brook is changing and shaping the landscape
Other useful task sheets are related to insect identification (macro lacustrine fauna) and using a so called macro-organism index to identify pollution tolerant organisms etc. Also tasks about land use recording, mapping and planning have been used. Pupils have recorded the land use and cultural remnants of the past. Also water use conflicts and their solutions have been studied. For example, the Multiple Use Key has been applied in the Riverlet Troll Approach. The case is described in further details in this book.

Lessons learned

Integrating “Close to nature- life” in school work represents a long tradition in Norway. Our experiences are that this will lead to better integrated learning. School education is anchored in cultural environmental values and enhances well-being and health. By utilising the river nearby we can meet these objectives.

River or watercourse activities offer valuable social challenges. For example, three pupils working together in the same canoe is not that easy, especially when there are some cultural and language differences. That is what we learned during the international camp schools, for instance. Sharing the same fishing site with different flies on their rods may also be a challenging situation for children. But generally speaking, outdoor education positively complements indoor education, resulting in the integration of practice and theory.
Watercourse is an Excellent Resource for Environmental Learning

There are some obstacles that need to be considered. The study areas should not be too far away from the school itself, even though all other criteria of the site’s biodiversity and cross connections between items are fulfilled. The site should be close enough to allow access by foot for the younger pupils as well. Even at the new study area Goroso, it takes some time to involve the respective teachers and to adapt the school daily rhythm to the field activities. The site has, however, proven its worth to the schools.
‘The rivulet troll approach’ in Norway

Multiple use matrix approach for children

Through a visit to a river pupils are introduced to the complexity of the ecology of river systems and peoples’ interactions with them in a simple and effective way. The methodology can be adapted to make it suitable for children of a wide age range.

For example, the pupils walk along their river stretch at a pool, observing the fish jumping and the waste pipe entering the river with a brownish line of dirty water in very same pool. They also observe the farmer at a riverside strawberry farm watering his crop with pumped water from the river. After all these observations the children may take a break in the hot midday sun and swim in the river...

Back in the classroom it is time for reflection, and the next lesson is drawing. The teacher and the pupils together use their observations and experiences in a more systematic way to teach ecological principles.

The pupils talk about their observations and then draw an illustration of each of them, in this case four drawings; the fish jumping, the waste pipe outlet, the farmer watering his strawberries, and finally the pupils, themselves, swimming. Then the teacher copies these four drawings, duplicating them to create the row and column headings in a matrix (below):

<table>
<thead>
<tr>
<th></th>
<th>Fish life (pupil drawing)</th>
<th>Dirty run off (pupil drawing)</th>
<th>Strawberry garden watering (pupil drawing)</th>
<th>Swimming place (pupil drawing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish life</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dirty run off</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strawberry</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Garden watering</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swimming place</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Troll faces show if there is a conflict or positive relationship

While the pupils are drawing, the teacher will tell them the traditional stories about the water trolls ruling the rivers and rapids, controlling that the life and activities in the water are in harmony.

Next step is to draw 3 “water troll” faces: one smiling; one angry (or afraid!) and one neutral face. These 3 troll drawings are copied so that there are 6–8 copies of each. Then the pupils are told to attach them inside the relevant squares. Removable tape or glue is practical for this purpose.

For instance, in the crossing square where the “fish life” and the “dirty run off” meet, an angry troll face should appear. In the crossing square between the fish life and the swimming place a pleasant smiling troll face should appear.

Writing explanations lead to further learning

Inside each troll square the pupils may put a number (a footnote), referring to explanatory text written by the pupils. This should explain, for example, why dirty runoff is harmful for fish. Similarly in the crossing square between fish life and runoff, it can explain how the conflict has started and how it should be solved. In the other square where fish life and swimming place meet a footnote to text can explain, how swimming and fishing may be combined in a mutual way. Perhaps some of the pupils will even find out that after their swimming, the fishes were attracted to the area, where they found small animals being being stirred up from the bottom.

The possibilities are endless. Additional water uses might get additional squares, and for instance a plan of a new riverside road might get its square at the bottom of the table, being confronted with all the other interests at the pond. The above simple version of the multiple use matrix should match 10–12 years age. The combinations of land use should be presented as symmetric meetings only, so just the squares above the diagonal of the paste board might be filled in.

A good method also for older pupils

At 13–15 years age, more elaborated versions of the multiple use matrix can be introduced, presenting an understanding of the mutual relations
of land use combinations: The fish does not influence the waste pipe, but the waste pipe is influencing the fish etc. This approach can easily be illustrated by reserving the squares on the upper side of the diagonal for the active combinations (fish influencing the runoff pipe etc.) and the squares below the diagonal for the passive combinations (fish influenced by...).

After these exercises, the pupils, whether they are 10 or 15 years old, might draw a situation map (a draft plan!) of the river pond or river stretch with adjacent land. The pupils can illustrate their own view of what is the most appropriate way for managing the river with competing demands and needs. This should illustrate how all the activities: sewage runoff, road, fishing, bathing and garden watering can coexist in balance.

Lessons learned

This environmental education approach, “The riverlet troll” or “Bekkenøkken” in Norwegian, has been tested in the primary schools of Grenland (Telemark), in 10 other schools in Telemark, in Africa (Tanzania) and in the Norwegian/ Baltic /Russian “3 river project” in the border region of Latvia/ Russia/ Estonia. The approach is mediated to Nordreisa, Tinn and Vinje municipalities. As can be noticed, the approach is a variety of the Multiple Use Matrix with identical principles. They are described in details in the Part I of this book (Participatory Approach and Community Development Hand in Hand).

The above exercise is a simple mechanism for introducing children to the complexities of sustainable river management planning. When such exercises are linked to the real life, for example in the vicinity of the school, the training towards social participation will be deeper and cause more reflection than just telling the children that “dirty water is bad and fish are good”. The same principle can of course be applied to a wide range of circumstances, for examples in promoting healthy eating or physical exercise.

Further information is available from:

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Good Practices in Northern Watercourses

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ottar.remmen@nordreisa.kommune.no

Further reading:


Camp school at a watercourse for 7th stage pupils in Norway

The Sappen camp school activities

All municipalities in Norway get some funds for camp school visits for all 7th year pupils. Sappen camp school in Nordreisa is one example. The Sappen river areas are actively used by the Sappen school itself and also as field areas during the annual Russian–Norwegian environmental summer camps for 40–55 participants.

Sappen is situated at the tributaries of Joselva and Fielbma rivers, which are used for canoeing and environmental education. For example, the Fielbma rivulet is narrow (ca. 5 m) and thus a suitable and a safe enough route for beginners. The lake Josvannet offers ice-fishing opportunities and the mountain “walls” illustrate the ecology of watersheds very well.

The village council and the school of Sappen have created a culture trail. As a part of the first NorWat year the school and the village board mapped and prepared riverside and village projects to be undertaken according to a landscape plan, for example reconstructions in the modified Joselva river tributary. These requests were sent to the Norwegian water engineering authorities (NVE), as a part of the Reisa restoration scheme.

Pupils from Norway, Sweden, Finland and Russia have used Sappen camp school at Reisa river during the NorWat period. The Nordic Association (Foreningen Norden) and Reisa section in cooperation with NorWat arranged Russian-Norwegian camp weeks. The first ones were held in Nikel, Russia and the second one in Sappen, Norway. NorWat staff members were instructors in those camps, Storslett school for the previous 8 years.

An international wilderness canoe rafting on the Fielbma river (Sami name meaning “silent river”) with Russian and Nordic pupils in the same canoe was one of the highspots of the camps.
A typical camp school day and schedule at Sappen is as follows:

1) Transporting canoes and pupils to Fielbma river, 5 km upstream (1/2 hr)
2) General introduction to the nature and ecology of Fielbma tributary river, its catchment area, arctic char ecology, river course description, human impacts and settlements (Sami/Finnish/Norwegian impacts), riverside vegetation and fauna, introduction to canoeing and the challenge of cooperation across language barriers (Russians–Scandinavians), health and security (1/2 hr)
3) Canoe rafting downstream through the rapids and the meandering wilderness Fielbma rivulet (5 km, ca. 2 hrs). 25 canoes, 2 persons in each, sent downstream a few minutes between each pair. Focus on canoeing, pleasure and physical challenges during this trip.
4) While waiting their turn to canoeing, other pupils can study riverside vegetation and/or draw and paint their motifs and perceptions of the ecological entity of “the landscape room”, the Reisa/Fielbma valley (1 hr)
5) Picnic lunch by an open fire.
6) Return to Sappen camp school.
7) Dinner.
8) Football/orienteering/swimming/fishing – free activities

Lessons learned

Camp school is a good way to engage children in the ecology and management of river systems. During the example day above the pupils meet different challenges:

- They need to clear vegetation in Fielbma rivulet in advance for canoeing purpose.
- There is a challenge to ensure safety and follow common instructions.
- There is a challenge to engage the pupils while waiting for river rafting.
- There are several cross disciplinary learning opportunities at the river.
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Camp school activities at Sappen.
(Photos: Ottar Remmen)
'Ole Book’ – a water related gift at school start in Norway

A project in association with the regional library

“Ole Brum” is a popular children’s book in Norway. The regional library got the idea of giving a series of 4 books free to every child starting his/her first class at school (6 years old, about 70 pupils). The project was called “Ole Bok” (in Norwegian).

In 2005, through NorWat support and cooperation, the “Fiskeboka” (“The book about Norwegian fish”, edited by Prof. L. Ryvarden from the University of Oslo) was given as one of these 4 books. The intention of the gift is to stimulate reading and environmental understanding through use of this reference book. In this part of Norway fishing is important both socially and economically. The book is interesting for parents as well as children of all ages.

The intention is that the youngest children will learn from looking at the pictures of the fish while sitting on the mother’s/father’s knee. In the following years, as the children get older, the interesting biological and ecological text in the book will draw their curiosity.

Lessons learned

The feedback from the parents and the library has been good. In our example, the school library and the regional library are very closely linked to the school, so it was an easy and productive partnership. The task was inspired by the Scottish “River Bank” project – an educational resource developed and used in Scottish schools in the River Spey catchment area. The River Bank is described in further details in this publication.

Further information is available at:
Nord-Troms Regionbibliotek (Regional Library)
Director Margrethe Haslund, 9151 Storslett
nordreisa.bibliotek@nordreisa.kommune.no
The hatcheries and the schools in Norway

A new riverside hatchery was constructed

Due to infection risks, the county environmental administration in Troms did not allow establishment of small scale hatchery activities in schools. It was not possible to use fish tanks in the similar way as in the Scottish cases (‘Fish go to school’).

On the other hand, the Reisa River Association (Reisa elvelag) was allowed to reconstruct a salmon hatchery from 1930 on the same river terrace, watered by the same clean ground water. The permit for this work was given during the first NorWat year.

The hatchery at Kjelderer, supported by NorWat and county agro-funds, is now built and will be opened in 2007. A track leads to the previous hatchery site on the same terrace. Display boards will interpret traditional salmon management in the Reisa valley. As a result of this project, there is now a working relationship between riverside farmers, biologists, and teachers and pupils at Storslett primary and secondary school. Experts from the fish farming industries at Reisa are also involved. Scottish, Finnish and Swedish NorWat partners and biologists contributed to this hatchery project.

At Kvaenangen the existing trout hatchery run by the local hunting and fishing club is situated in the same building as the primary and secondary school. This offers scope for both practical and theoretical projects.

Lessons learned

Obstacles
Decision-making, clarifying of water rights, building construction rules and guidelines, and the school preparation and involvement take a lot of time.

Positive outputs and experiences
Funding was surprisingly easy to secure, and there was a lot of local goodwill and motivation. The teachers involved were enthusiastic and skilled.
The purpose of the hatchery project fitted well with the Reisa Salmon stock protection objectives and also with the cultural landscape tasks. This was also closely linked to the NorWat objectives (economic, scientific and educational aims). The project fit well with all three NorWat themes (participatory approach, river restoration and environmental education). Transnational learning took place especially through the Scottish “Fish go to school” project.
Cooperation between schools and institutions in Norway

External experts for education

Diverse cooperation took place in the Norwegian NorWat projects. Connections were created in and between all three main themes. Very concrete results can be seen especially in the environmental education and school cooperation.

Personnel from the county agro-section were contributing to the lessons on the cultural landscape at Goroso. At Trollvik experts introduced pupils to electro-fishing and fish recording. Students at Nordreisa high school advised younger pupils on sampling and fresh water ecology at Goroso.

The same classes and teachers at Nordreisa high school assisted Norwegian water authorities (NVE) on fresh water sampling and bio-status recording before the restoration tasks in the Kildal river at the Furulund. This was a part of the planned reinstatement of an old meander.

The Regional Museum of Northern Troms, the Halti National Park Centre and the Kult architect office cooperated with Reisa and Kvaenan-gen schools on their field trips, river boat culture tasks, landscape understanding and story telling at several occasions during the NorWat period.

These activities were partly directed towards teachers and other NorWat partners and partly towards didactic development. There has also been close cooperation with environmental landscape ecologists and planners, and staff members of the University of Tromso. Experts from fish farms in outer Reisa region, Reisa River Association staff and the State directory on Nature management Trondheim contributed to the establishment of the demonstration hatchery at Kjelderen.

Contacts between pupils, teachers and schools in other NorWat countries

Contacts between schools in the other partner countries have been promoted as a part of developing the environmental education. However,
Good Practices in Northern Watercourses

there have been problems in achieving this. Changes in teachers, pupils and school organisations and lack of familiarity with internet based technology have caused some difficulties.

International visits and camp schools are important in strengthening the bonds. Meeting face to face is very important. Luckily, there have been several mutual visits between the partner countries during the project. In between the camp schools and other school visits, several “exchange idea calls” have taken place.
Basic system ecology links to fisheries – experiences from Sweden

Collection of insects and fly-tying are interesting tasks at school

The following text is based on the NorWat works in the primary schools of Blattnicksele and Gargnäs. An officer from the River Vindelälven Advisory Fishery Board and volunteers from the local fishery organisation visited the schools in order to collect insects for education in biology and further classes in imitation fly-tying.

Fly-fishing is a good method to increase people’s awareness of the environment. There are natural links between fish and their prey. A rich insect fauna produces healthy fish that are in good condition. Fly-fishing, compared with other fishing methods, may give a better connection between nature and man. Furthermore, aquatic insects are good indicators of water pollution. People who find fly-fishing interesting often keep and develop that hobby for the rest of their lives.

From insect ’hunting’ in the field to microscope studies

School children find collecting insects an interesting task. Some particular animals, like dragonfly nymphs, may draw their attention in a positive way. Collecting is best done in the autumn or late summer when insects are well grown and full-sized. A nearby watercourse is a good location so that transportation can easily be organized.

It is normally easier to find insects in weedy or lush lakes or slow parts of rivers than in faster flowing parts where wearing waders is required. Safety is also an important aspect in selection of the watercourse. Good equipment such as nets and boxes are important. Children can also bring their own nets if they want to. You can divide the class into smaller groups to collect insects in different habitats. 30 minutes is normally enough to catch the amount of insects that is wanted.

After ending the session the groups can, for example, describe the habitat they have taken the samples from and put them in a big box so that everyone can see their insects. This part is often found very interest-
ing by the pupils. Different invertebrate families and species are thereby collected in small boxes containing liquid to preserve the insects. It is best to collect big insects rather than small, regardless of their rarity or vulnerability in the environment.

Insects are thereafter studied indoors by using a microscope. The pupils can detect the order, family or species. Naturally, the age and background knowledge of the children needs to be taken into account. The insect habitat requirements can also be documented and linked to the following session which is imitating the insects by fly-tying.

Fly-tying fits well in the school education

Fly-tying and fly-fishing are often considered as difficult, both technically and in theory. One of our goals was to prove that this is incorrect. A couple of the collected insects were used as models when the fly-tying class started. Fly-tying demands small classes/ groups or several instructors. One instructor per five pupils has proved to be a reasonable ratio.

The equipment can often be borrowed from the local angling club, and if possible it is good to involve them in the class as well. It is important to focus on basic and easily usable tools. One way is to start the class with a small theoretical lesson when the chosen fly and the tools are described. Then one instructor ties the chosen fly in front of the class. Choose an imitation that is not difficult to tie but looks reasonably similar to the imitation insect.

Fairly big hooks are chosen with strong thread and few materials are used. Often these easy patterns are the best fishing flies. It is crucial that every attempt is made slowly with a good description of every step. After this the pupils can start to tie the fly on their own. The instructor provides help as necessary. After the first fly is made the children can make another one. New patterns are chosen with the same presentation methodology as above.

The last step is to try the flies in practice. This could either be done during ice fishing or during summer with fly-rods. It is nice, if the children can test their own flies. This is in a way a logical and fruitful end of this learning session.
School children enjoyed fly-tying. (Photos: Daniel Holmqvist)
Winter ecology and ice-fishing at primary schools in Sweden

A luxurious day outdoors!

The following text is based on the NorWat works at the primary schools of Blattnicksele and Gargnäs. Officers from the River Vindelälven Advisory Fishery Board and Rural Economy and Agricultural Society visited the schools and took the pupils out ice fishing. First, an introductory lesson was held indoors in order to prepare the children for what to expect. Almost everyone caught fish and found it splendid to fish on school time. Lunch was cooked and served in the outdoors by the teachers with some help from a couple of pupils. The ice fishing event was documented by the regional radio station and was broadcasted in a 15 minutes long show in the radio program “Nature”.

Fishing as a hobby for children seems to be decreasing. Competition from other activities has increased in recent years, and more people nowadays live in urban areas with less opportunities to take part in outdoor activities. Fishing is a great way to increase schoolchildren’s awareness of watercourses and a good start in understanding the environmental connections between a good fishing resource and healthy waters.

Take advantage of the long winters

In northern Sweden, Finland and Norway the watercourses are covered with ice during the major part of the school year. Fishing on the ice has long traditions in northern areas and is practiced as a social event amongst families and other groups more than summer fishing. Ice fishing is also a great method for school children as it is not technically difficult. No fancy rod, bait or other equipment is required.

Difficulties may occur due to the weather, and really warm clothes are required. Also drilling holes through the ice is physically demanding for younger pupils. If possible, try to select a good sunny day which is not too cold.

It is good to give the children realistic information about what to expect on the ice. Theoretical lessons before fishing are also worthwhile,
Watercourse is an Excellent Resource for Environmental Learning

for example how to make useable knots and baits. The winter ecology of fish is an interesting issue to teach. Different questions can be put to the children: How can the fish survive during winter? Are the fish found on the same spots as in summertime? What do they eat? What are the differences in winter activity among various fish species?

The safety aspect of walking on the ice is also important in these classes. It is good to go through which safety gear is used, what are the differences in the strength of the ice during season, how to recognize weaker ice, and how to react if the ice breaks.

A lot of small fish rather than only few big ones

For children, it is more important to catch many small fish rather than a few “trophy fish”. This influences the selection of the ice-fishing site. Look for a watercourse that holds a lot of small perch or roach instead of hard caught salmonids as arctic char. It is also good to have pre-drilled holes through the ice so it is easy and quick to start the fishing session. The interest is, as usual, biggest at the start. An effective beginning to the event is often crucial for success. Several teachers or guides are often required so that the children can easily get help when it is needed. Some pupils are less patient and interested in fishing than others. It is good to have alternative activities for those. They can, for example, help to make the fire, after having tried fishing.

Look for a watercourse that holds a lot of small perch or roach instead of hard caught salmonids like arctic char.

(Photo: Daniel Holmqvist)
Good Practices in Northern Watercourses

Children get easily bored after a while, especially if they have not caught any fish. Therefore the fishing session should not be too long. A maximum of 2 hours, with a break for lunch cooked over fire is a good way to keep the children engaged and inspire them. Those who do not want to fish can also help with cooking.

Further information is available at:
River Vindelälven Fishery Advisory Board
www.vindelalven.se/fiske/vindelalven
Rural Economy and Agricultural Society
www.hush.se/ac/
Vindel river Association
www.vindelalven.se

Sometimes the fishing gear got tangled; several teachers or guides are often required so that the children can easily get help when it’s needed. (Photo: Leopold Sjöström)
Fisheries management seminar for different interest groups in Scotland

A one day training course is aimed at land managers, farmers, crofters and outdoor recreation providers, who have an interest in the rivers of the Cairngorms in terms of fisheries management. Using the River Spey as an example the workshop seeks to increase awareness about fish species present within the river; to identify threats to existing populations and examine management options to minimise these; to examine water use within the river and the effects on fish populations; to examine recreational access within the river and to look at potential ways to minimise conflict.

The Spey is used for several purposes

The Spey is a key river for salmon and was recently designated as a Special Area of Conservation (SAC) for the species along with the pearl mussel, otter and sea lamprey. There is no doubt regarding the importance of salmon fishing to the local economy and alongside that the Spey also supports one of the best sea trout fisheries in Scotland. A growing interest in pike fishing is also developing. The Spey is also a major public water supply. It supports the distilling industry and produces hydro-power in the upper catchment. Other recreational activities such as canoeing and rafting are also blossoming.

Awareness of fishery management and fish species requirements were increased

Maintaining fish stocks and sustaining viable fisheries, along with meeting conservation targets, requires a considerable management commitment. This falls on the shoulders of the Spey Fishery Board and statutory bodies such as Scottish Natural Heritage and Scottish Environmental Protection Agency. Much of the management of the river goes unseen.

The purpose of this one day seminar is to tell about the recent advances in managing the River Spey and its fish populations to local people, anglers, ghillies and other river users. In addition a series of practical
workshops were developed to provide hands on experience of fish management techniques. These included visits to the SFB hatchery, fish counter and fish pass demonstrations, and electro-fishing demonstrations. A canoe trip along a short stretch of the Spey was also developed.

The seminar was lead by the R. Laughton, biologist of the Spey Fishery Board, and supported by additional expert speakers. Organisation and delivery of the seminar was assisted by Kate Christie, Land Based Training Unit of Cairngorms National Park. See the programme for the day in Appendix VI.

Further information is available from:

Bob Laughton
Spey Fishery Board
www.speyfisheryboard.com

Kate Christie
Cairngorms National Park
The Square, Grantown-on-Spey PH26 5HG
Tel 01479 870 535/537
katechristie@cairngorms.co.uk
Invertebrate training course for adults in Scotland

A short course in invertebrate collection and identification was established to provide participants with the skills to conduct invertebrate surveys for general baseline surveys. The skills gained can also be used for introducing school groups to invertebrates, rapid assessments of pollution incidents and collection of general invertebrate data to assess the condition of a river.

Invertebrate Monitoring Programme

Assessment of invertebrate communities can produce a useful, general measure of stream health and productivity. Many aquatic invertebrates have specific habitat requirements, including a limited range of water chemistry and these species can be used as biological indicators to broadly assess the status of the water.

To fully identify all the invertebrates commonly found in watercourse takes many years of training so there is a need to establish a short less intensive approach which can be used more widely by a range of personnel interested in watercourses.

The current course was developed by Craig Macadam (Bradan Aquasurveys Ltd). The aim is to introduce participants to the key families of invertebrates and to allow estimates of abundance and an assessment of water quality to be determined.

Equipment list

The following equipment was found useful and practical in the Scottish course:

- Safety equipment – life jacket, dry wash, etc.
- Waders
- Standard hand net (commonly called ‘pond net’).
  Standard frame plus 50cm deep net with a 1mm mesh.
- Bucket
Good Practices in Northern Watercourses

- Large white tray
- Large pipette
- Quick Reference Guide
- Hand lens (optional)
- Record Sheet and pencil

Methodology utilized in the Scottish course

1) The different habitats within the sampling area are identified, for example, shallow still water, fast moving riffle, slow water and weed.

2) A total sampling time of 3 minutes is split proportionally relative to the areas of habitats including the margins. For example, if riffles occupy 50% of the site area they should be sampled for 1.5 minutes and if weeds occupy 25% of the site area they should be sampled for 45 seconds.

3) The hand net is rested on the riverbed and the area immediately upstream is disturbed using your foot. The invertebrates are carried into the net by the current. (For sampling from a weed area the weed is kicked upstream of the net.)

4) The sample is emptied into a bucket of water and slowly worked through in a separate tray identifying the following targeted taxonomic groups:
   - Stoneflies
   - Cased caddisflies
   - Caseless caddisflies
   - Mayflies – *Baetidae* (swimmers, Olives)
   - Mayflies – *Heptageniidae* (clingers, Yellow May Dun)
   - Mayflies – *Ephemeridae* (Classic ’mayfly’)
   - Freshwater shrimps
   - Snails
   - Leeches
   - Water Hoglouse.

The abundance of each group is recorded on the record sheet using the following codes:
A) 1–9 absolute count
B) 10–99 nearest 10
C) 100–999 nearest 100
D) over 1000

The sample can then be emptied back into the river. Selected specimens can be kept for further identification, if required. A laminated key for identification is supplied.

The volunteer monitoring reference guide and record sheet can be found in Appendix IVA and IVB.

**Health and safety considerations**

The immediate hazard is drowning although there are other hazards such as sudden immersion into cold water causing shock, clothing making swimming and staying afloat difficult or fatigue and hypothermia where rescue is not immediate. Before entering the water the area should be checked with a staff or pole to ensure that the substrate is stable and capable of bearing your weight. When wading always have one foot firmly on the bed before moving the other. Never wade out further than two thirds of your wader length.

Leptospirosis or Weil’s Disease as it is commonly known is a serious and sometimes fatal infection that is transmitted to humans by contact with urine from infected rats. This disease starts with a flu-like illness with a persistent and severe headache. You can catch Weil’s Disease through cuts and scratches and through the lining of the mouth, throat and eyes after contact with infected urine or contaminated water, such as in ditches, ponds and slow flowing rivers. To prevent the transmission of this disease you should take the following precautions:

- Cover all cuts and broken skin with waterproof plasters before and during work.
- Wear protective clothing and gloves.
- Wash your hands before eating, drinking or smoking. If you think you have contracted Weil’s Disease you should report any illness to your doctor and tell about your work. Leptospirosis is much less severe if it is treated promptly.
Invertebrate collection through kick sampling training (above). Invertebrate samples are sorted and key families identified and counted on site (below). (Photos: Bob Laughton)
Watercourse is an Excellent Resource for Environmental Learning

In urban areas, glass or metal debris may be present in the stream bed. Take care when sorting through the sample or examining stones from the watercourse.

Always make sure that someone knows where you are planning to sample and when you expect to return. Make suitable arrangements for action to be taken if you do not return when expected.

Lessons learned

- Samples can be collected, quickly and cost effectively. Very little specialist equipment is required.
- High quality data is produced on invertebrate communities and water quality without the need for costly expert advice. However, samples can be retained for further analysis if required.
- Good baseline data is received for comparison with future samples.
- New skills are developed.
- A network of skilled invertebrate samplers who can collect data regularly and build up information on water quality can be established.

More information is available at:

Spey Fishery Board
www.speyfisheryboard.com

Bradan Aquasurveys Ltd.,
PO Box 21659, LARBERT, FK5 4WX,
Tel: 07786 631369
www.bradan-aquasurveys.co.uk
EU Water Framework Directive leading to a landowner course

Cooperation with a forestry project in Sweden

In spring 2005, a project called Forest for Water (FFW) was working in the same area as NorWat. The local project coordinator of the “Forest for Water” was contacted at the Swedish Forest Agency. FFW decided to include river Gargån among their pilot areas to enable cooperation and sharing of experience between the two projects.

It was jointly decided to establish a local interest group for river Gargån. Landowners in the area were invited to a short course about the goals of the Water Framework Directive and about the opportunity to participate in this work.

The first meeting was held in Sorsele in spring 2005. Twelve participants learned more about the ecology of water and the area surrounding the water. They also discussed how to practically improve the status of the river Gargån. In the second meeting two weeks later the lectures and discussions continued. All lectures were based on a manual provided by “Forest for Water”.

The curriculum and contents of the landowner course

Session 1
Presentation of curriculum file, paragraph 1–5 (see the contents on the following page) Discussion about practical actions to improve the environment along River Laisilven and River Gargån

Session 2
Presentation of curriculum file, paragraph 6–10 (see the contents on the following page) Discussion about practical actions

Session 3
Field excursion to Abmobäcken, a tributary to River Gargån
## Contents of the curriculum file

### Part 1: Project descriptions
Description of FFW and NorWat

### Part 2: What is EU Water Framework Directive?
A short overview of the Directive and the new Regional Water Authorities

### Part 3: Outflow areas
Description and map documentation of river Laisälven and river Gargân outflow areas

### Part 4: Water from air to sea
Water circulation and water flow in the landscape

### Part 5: Life in water
Ecosystems and forms of life in watercourses. The adaptation of fauna in running waters

### Part 6: Forestry impacts on water
The impacts of forestry on hydrology and water chemistry. Acidification and recovery.

### Part 7: Water adapted forestry
How to foster excellent water environment through forestry practices and management?

### Part 8: Water conservation
Means of restoring lakes and watercourses, e.g. lime washing or restoration of watercourses affected by timber floating

### Part 9: Social values

### Part 10: Legislation, subsidies and protection
Overview of Forestry and Environmental legislation. Information about Nature Conservation Agreement and Biotope Protection

### Part 11: Co-operative actions
Landowner discussions about relevant actions in actual water flow areas

### Part 12: Glossary
Good Practices in Northern Watercourses

In early summer 2005 the group made a field trip to Abmobäcken, a tributary to river Gargån. There representatives of both NorWat and Forest for Water showed some practical examples of things that had been done to improve the status of the water and its surroundings. A group of scientists, for example, had placed dead trees in the water of river Abmobäcken to study what positive effects dead wood has on the insects and fish that live in the water. Also a representative from the County Administration of Västerbotten showed the results of their studies at the river Gargån and its surroundings, based on geographic information data.
PART IV
NorWat Lessons in a Nutshell
What did we learn from NorWat?

As in all human activities, we have faced several problems and obstacles in the implementation of the NorWat project. However, we want to see these difficulties as positive challenges and as learning opportunities. We have put together the list below of those matters we could have done better or in another way. Some of these obstacles were identified and listed during two GOPP (Goal Oriented Project Planning) workshops we held during the final year of the project.

In this paper we focus mainly on management and administrative matters, and those larger-scale or general issues that might improve the quality of future projects. The lessons learned (pros and cons) in the practical NorWat cases have been described in each case description.

Definition of project’s objectives

- When planning and preparing a project, it is important to
  - share all partners’ expectations, contributions and roles in the partnership.
  - jointly analyse the possible obstacles to success.
  - jointly agree the project outcomes and specify the project targets in as tangible a way as possible.
  - jointly develop project actions, define responsibilities and establish the schedule for each component of the project
  - make the project objectives as tangible and measurable as possible.
  - define the key-terminology so that communication is easier.
- Application of a participatory planning method is worthwhile, e.g. GOPP workshops.

Allocating resources

- Realistic resource allocation (time and funding) is very important in all partner organisations to ensure the success of the project. This needs careful planning in the project preparation phase.
• People tend to have too many tasks rather than too few. Be realistic!
• Describe the roles, tasks and responsibilities of each partner or even each person in as detailed a way as possible.
• Underestimating the costs at the planning phase may cause problems and limit operational flexibility during the implementation phase.

Communications

• Good communication – both internal and external – is needed for a successful project, particularly where there are language barriers. Communication is never too good!
• A comprehensive communication plan from the very beginning of the project is an asset.
  – Remember different communication channels and media.
  – Remember the potential end-users’ or beneficiaries’ needs.
• A high quality and informative web site for the project can serve both internal and external communication needs.
• Efficient internal communication is a necessity in managing the daily activities, agreeing upon joint “rules of the game”, avoiding misunderstanding, enhancing partners’ commitment, updating information etc.
  – Efforts focussed on creating an efficient start to the project are worthwhile.
  > Organise the initiation meeting or workshop face-to-face. Virtual meetings (e.g. video-conferences) are cheaper but less productive in terms of creating a good working atmosphere and efficient start to the project.
  > Remember the importance of reinforcing confidence, commitment and cooperation from the very beginning.
  > Invest some time in training partners in project management, administration and other mandatory practices, and if possible invite representatives of the financing institutions to participate. This will help the running of the project.
  > Recheck whether the project plan is in line with partners’ expectations, contributions, external risks etc. and revise the details if needed. Keep the financiers up-to-date.
Good Practices in Northern Watercourses

- “Monthly Bulletin or Newsletter” is a very practical tool for reaching various stakeholder groups regularly. It is fast and economical when sent electronically.
  - A newsletter is not just a source of information but also an instrument to increase awareness.

Commitment

- The participative approach in all project phases is very important. Participation of a wide range of people (partners) from the planning and application phase to the practical implementation and the final phases of the project is useful. This helps in
  - incorporating all partners’ views and knowledge
  - developing a joint understanding and view about the development needs, objectives, actions and activities of the project
  - developing trust and confidence between partners
  - laying the basis for sound and productive working relations
- Utilise and apply participative working methods within the partnership as much as possible
  - We have found for example GOPP workshops (Goal Oriented Project Planning) useful in identifying issues, problems and objectives, and also in increasing positive atmosphere and job satisfaction.

'Differences' in a transnational project

- Partners’ and partner countries’ differences in interests, starting situations, working cultures and in other matters, serve to enrich the project in most cases, despite some practical problems.
- Keep in mind the learning aspect of cultural differences. There is no “good” nor “bad” culture. Forget the attitude of “Besser wisser”.
- Open communication, giving and asking feedback, sharing expectations, experiences and problems often and regularly help in understanding others.

NorWat messages for decision makers

- Treatment of wastewaters in rural areas has a significant impact on the environment. In general, well-designed water resources management is one of the key issues that can maintain the viability in rural areas. This needs government support.
People do not fully understand what affects water quality. For example, activities and influences in catchment level are not clear. More resources are needed for catchment level water protection.

In addition to national funding also regional resources are needed for developing environmental education. This works quite well in Scotland.

Village schools are extremely important in supporting community development and the vitality of rural areas.

More positive incentives rather than punishments are needed in promoting environmental protection. We learned that some Scottish experiences may be useful for Norway, Sweden and Finland.

End phase of the project

Both internal and external evaluation of the project is important throughout its life. Especially during the final phases evaluation is essential and can create a basis for future activities.

Managing all the material (both printed and electronic) created in a large transnational project is a challenge. The intention is to widely disseminate information and the results of the project, after the project period. Our solution is to locate all NorWat material and documents at the library of the Jyväskylä University of Applied Sciences/Institute of Natural Resources.
Final words from the Editor’s Desk

There are a lot of very positive results and outputs in the NorWat project. From the editor’s point of view some activities may deserve a special distinction. The environmental education activities as a whole were implemented in the most transnational and cooperative way. All countries were actively involved and learned from each other. For instance, the brook restoration project, camp schools, “Fish go to School” and “School goes to Fish” initiatives were all success stories and examples of cooperation across borders. Different age groups, experts, organisations and nations were working together – literally.

Utilisation of the so-called Multiple Use Matrix Model (MUM) also belongs to the highlights of the project. It taught us many important aspects about participation in environmental planning and management. Community development planning with tangible and visible work in the villages in question were appreciated by the local people. Experts’ willingness to share their knowledge about practical solutions in watercourse restoration was also valuable.

There is still a lot of work to do along northern watercourses. We hope that NorWat activities and outputs can inspire further development work in the areas of River Spey, River Reisa, River Vindel and Saarijärvi watercourse. By the same token, we hope that our experiences can motivate other regions in the Northern Periphery. Many NorWat activities are worth implementing elsewhere!
Reisa Release Rap!

Backing my outboard from riverbank Reisa,
the sun is so high, like me I and my fly!

Lille-Mollis RAPP!!!
Lille-Mollis, Disseltakka, Voumatakka RAP!!!

A twenty pound salmon rushes my line
– nobody here – that fish shall be mine!

Lille-Mollis RAPP!!!
Lille-Mollis, Disseltakka, Voumatakka RAP!!!

– Attack from police-boat! The river police
steel my fish to release, my fish to release!!!

Lille-Mollis RAPP!!!
Lille-Mollis, Disseltakka, Voumatakka RAP!!!

Lillemollis Rap adapted
NorWat, May 2006
References
References


References


References


Slettsset/Styggøya reports, River Reisa (TWG2). NorWat/ Reisa Elvelag et al.


Workshop on local riverside planning, River Reisa (TWG1). 2004. NorWat /Sappen village board.

Appendixes
Appendix IA – Wastewater clarification checklist

Wastewater clarification checklist for the surveyor in a village

How to make a clarification or report of the wastewater system of house not connected to sewer networks?

General aspects
• This is a short list for the surveyor and needs to be adapted and completed for different practical cases.
• The more implemented clarifications, the better “expert eye” and routine!

Planning and preparation of the survey
• The basic question is the need and the purpose of the survey: what kind of information is needed and why?
• The pre-definition of the survey area needs to be done jointly with the municipal authorities. There is no optimal size of the survey area; it varies from one case to another.
• The property registers and maps help in getting an overview of the properties in the area.
• Contact the owners of each property and fit in the schedule of the survey early enough, for example a week before the date you are planning to suggest. It is good, if the municipal authorities take the initiative in contacting the property owners.
• Spare at least two hours for each property. The more you know about the property beforehand, the better you can estimate the time needed.
• Whenever possible, the owner of the property should always be present in the survey.
• Tell what kind of information should be available during the survey.
  – Topographic map
  – Design drawings of the building, living area/ surface area, papers concerning the current wastewater treatment system, location drawings
  – Area of the site, register number
  – Photos of the building period of the system, if available
• Check or ask the owner/ customer to check
  – Town planning information, exceptional permissions
  – Ground water information, soil information
• Prepare yourself to telling about financial possibilities in renewing the wastewater system.
• Ask if the customer wishes to know about some special issues, e.g. dry toilets. Prepare yourself to questions and get information material if available.
• Plan your survey route and timing. It is good to visit free-time residents during the weekends, working people in the weekends or in the evenings and senior citizens daytime during the weekdays.
• Prepare the material and the questions (see an example of the questionnaire form below) to be stated. Acquire also the necessary survey and measurement equipment.
Appendix 1A – Wastewater clarification checklist

• Prepare yourself also to situations that there is nobody present at the property. In these cases you should leave an informative leaflet and ask the property owner to contact you later.

At the property
• Introduce yourself and be always polite, even if you receive “cold” reception.
• In the beginning, tell the basic facts about the current (and future) legislation.
  – Why is the survey needed? How will it be utilised?
• Remember open and friendly discussion and two-way interaction!
• Work systematically during the survey
  – First ocular survey of the system and the current situation, then a more detailed survey of the system.
• Evaluation of the function and condition of the current system.
  – Write down your appraisal in the questionnaire form.
  – Advice for the future actions: schedule, different alternatives
• Measurements for the drawings
  – Nearby buildings and other targets with centimetres accuracy.
  – Targets within a range of a few tens of metres, 0.5 metre accuracy
  – Estimate distances to more remote targets; e.g. 60–70 m or 150–200 m.
  – Take always into account the topography and other circumstances.
• Mark down the slope of the terrain, if easy to notice.
  – Extra clarifications if relevant (e.g. a very steep slope)
• An outline of the structure of the wastewater treatment system
  – Not necessary if there are only septic tanks and a drainpipe to a ditch or a pile/stack of stones
  – Always deliberate consideration in special cases
  – The outline needs not to be in scale, if it is otherwise clear enough.
  – Instructions on service and maintenance
  – Tell why a log book of maintenance is needed. Tell what its contents should be.
  – Go through all matters related to the real estate in question.
  – Give the customer only relevant parts of the log book of the system’s usage.
  – Advise the customer to the utilisation and filling of the log book.
• Leave always relevant information material to the owner/resident of the property.
• Sometimes you may need to make a telephone interview if you cannot reach the property owner personally. In these cases, work again systematically and use the similar format as during the visits.

Making the report
• Remember the original purpose and need of the survey when writing the report.
Appendix IA – Wastewater clarification checklist

• Make relevant classifications and groupings for handling the data and making the statistics. For instance, it may be useful to group the data according to the current treatment system, type of the residence utilisation (permanent or free-time) and the location of the building (e.g. whether or not in the ground-water area).
• Think about photos, figures and drawings. They can be very useful and informative.

As an example of a wastewater treatment survey and its report, we present the questionnaire form developed by the experts of the “Rural Wastewater Treatment Project in Central Finland” (Jyväskylä University of Applied Sciences/Institute of Natural Resources). This form was used also in the NorWat survey implemented in Lannevesi village.

The surveyor should have technical knowledge, for example background in construction engineering. Understanding of the legislation, communication and advising skills as well as good physical condition for the field studies are also important qualifications.
### Wastewater Treatment Report

To be kept at the property. To be shown to the authorities when asked.

<table>
<thead>
<tr>
<th><strong>OWNER OF THE PROPERTY</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Name:</td>
<td></td>
</tr>
<tr>
<td>Address:</td>
<td></td>
</tr>
<tr>
<td>Telephone home:</td>
<td>Telephone work:</td>
</tr>
<tr>
<td>Occupier of the property (if different from the owner):</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>LOCATION OF THE BUILDING</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Village:</td>
<td>Name of the real estate and register number:</td>
</tr>
<tr>
<td>Address of the building:</td>
<td></td>
</tr>
<tr>
<td>Area of the real estate/site:</td>
<td>State of town planning/zoning:</td>
</tr>
<tr>
<td>Is the building located in the groundwater area: yes no</td>
<td></td>
</tr>
<tr>
<td>Further information:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>TYPE OF BUILDING</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ detached house</td>
<td>□ terraced house</td>
</tr>
<tr>
<td>□ free-time house (cottage)</td>
<td>□ sauna</td>
</tr>
<tr>
<td>□ residential building of a farm</td>
<td>□ other, what?</td>
</tr>
<tr>
<td>Number of persons:</td>
<td>Living/ surface area m²</td>
</tr>
<tr>
<td>□ permanent</td>
<td>□ temporary/occasional</td>
</tr>
<tr>
<td>Further information:</td>
<td>Estimated time of utilisation months/year</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>WATER FOR HOUSEHOLD CONSUMPTION</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tap water: yes no (carried or pumped from the well or respective)</td>
<td></td>
</tr>
<tr>
<td>Service water taken to the building from: own well water system elsewhere, where from?</td>
<td></td>
</tr>
<tr>
<td>Estimated water consumption m³/month</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>WASTEWATER GENERATED IN THE REAL ESTATE</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ toilet waste waters and washing waters</td>
<td>□ only washing waters</td>
</tr>
<tr>
<td>□ other waste waters (e.g. oily waters), the origin of which:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>TYPE OF TOILET</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ flush toilet</td>
<td>□ ordinary small water consumption other, what?</td>
</tr>
<tr>
<td>□ composting toilet</td>
<td></td>
</tr>
<tr>
<td>How is the waste handled?</td>
<td>The distance of the waste treatment location from the shore meters.</td>
</tr>
<tr>
<td>□ outdoor toilet/lavatory</td>
<td>How is the waste handled?</td>
</tr>
<tr>
<td>The distance of the waste treatment location from the shore meters.</td>
<td></td>
</tr>
<tr>
<td>□ other, what?</td>
<td></td>
</tr>
<tr>
<td>Further information:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>TREATMENT OF WC WATERS</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ waters are led to a closed container</td>
<td>Material of the container □ plastic □ concrete other, what?</td>
</tr>
</tbody>
</table>
## Appendix IB – Wastewater treatment report

### Effective volume of the container

<table>
<thead>
<tr>
<th>Container Type</th>
<th>Volume (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective Volume</td>
<td>m³</td>
</tr>
</tbody>
</table>

### Manufacturer of the Container

<table>
<thead>
<tr>
<th>Container Type</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Container Name</td>
<td>Name</td>
</tr>
</tbody>
</table>

### Model of the Container

<table>
<thead>
<tr>
<th>Container Type</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Container Name</td>
<td>Model</td>
</tr>
</tbody>
</table>

### Age of the Container

<table>
<thead>
<tr>
<th>Container Type</th>
<th>Age (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Container Name</td>
<td>Age</td>
</tr>
</tbody>
</table>

### Is there an alarm system of fulfilment of the container?

- Yes
- No

### Is the container waterproof?

- Yes
- No

### Further information:

- WC waters are treated jointly with other waste waters
- Other treatment, what?

### TREATMENT OF OTHER WASTE WATERS (kitchen and washing waters)

<table>
<thead>
<tr>
<th>Container Type</th>
<th>Volume (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective Volume</td>
<td>m³</td>
</tr>
</tbody>
</table>

### Material of the Container

- Plastic
- Concrete
- Other, what?

### Manufacturer of the Container

<table>
<thead>
<tr>
<th>Container Type</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Container Name</td>
<td>Name</td>
</tr>
</tbody>
</table>

### Model of the Container

<table>
<thead>
<tr>
<th>Container Type</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Container Name</td>
<td>Model</td>
</tr>
</tbody>
</table>

### Age of the Container

<table>
<thead>
<tr>
<th>Container Type</th>
<th>Age (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Container Name</td>
<td>Age</td>
</tr>
</tbody>
</table>

### Is there an alarm system of fulfilment of the container?

- Yes
- No

### Is the container waterproof?

- Yes
- No

### Further information:

- Wastewaters are treated in the following way

### Number of components in the septic tanks

<table>
<thead>
<tr>
<th>Component Type</th>
<th>Volume (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water capacity of the first component/chamber</td>
<td>m³</td>
</tr>
<tr>
<td>Water capacity of the second component/chamber</td>
<td>m³</td>
</tr>
<tr>
<td>Water capacity of the third component/chamber</td>
<td>m³</td>
</tr>
</tbody>
</table>

### Total capacity

<table>
<thead>
<tr>
<th>Total Capacity (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total capacity</td>
</tr>
</tbody>
</table>

### Is the volume of the septic tanks sufficient?

- Yes
- No

### Are the tanks waterproof?

- Yes
- No

### Material of the Tank

- Plastic
- Concrete
- Other, what?

### Manufacturer of the Tank

<table>
<thead>
<tr>
<th>Tank Type</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tank Name</td>
<td>Model</td>
</tr>
</tbody>
</table>

### Building Year of the Tank

<table>
<thead>
<tr>
<th>Building Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building year</td>
</tr>
</tbody>
</table>

### Do the septic tanks have bottoms?

- Yes
- No

### Do the drainpipes have T junctions?

- Yes
- No

### How often are the septic tanks emptied?

- Times a year.

### Where is the sludge delivered from the septic tanks?

- To the main treatment (e.g. sand filtration, soil infiltration)
- Through a drainpipe, where?

### Further information:

- Infiltration into the soil
- Soil infiltration (ditches)
- Infiltration area/field m²
- Infiltration pipes metres
### Appendix IB – Wastewater treatment report

#### The main treatment of the wastewaters

- **Infiltration field:**
  - Infiltration area: ___ m²
  - Infiltration pipes: ___ metres

- **Soil type in the infiltration site:** not known

- **Groundwater distance from the infiltration surface:** not known

- **Building year of the soil infiltration site:**

- **Further information:**

---

- **Sand filtration**

- **Filtration field:**
  - Filtration area: ___ m²
  - Filtration pipes: ___ metres

- **Filtration sections/ ditches:**
  - Filtration area: ___ m²
  - Filtration pipes: ___ metres

- **Groundwater distance from the bottom of the filtration site:** not known

- **Building year of the filtration site:**

- **Further information:**

---

- **Small-scale sewage treatment (single property)**

- **Manufacturer:**
- **Model:**

- **Building year of the small scale sewage treatment plant:**

- **Other, what?**

The cleansed wastewater after the final treatment is led by a drainpipe to:
- **the ground**
- **ditch or pool**
- **body of water**
- **elsewhere, where?**

The discharge site is located on:
- **own land**
- **land owned by someone else**

- **Stream velocity of the drain ditch is estimated to be:**
  - **slow**
  - **fast**
  - **none**

- **Further information:**

---

**EVALUATION OF THE CONDITION OF THE SYSTEM**

- Malfunctions occurred in the wastewater treatment system and reparations implemented:

- **Describe the condition of the waste water treatment system (e.g. waterproofness, unbrokeness, weathering):**

- **Reparation needs of the wastewater treatment system:**

- Are the drainage waters of the property led:
  - **to a septic tank**
  - **directly to the cleansing process**
  - **elsewhere, where?**
  - **not known**
  - **there is no drainage water system**

- **Further information:**

---

**EVALUATION OF THE CLEANSING EFFICIENCY**

Select the most appropriate type of your property (1. flush toilet, 2. dry toilet or 3. property with very small amounts of waste waters) and tick the alternative (poor/ tolerable/ good) that matches best with the cleansing efficacy of your waste water system. Please, tick also the appropriate subtitles.
Appendix IB – Wastewater treatment report

1. There is a flush toilet in the property:
   - **Poor**
     - There is no cleansing system
     - For all wastewaters there are only 1-2 septic tanks
     - The septic tanks or the closed container are old (age e.g. over 20 years), no renovations
     - The septic tanks do not have bottoms
     - There is no cleansing process after the septic tanks
     - Significant malfunctions (odours, blocks, contamination of the nearby wells)
     - Occasional service and maintenance
     - Other, what?
   - **Tolerable**
     - 3 septic tanks plus main treatment process or respective or a closed container but the waterproofness of the septic tanks or closed container is uncertain (age e.g. 10-20 years)
     - There are some minor malfunctions in the main treatment process (odours)
     - Annually emptied or functionality observed
     - Other, what?
   - **Good**
     - 3 septic tanks plus main treatment process or respective or a closed container
     - No malfunctions or just a few problems a year
     - The cleansing system is relatively new
     - Regularly emptied or functionality observed
     - Other, what?

2. The property is plumbed in but there is a dry toilet:
   - **Poor**
     - There is no cleansing system
     - Significant malfunctions (odours, contamination of the nearby wells/water systems)
     - Other, what?
   - **Tolerable**
     - 1-2 septic tanks and soil infiltration but the condition of the containers is poor (e.g. age over 20 years)
     - Malfunctions in the system (odours)
     - Other, what?
   - **Good**
     - 1-2 septic tanks plus main treatment process
     - The cleansing system is relatively new
     - No malfunctions or just a few problems a year
     - Other, what?

3. Only a very small amount of wastewater is generated in the property ("grey wastewaters" from kitchen and bathroom):  
   - **Poor**
     - Wastewaters are led to water systems without any cleansing
   - **Tolerable**
     - Wastewaters are soaked into the ground or treated in a cleansing process
   - **Good**
     - A sample of the cleansed water can be taken easily (e.g. from a well or drainpipe)

**Sampling**

A sample of the cleansed water can be taken easily (e.g. from a well or drainpipe)

**Follow-up studies/results, if available:**

<table>
<thead>
<tr>
<th>Biological oxygen demand (BOD)</th>
<th>Total phosphorus (P&lt;sub&gt;tot&lt;/sub&gt;)</th>
<th>Total nitrogen (N&lt;sub&gt;org&lt;/sub&gt;)</th>
<th>Latest date of sampling</th>
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</thead>
<tbody>
<tr>
<td>Yes</td>
<td>1</td>
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<td></td>
</tr>
</tbody>
</table>

**Future Plans**

Are there any plans to repair or renew the wastewater treatment system or some parts of it?

**Name of the Surveyor**

Date:

Signature:

Assistant: in the survey:

**Appendices**

1. **Topographic map**, marked with the location of the building.
2. **Location drawing** (scale 1:500), with the following information:
   - Buildings, household water wells
   - Septic tanks, closed containers, cleansing apparatus (soil infiltration, sand ditches filtration), drainpipe
   - And waterways, contour lines, underdrains and location of their discharge
   - Household water wells or springs located in the neighbour sites and within 200 meter range (both distance and course) and waterways
3. Plan drawings of the cleansing system, or if not available, a sketch drawing of the system.
Appendix II – Riverbank resource list

RIVERBANK RESOURCE LIST

Compiled by Liz Balharry & Pat Thornton
Appendix II – Riverbank resource list

The resources are listed under the following formats:
Riverbank Users guide
Teachers' packs
Teachers' guides & booklets
Resources on the Spey Catchment
Books
Identification books
Booklets
Archive Folder
Photographs
Information packs in plastic wallets covering the following topics:
1. Water safety information
2. Activities & ideas for lessons on water related topics
3. Tourism, recreation & occupations around the Spey
4. Nature reserves & protected areas in the Spey catchment; Wildlife & The Law
5. Drinking water, waste water & sewage treatment
6. Good management of river banks
7. Rivers physical: how rivers behave, geology & acid rain
8. Freshwater mini beasts
9. Freshwater pearl mussel
10. Birds of the Spey
11. Osprey feathers & rings
12. Fish of the Spey
13. Mammals - otters, mink, bats, red squirrel, badgers
14. Mammals - water voles, beavers, seals, cetaceans
15. Trees & plants in the Spey catchment
16. Pond life and small creatures photo pack
17. Great Photos
18. Computer discs & Music
19. Keys (single copy items)
20. Keys (3 class packs)
21. Keys (3 class packs)
Maps
Keys
Videos
Posters
Music
Computer Discs
Games
Field Equipment
Artefacts & Spey Bay pebbles

RIVERBANK USERS GUIDE
Blue Lever arch file containing:
- Curriculum links
- Planning
- Lesson plans
- Worksheets
- Useful local contacts & websites
Appendix II – Riverbank resource list

TEACHERS’ PACKS

Second Nature, society, science and technology – environmental studies 5-14 (SNH, RSPB, bp)
Focus on Rivers (WWF) (ISBN 1-85850-145-8)
Salmon in the classroom (Dumfries & Galloway Regional Council)
Teaching about Energy, (Centre for Alternative Technology) ISBN 1-85741-088-2)
Bats in Scotland – investigations for 5-14 (The Bat Conservation Trust)
Water Detectives Teacher’s pack (Mersey Basin Trust)
Water wise - science worksheets – environmental studies 5-14 (East of Scotland Water)

TEACHERS’ GUIDES & BOOKLETS

Poetry & pieces of language booklet
Forests and Birds (RSPB) (ISBN 0-903138913)
SCCC Environmental Studies 5-14: River Study
The Highland Folk Museum (The Highland Folk Museum)
The River Bank (National River Watch)
The River Valley (National River Watch)
The River Water (National River Watch)
The River Report (National River Watch)
River Investigations booklets (River Watch Packs)
Water and water life – Teacher’s guide (RSPB)
Water and water life – Students’ guide (RSPB)
Primary Geography (RSPB)
Wild Rivers, Scotland’s rivers – information for educators (WWF)
Wild Rivers (WWF)
The forest adventure (sheets for photocopying) (Forestry Commission)
Scotland’s trees woods & forests (Forestry Commission)

RESOURCES ON THE SPEY CATCHMENT

Study Excursion to the mouth of the River Spey & Excursions to the upper Spey and Spey bay (Inverness Field Club)
River Spey Catchment Management Plan (Spey Catchment Steering Group)
River Spey Report by E.M.Matthew (SNH)
Spey Fishery Board annual report (2002)
The Glen with More (Glenmore Forest Park)
Speybuilt, the story of a forgotten industry (ISBN 0-9523243 –1-8)
The heart of the Highlands of Scotland (ISBN 1-873891-38-5)
Abernethy Forest Its people and its past (The Arkleton Trust)
The Cairngorm Gateway (ISBN 1-84017-027-1)

BOOKS

The Scottish Fishing Book (ISBN 1-84204-020-0)
The Scotch Whisky Book (ISBN 1-84204-02109)
Wind in the Willows (adult version) (ISBN 0-14-036685-7)
The Scots Pine (ISBN 0-521-49932-1)
Appendix II – Riverbank resource list

The forest (ISBN 0-7112-1385-2)
Food for free (ISBN 0-00-220159-3)
The River (ISBN 0-7112-1387-9)
Why do we have? Rivers & seas (ISBN 0-600-58786-X)
What are rivers (2 x 5.99) (ISBN 0-431-02345-X) x 2 copies
Rivers (Earth Alert) (ISBN 0-7502-3377-X) x 2 copies
The Water’s Journey (ISBN 1-55858-360-2)
Ponds & Streams (ISBN 0-74601265-9)
The Piggy Back and other tales of Strathspey (ISBN 0-9503440-2-8)
Scottish place names (ISBN 1-84204-010-3) x 2 copies
Tree Tales (Royal Botanic Gardens Edinburgh)

Identification books
Scottish Trees (Royal Botanic Gardens Edinburgh)
Usborne spotter’s guide to Ponds & Lakes (ISBN 9-780746041345)
Freshwater fish of Britain and Europe (ISBN 1-84000392-8)

Booklets
Return of the Natives (ISBN 1-872291-147)
Firths, SNH (ISBN 1-85397-271- 1)
Soils, SNH (ISBN 1-85397-223 - 1)
Coasts, SNH (ISBN 1-85397-003 - 4)
Bog lands, SNH (ISBN 1-85397- 102 -0)
Native woodlands of Scotland (Forestry Commission booklet) (ISBN 1 85538 3577)
River Runners, SNH (ISBN 1 85397 353 X)

ARCHIVE FOLDER Full contents list in the folder
Copies of archive material (photographs & text) from the Highland Folk Park
Photocopies about the Muckle Spate (National libraries of Scotland)
Exploring archaeology in Badenoch & Strathspey (Highland Council booklet)
Tugnet ice house & salmon netting information (Falkener museum)
Laminated sheet with photographs of coracles (copied from originals at Elgin museum)
Material from a display about boat building & logging on the Spey (Elgin museum)
Archive material on logging, floating & sawmills (copied from originals at Landmark)
Archive maps
Appendix II – Riverbank resource list

PHOTOGRAPHS
Pond life and small creatures photo pack
36 A4 laminated prints of bridges, flooding, river activities, wildlife & aerial views of the Spey
2 A4 laminated sheets of remains of salmon kelts
Coracles & boat building
Logging, floating & sawmills
Wildlife posters
Salmon go to school, school project photos
Counting salmon eggs
Hatchery & stocking activities
Counting salmon
Tagging salmon

INFORMATION PACKS IN PLASTIC WALLETS
1. Water safety information
River Bank safety Code (National Riverwatch)
Safety guidelines Riverbank booklet

2. Activities & ideas for lessons on water related topics
WWF Lifelines magazines & primary & secondary supplements with ideas for lessons on water related topics.

3. Tourism, recreation & occupations around the Spey
Numerous leaflets from tourist information outlets covering angling, whisky industry, walks, ranger services, outdoor pursuits and tourist attractions

4. Nature reserves & protected areas in the Spey catchment;
   Wildlife & The Law
Nature reserve leaflets
Natura 2000 information
SSSI information
SAC information
SNH leaflets on protecting wildlife, wildlife crime & wildlife & the law

5. Drinking water, waste water & sewage treatment
Pull down card on the use of water (YOC) x 2 copies
Pack of postcards for class use (Scottish water)
A4 laminated sheet on the classification of river water quality (SEPA) x 6 copies
‘Yellow fish’ oil care campaign A4 laminated information sheet (SEPA) x 6 copies
We’ll meet again leaflets (Scottish Water)
Toilet trouble bookmarks (Scottish Water)
Scottish Water interactive cd rom
Water in our Food (West of Scotland Water)
Why water is good for you (Scottish water)
Water – where it comes from (East of Scotland water board) (children’s colouring sheet)
Appendix II – Riverbank resource list

6. Good management of river banks
Forests and water guidelines (Forestry Commission leaflet)
Forests & water guidelines (Forestry Commission)
Riparian Management (North East rivers project & FWAG)
Taking Stock booklet, managing salmon and trout (Salmonid 21C)
The rivers & Lochs of Scotland (an NCC & SCP booklet)
River Works on the Spey and its tributaries (Spey Catchment Steering Group leaflet) x 2
Extracts from the Farming and watercourse management handbook (Wild rivers)
  Farms & Water
    What to aim for – blueprint
    Cropping & grazing beside rivers
    Chemical control of vegetation
    Using water wisely
    Gravel extraction
Managing water wisely (WWF)
Managing river valleys for bats (Environment Agency)
River level information – Spey (SEPA website printout)

7. Rivers physical: how rivers behave, geology & acid rain
Cairngorms, a landscape fashioned by geology (SNH & British Geological Survey, booklet)
Extracts from the Farming and watercourse management handbook (Wild rivers)
  Basics of River Behaviour
  Bank Erosion
  Reducing Flood Damage
Teaching primary earth science (Earth Science Teachers’ association)
  Rivers – erosion (classroom practical activities)
  Environmental Impacts, rivers
  Limestone (the world’s most useful rock)
  Rocks and Landscape 1 & 2
  Groundwater – the water Cycle part 2
A4 laminated sheet on acidification of rivers (SEPA) x 6 copies
A4 laminated sheet on river water classification (SEPA) x 6 copies
Your Local Geology – FAQs (National Museums of Scotland hand out)
Acid rain fact sheet (print out from www.yptenc.org.uk)
Metamorphic rocks (print out from www.canadianrockhound.com/junior)

8. Freshwater mini beasts
Dragonfly and damselfly printouts (www.naturegrid.org.uk)
Dragonflies printout (www.uksafari.com)
Identification keys x 2 printouts (www.naturegrid.org.uk)
Cyclops printout (www.naturegrid.org.uk)
Phantom midge larva printout (www.naturegrid.org.uk)
Chironid larva printout (www.naturegrid.org.uk)
Water flea (Daphnia) printouts (www.naturegrid.org.uk)
Water Louse printout (www.naturegrid.org.uk)
Mayfly nymph printout (www.naturegrid.org.uk)
Appendix II – Riverbank resource list

Freshwater shrimp printout (www.naturegrid.org.uk)
Laminated photo of golden ringed dragonfly
Laminated photo pf dragonfly

9. Freshwater pearl mussel
Bundle of SNH leaflets ‘this little creature could live for 100 years’
2 SNH leaflets ‘Crimes against amphibians and freshwater pearl mussels’
Pearl mussel article (Freshwater Forum 2001 Volume 15)
Pearl mussel article (British Wildlife June 2000 Volume 11 no. 5)
Laminated A4 photo of a pearl mussel

10. Birds of the Spey
Osprey centre leaflet (RSPB) x 5 copies
4 Osprey fact sheets (Forestry Commission & RSPB)
2 goldeneye fact sheets (Forestry Commission & RSPB)
printout on eider ducks
2 leaflets Cairngorms NNR – Birds (NCC)
2 printouts from web sites about herons
Explore the Abernethy riverside walk leaflet (Spring & summer guide)
6 RSPB leaflets (ducks and ducklings, swans, fish-eating birds, the swallow, sand martin & kingfisher
7 RSPB laminated cards (grey wagtail, dipper, ospreys, goldeneye, heron, sand martin, goosander)
Birds of the Spey information sheet with drawings (RSPB)
Wader migration information (RSPB)
Capercaillie leaflet (life 2002)
Naturally Scottish - Red Kites (SNH/ RSPB)

11. Osprey feathers & rings
2 feathers
2 rings
Information sheet

12. Fish of the Spey
Salmon Go to School, June 2000 (Spey Fishery Board Briefing)
Atlantic salmon facts booklet (Atlantic Salmon Trust) x 2 copies
All about salmon fact sheet (SNH) x 3 copies
Young salmon and trout poster (Freshwater Fisheries Laboratory)
Atlantic salmon information (print out from UK Safari web site)
2 sheets of photographs of dead salmon kelts (P. Cosgrove)
Salmon go to school, school project photos (Spey Fisheries Trust) x 2 sheets
Counting salmon eggs photo (Spey Fisheries Trust)
Hatchery & stocking activities laminated sheet (Spey Fisheries Trust)
Counting salmon, A4 laminated sheet of photos (Spey Fisheries Trust)
Tagging salmon A4 laminated sheet of photos (Spey Fisheries Trust)
Information on the decline of Atlantic salmon
Laminated diagram of a salmon scale showing growth rings
Lamprey article (British Wildlife Volume 13 no. 6 August 2002)
Appendix II – Riverbank resource list

- Lamprey leaflets (SNH) x 4 copies
- Caimgorns NNR leaflet: mammals, amphibians, reptiles and fish (NCC) x 2 copies
- Sea trout leaflet, wild rivers (WWF)
- Saving Scottish sea trout in the Highlands and Islands leaflets (Freshwater Fisheries lab. & SNH) x 4 copies
- Fish of the Spey laminated list
- Fact sheet on fish (Marine conservation society)
- Caring for the wild brown trout leaflets x 3 copies

13. Mammals - otters, mink, bats, red squirrel, badgers
- All about Otter fact sheet (SNH) x 3 copies
- Natural Heritage Trends: freshwaters: American mink fact sheet (SNH)
- Otter news magazines (IOSF) x 3 copies
- Otters in the Highlands leaflets (IOSF) x 5 copies
- IOSF leaflet (IOSF)
- Otter fact sheet (Mammal Society)
- Mink (Mammal society booklet) (ISBN 0-904614-20-4)
- The otter (Mammal society booklet) (ISBN 0-906282-49-7)
- Bat Conservation Trust leaflets: Bats – an introduction; bat boxes; Pipistrelles; Daubentons’s bat.
- Daubentons’s bat printout (www.naturegrid.org.uk/biodiversity)
- Daubentons’s bat printout (www.uksafari.com/daubentons)
- The young bat worker newsletter (BCT)
- Naturally Scottish – Badgers (SNH)
- Naturally Scottish – Red Squirrels (SNH)
- Managing river valleys for bats (Environment Agency) x 2 copies

14. Mammals - water voles, beavers, seals, cetaceans
- European beaver leaflet (WWF- wild rivers)
- Water vole information (printout from SWT web site)
- Water vole leaflet (Mammal society)
- Water vole article (British Wildlife Volume 13 no. 4 April 2002)
- Naturally Scottish – Seals (SNH)
- Naturally Scottish – Whales, dolphins and porpoises (SNH)
- Laminated newspaper cutting about water voles
- European beaver printout from SWT website

15. Trees & plants in the Spey catchment
- Caimgorns NNR leaflet: wild flowers (NCC) x 2 copies
- Caimgorns NNR leaflet: trees (NCC) x 2 copies
- Printouts from the web site British-Trees.com on alder, willow, birch & oak, rowan, pine & willow
- Alder information leaflet (WWF-wild rivers)
- An easy guide to forest trees and their uses (Forestry commission leaflet) x 4 copies
- Native woodlands of Scotland (Forestry Commission booklet) x 2 copies
- Pillwort article (British Wildlife volume 10 no. 5 June 1999)
- How a tree works poster (Forestry Commission)
Appendix II – Riverbank resource list

Set of posters on 6 trees (ash, birch, larch, Sitka spruce, Scots pine, oak) 
(Forestry Commission)

16. Pond life and small creatures photo pack
24 close up A4 photographs of pond life, minibeasts & small creatures. 
Teaching notes copied onto reverse of the photos.

17. Great Photos
Shingle beaches & Spey Bay
Loch Einich & Osprey
Culbin bar & Glen Feshie
Burn & Loch Etchachan
Loch Avon & Loch Morlich
Loch Avon (A4)
Aerial view of river Spey
Reed Bed
Alder woodland
Burn & riparian woodland
Insh Marshes
Native pinewood & birch wood
Reed bed & Insh Marshes
Juniper Glenfeshie & view of Strathspey near Aviemore
Twinflower & native pine wood
Garmouth viaduct
Ballindalloch viaduct
Victoria bridge & high tide at Spey Bay
Glenlivet packhorse bridge
Telford bridge Craigellachie
Broomhill bridge & Craigellachie bridge
Bridge of Carr in ice
Ballindalloch bridge
New road bridge – Grantown & Fochabers bridge
Garva bridge
White water rafting
Hydro power, Laggan Dam
Spey in flood with distillery barrels going down
Kayaks on Loch Morlich
Building oat stooks & wildflowers on the Speyside Way
Arctic charr & Salmon fishing
Salmon fishing
Angler with fish
Pearl mussels
Damsel flies on bog asphodel
Mountain hare & golden eagle

18. Computer discs & Music
The Salmon Game CD (Scottish Hydro Electric)
Riverside Explorer CD (Environment Agency)
Salmon go to school CD (Spey Research Trust)
Power from the Glens CD (hydro power) (Scottish & Southern Energy)
Riverbank Users’ guide (teachers’ planning, lesson plans etc),
worksheets developed for the Riverbank & Riverbank resource list on CD
Handel’s water music CD
James Scott Skinner the Strathspey King CD
Vltava by Smetana (a musical interpretation of river source to sea) CD
Enchanting Echoes, bat vocalisations (BCT) cassette tape

19. Keys (single copy items)
Freshwater name trail (Field Studies Council)
Water plants key (Field Studies Council)
Mammals tracks & signs (Field Studies Council)
Keeping frog tadpoles (Field Studies Council)
Riverbank class pack of keys containing the following laminated sheets:
- Mammal tracks (National River Watch)
- Which fish? (National River Watch)
- Identifying freshwater invertebrates (Water Detectives)
- Identification sheet of freshwater invertebrates (Water Detectives)
The living stream dial (Freshwater Biological Association)
Wildlife value dial (National River Watch)
The pond watch bug dial (Wildfowl & Wetlands Trust)
The pond watch bug dial photocopy laminated card
Water Quality Indicator species pull down & reveal laminated card for photocopying (National River Watch)

20. Keys (3 class packs)
Riverbank class packs of keys x 3 copies. Each containing the following laminated sheets:
- Water Pollution detector animals (East of Scotland water, reverse Junior Focus)
- Identification key of pond animals (Canterbury Environmental Education Centre)
- Pond minibeast identification (RSPB)
- Water birds & bird spot identification (RSPB, reverse National River Watch)
- Identifying waterside plants (Water Detectives)
- Plant Survey Sheet (National River Watch)
- Plants from activity sheets 15a & 15b (Second Nature)

21. Keys (3 class packs)
Riverbank class packs of keys x 3 copies. Each containing the following laminated sheets:
- Water Pollution detector animals (East of Scotland water, reverse Junior Focus)
- Identification key of pond animals (Canterbury Environmental Education Centre)
- Pond minibeast identification (RSPB)
- Water birds & bird spot identification (RSPB, reverse National River Watch)
Appendix II – Riverbank resource list

- Identifying waterside plants (Water Detectives)
- Plant Survey Sheet (National River Watch)
- Plants from activity sheets 15a & 15b (Second Nature)

MAPS
- Elgin & Dufftown OS Landranger map No. 28
- Fort Augustus OS Landranger map No. 34
- Kingussie & Monadhliath Mountains OS Landranger map No. 35
- Grantown & Aviemore OS Landranger No. 36
- Walk Loch Ness and the Spey Valley (Collins) (ISBN 0-00-448755-9)
- Drove roads (Highland Folk Park)

Laminated maps
- River Spey Map in colour showing catchment only (SNH/Wendy Price)
- Fisherman’s map of salmon Pools on the River Spey (Nigel Houldsworth)
- Cairngorms National Park boundary map (SNH)
- Survey of the province of Moray (1858)
- River Spey from source to sea (1860)
- Outline map of Scotland showing rivers & lochs
- Outline map of Scotland showing names of major towns (SNH)
- Outline map of Scotland showing names of major rivers (SNH)
- River Spey Catchment (SNH)
- A3 River Spey (B & W) (SNH)

KEYS - see plastic wallets 19, 20 & 21
- see identification books

VIDEOS
- The Geography Programme (BBC): World Physical (ISBN 120106)
- Meeting at River Creek (SNH) + bundle of leaflets ‘A shared resource’
- Water & water Life (RSPB)
- Catch & Release (Fisheries Research Services)
- While Stocks Last (Fisheries Research Services)
- The river Severn (Landmark, BBC 2) (1999)
- West of Scotland Water, water education
- Insh Marshes Nature Reserve

POSTERS
- Laminated posters
  - Salmon life cycle (Atlantic salmon Trust)
  - Salmon recognition (Atlantic salmon Trust)
  - Salmon Leaping (SNH)
  - Otter (SNH)
  - Exploring archaeology in Badenoch & Strathspey
  - How a tree works (Forestry Commission)
  - A shared resource leaflet (Sports Scotland/SNH)
  - Natural first aid remedies (Orangeburst Ltd.)
  - Newspaper cutting – River workers unite against land reform
  - Otter cub emerging from sea (Laurie Campbell’s Scottish Nature)

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Appendix II – Riverbank resource list

Posters in zippa bag
River Watch (RSNC)
Who’s afraid of a bit of rain (SNH)
Scotland’s Land Cover (SNH)
Scotland – a little piece of North America (SNH)
Native Woodlands of Scotland (Forestry Commission)
Water Birds (RSPB)
Wild Rivers (WWF)
National Inventory of Woodland and trees (FC)
The water Cycle (West of Scotland Water)
Water – where it comes from (East of Scotland water board)
Water Facts (West of Scotland Water)
Waste water treatment (West of Scotland Water)
Water treatment (West of Scotland Water)
Be Water Wise (West of Scotland Water)
Daubenton’s bats (The Bat Conservation Trust)
Scottish pinewoods (Forestry Commission / Royal Botanic Gardens Edinburgh)
Atlantic Oakwood (Forestry Commission / Royal Botanic Gardens Edinburgh)
How to release fish safely (Spey Fishery Board)

MUSIC
Handel’s water music CD
James Scott Skinner the Strathspey King CD
Vltava by Smetana (a musical interpretation of river source to sea) CD
Enchanting Echoes, bat vocalisations (BCT) cassette tape

COMPUTER DISCS
The Salmon Game interactive CD (Scottish Hydro Electric)
Riverside Explorer (Environment Agency) interactive CD
Salmon go to School power point presentation – Spey Research Trust
Riverbank Users’ guide (teachers’ planning, lesson plans etc).
worksheets developed for the Riverbank & Riverbank resource list on CD
Riverbank User’s guide, worksheets & resource lists (as above) on 6 floppy discs
Power from the Glens (hydro power) (Scottish & Southern Energy) CD
Scottish Water interactive CD

GAMES
Splash down (board game) (junior education Feb 2001)
Salar the salmon goes to sea / comes home (board game) (Salmon & Trout Association) 2 copies
The Salmon Game cd rom (Scottish Hydro Electric)

FIELD EQUIPMENT
Heavy duty cotton equipment bag
2 Long handled nets, coarse mesh, (Philip Harris Education)
Nets (fine mesh) (Spey Research Trust)
4 short handled nets, fine mesh (Scientific & Chemical )
Appendix II – Riverbank resource list

6 kitchen sieves
6 white trays (GB nets)
6 bug pots (GB nets) in plastic tub
Acidity test paper (Philip Harris Education)
Plastic spoons in plastic tub

ARTEFACTS
Osprey feathers & leg rings
Bag of pearl mussel shells

SPEY BAY PEBBLES:
Pebble bag containing labelled samples of the following pebble types:
- sandstone pebbles
- mudstone pebbles
- granite pebbles
- schist pebbles
- quartzite pebbles

laminated pebble ID sheet.
Appendix IIIA – Fish studies: Emily’s work on water temperature

Name: Emily        Date: 15.02.06

Water Temperatures

The first set of data was taken at Auchendoun Bridge, upstream from Dufftown. The second set is from Craigellachie, which is below all the distilleries and receives all the warm water.

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</table>

**Fiddich Temps January 2006**

- What do you notice about the water temperature at Craigellachie compared to that at Auchendoun?
  
  I have noticed that the water temperature at Craigellachie is warmer than it is at Auchendoun Bridge, Dufftown.

- Why do you think this is?
  
  There are many distilleries between Craigellachie and Dufftown. We have observed that many of the distilleries discharge warm water back into the River Fiddich making the overall temperature warmer at Craigellachie. The water is cooler at Auchendoun because it is upstream from all the distilleries.

- Why do you think there is little difference in the water temperature at the two sites from January 1st – 4th?
  
  I think it is because there has been little or no production at the distilleries over the Christmas and New Year period. This will explain why the water temperature over this period is the same at both sites.
Appendix IIIA – Fish studies: Emily's work on water temperature

The picture above shows the discharge of water from a nearby distillery going into the River Fiddich. I think that this is the main reason for the water being warmer at Craigellachie compared to Auchendoun.

We are going to measure the length of one year old salmon and trout at the two sites to see if the water temperature has any effect on the growth of the fish.

I was able to observe this with my Primary 6/7 class and under the helpful guidance of Mr Bob Laughton, Steve, Jim and other people from Spey Fishery Board.

By Emily Scott, Aged 11
Although the number of salmon caught was greater at Auchendoun Bridge the graph provides us with some interesting information about their size.

The most common length of salmon (mode) found at the Upper Site was between 51mm – 60mm. The most common length of salmon (mode) found at the Lower Site was between 61mm – 70mm.

Steve, from the Speyside Fishery Board supervising, while we measure the lengths of the salmon before putting them back in the River Fiddich.

By Declan Mellis
Appendix IIIC – Fish studies: Christopher’s frequency graph on salmon
### Appendix IVA – Reference guide to invertebrates

<table>
<thead>
<tr>
<th><strong>Stoneflies</strong></th>
<th>![Stonefly Image]</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Two tails</td>
<td></td>
</tr>
<tr>
<td>- Two long antennae</td>
<td></td>
</tr>
<tr>
<td>- Strong legs</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Baetidae - ‘olives’</strong></th>
<th>![Olives Image]</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Gills at side</td>
<td></td>
</tr>
<tr>
<td>- Streamlined nymph</td>
<td></td>
</tr>
<tr>
<td>- Darting about tray</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Heptageniidae - ‘stone clingers’</strong></th>
<th>![Stone Clingers Image]</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Gills at side</td>
<td></td>
</tr>
<tr>
<td>- Long tails</td>
<td></td>
</tr>
<tr>
<td>- Flattened nymph</td>
<td></td>
</tr>
<tr>
<td>- Clinging to stones</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Ephemeraidae - ‘danica’</strong></th>
<th>![Danica Image]</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Gills over back</td>
<td></td>
</tr>
<tr>
<td>- Short tails</td>
<td></td>
</tr>
<tr>
<td>- Large nymph</td>
<td></td>
</tr>
<tr>
<td>- Burrowing in silt/sand</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Cased Caddis</strong></th>
<th>![Cased Caddis Image]</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Cases made out of a variety of material:</td>
<td></td>
</tr>
<tr>
<td>- Plants</td>
<td></td>
</tr>
<tr>
<td>- Twigs</td>
<td></td>
</tr>
<tr>
<td>- Sand</td>
<td></td>
</tr>
<tr>
<td>- Stones</td>
<td></td>
</tr>
</tbody>
</table>
### Appendix IVA – Reference guide to invertebrates

<table>
<thead>
<tr>
<th>Caseless caddis</th>
<th>Snails</th>
<th>Leeches</th>
<th>Freshwater Shrimps - Gammarus</th>
<th>Water Slater - Asellus</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Most common types:</td>
<td>- Two types - Ramshorn &amp; Spire</td>
<td>- Move with a looping action</td>
<td>- Often orange in colour</td>
<td>- Similar to woodlouse</td>
</tr>
<tr>
<td>- Hydropsyche - Brown</td>
<td>- 'sticks' to tray</td>
<td>- Swims on side</td>
<td>- Swims on side</td>
<td>- Crawling slowly along bottom</td>
</tr>
<tr>
<td>- Rhyacophila - Green</td>
<td>- similar to flatworms</td>
<td>- Humped back</td>
<td>- Humped back</td>
<td>- Often amongst leaves</td>
</tr>
</tbody>
</table>
### Appendix IVB – Volunteer monitoring record sheet

<table>
<thead>
<tr>
<th>Location</th>
<th>Grid Reference</th>
<th>Date</th>
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</thead>
<tbody>
<tr>
<td>Surveyor</td>
<td>Mayflies - Baetidae</td>
<td>Mayflies - Heptageniidae</td>
</tr>
<tr>
<td>Comments</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>Grid Reference</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surveyor</td>
<td>Mayflies - Baetidae</td>
<td>Mayflies - Heptageniidae</td>
</tr>
<tr>
<td>Comments</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Small Environmental Dictionary (English, Finnish, Swedish, Norwegian) for Camp Schools

**Water - vesi - vatten – vann (vatn):**

<table>
<thead>
<tr>
<th>English</th>
<th>Finnish</th>
<th>Swedish</th>
<th>Norwegian</th>
</tr>
</thead>
<tbody>
<tr>
<td>aquatic animal</td>
<td>vesieläin</td>
<td>vattendjur</td>
<td>vanndyr</td>
</tr>
<tr>
<td>bottom animal</td>
<td>pohjaeläin</td>
<td>bottenfauna</td>
<td>bunnfauna</td>
</tr>
<tr>
<td>eutrophication</td>
<td>rehevöityminen</td>
<td>eutrofiering</td>
<td>eutrofiering</td>
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<td>sediment</td>
<td>(pohja)sedimentti</td>
<td>bottensediment</td>
<td>bunnosediment</td>
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<tr>
<td>catchment area</td>
<td>valuma-alue</td>
<td>avrinningsområde</td>
<td>avrenningsområde</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>(nedslagsfelt)</td>
</tr>
<tr>
<td>groundwater</td>
<td>pohjavesi</td>
<td>grundvatten</td>
<td>grunnvann (-vatn)</td>
</tr>
<tr>
<td>precipitation</td>
<td>sadanta</td>
<td>nederbörd</td>
<td>nedbør</td>
</tr>
<tr>
<td>plankton</td>
<td>plankton, keijusto</td>
<td>plakton</td>
<td>plankton</td>
</tr>
<tr>
<td>point source pollution</td>
<td>pistekuormitus</td>
<td>punktbelastning</td>
<td>punktbelastning</td>
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<tr>
<td></td>
<td></td>
<td>diffusförorening</td>
<td>diffus forurensing</td>
</tr>
<tr>
<td>diffuse pollution</td>
<td>hajakuormitus</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>runoff</td>
<td>valunta</td>
<td>avrinning</td>
<td>avrenning</td>
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<tr>
<td>evaporation</td>
<td>haiduntansa</td>
<td>avdunstning</td>
<td>fordamping</td>
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<td>waterquality</td>
<td>veden laatu</td>
<td>vattenkvalitet</td>
<td>vannkvalitet</td>
</tr>
<tr>
<td>hydrological cycle</td>
<td>veden kierto</td>
<td>vattnets kretslap</td>
<td>vannets kretslap</td>
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<tr>
<td>waterfall</td>
<td>vesiputous</td>
<td>vattenfall</td>
<td>foss</td>
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<tr>
<td>rapid</td>
<td>koski</td>
<td>fors</td>
<td>stryk</td>
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<tr>
<td>pool</td>
<td>suvanto</td>
<td>pool</td>
<td>kulp</td>
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<tr>
<td>brook</td>
<td>puro</td>
<td>bick</td>
<td>bekk</td>
</tr>
<tr>
<td>riverbank</td>
<td>jokitörmä</td>
<td>älvströmbound</td>
<td>elvebredd</td>
</tr>
<tr>
<td>dam</td>
<td>pato</td>
<td>damm</td>
<td>demning</td>
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<tr>
<td>embankment</td>
<td>tulvapenger</td>
<td>erosionskydd</td>
<td>elveforbygning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>översvämmningskydd</td>
<td></td>
</tr>
<tr>
<td>peatland</td>
<td>su, turvemaa</td>
<td>myr, torvmark</td>
<td>myr, sump</td>
</tr>
<tr>
<td>ditch</td>
<td>oja</td>
<td>dike</td>
<td>greft</td>
</tr>
<tr>
<td>flow</td>
<td>virtaus, virtaama</td>
<td>flode</td>
<td>flom</td>
</tr>
<tr>
<td>ice</td>
<td>jäi</td>
<td>is</td>
<td>is</td>
</tr>
<tr>
<td>snow</td>
<td>lumi</td>
<td>snö</td>
<td>snø (sne)</td>
</tr>
<tr>
<td>melting</td>
<td>sulaminen</td>
<td>småttning (snø/ is)</td>
<td>smelting</td>
</tr>
<tr>
<td>riverbend</td>
<td>joenmutka</td>
<td>îlvkrök</td>
<td>elvesving</td>
</tr>
<tr>
<td>outlet</td>
<td>laskujoki</td>
<td>utlopp</td>
<td>os, utløp</td>
</tr>
<tr>
<td>flood</td>
<td>tulva</td>
<td>översvämning</td>
<td>översvømmelser</td>
</tr>
<tr>
<td>dry</td>
<td>kuiva</td>
<td>torr</td>
<td>tørr</td>
</tr>
<tr>
<td>wet</td>
<td>märkä</td>
<td>vär</td>
<td>vær</td>
</tr>
<tr>
<td>lake, loch</td>
<td>järvii</td>
<td>sjö</td>
<td>innsjø</td>
</tr>
<tr>
<td>pond, lochan</td>
<td>lampi</td>
<td>tjärn</td>
<td>tjern</td>
</tr>
<tr>
<td>puddle</td>
<td>lamnäkko, lättäkkö</td>
<td>pöl</td>
<td>pytt, putt</td>
</tr>
</tbody>
</table>

**Landscape - maisema – landskap – landskap:**

| agriculture              | maatalous         | jordbruk         | jordbruk, landbruk |
| grazing                  | laiuntaminen     | betande          | beiting, beite    |
| sheep                    | lammars          | får              | sau              |
| foal                     | varsar           | föl              | fôll, hest       |
| forestry                 | metsäalous       | skogsbruk        | skogbruk         |
| cultural landscape       | kulttuurimaisema | kulturlandskap   | kulturlandskap   |
| hedge                    | pensasata        | bäck             | hekk, le-planting |

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**Appendix V – Small environmental dictionary**

<table>
<thead>
<tr>
<th>English</th>
<th>Finnish</th>
<th>Swedish</th>
<th>Norwegian</th>
</tr>
</thead>
<tbody>
<tr>
<td>landscape management</td>
<td>maisemanhoito</td>
<td>landskapsvård</td>
<td>landskapsvern</td>
</tr>
<tr>
<td>landscape planning</td>
<td>maisemassuunnittelu</td>
<td>landskapsplanering</td>
<td>landskapsplanlegging</td>
</tr>
<tr>
<td>biodiversity</td>
<td>luonnonmonimuotoisuus</td>
<td>naturens mångfald</td>
<td>biodiversitet, naturmanfold</td>
</tr>
<tr>
<td>blocked by thickets</td>
<td>umpeutuminen, puskikoituminen</td>
<td>blockkerad av buskage</td>
<td>blokkiert av busker, krattområder</td>
</tr>
<tr>
<td>key biotope</td>
<td>avainbiotooppi</td>
<td>nyckelbiotop</td>
<td>nøkkelbiotop</td>
</tr>
<tr>
<td>clearing</td>
<td>raivaus</td>
<td>röjning</td>
<td>rydning</td>
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<tr>
<td>thinning</td>
<td>harvennus</td>
<td>gallring</td>
<td>tynningshögst</td>
</tr>
<tr>
<td>mountain plateau</td>
<td>ylänkö</td>
<td>höglant, högslätt</td>
<td>vidde</td>
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<tr>
<td>canyon</td>
<td>kanjon</td>
<td>canyon</td>
<td>elvegjel, canyon</td>
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<tr>
<td>gravel</td>
<td>sora</td>
<td>grus</td>
<td>grus</td>
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<tr>
<td>clay</td>
<td>savi</td>
<td>lera</td>
<td>leire</td>
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<tr>
<td>slope</td>
<td>rinne</td>
<td>sluttning</td>
<td>skrent, helling</td>
</tr>
<tr>
<td>valley</td>
<td>laakso</td>
<td>dal</td>
<td>dal</td>
</tr>
<tr>
<td>shore</td>
<td>ranta</td>
<td>strand</td>
<td>strand</td>
</tr>
<tr>
<td>detritus, forest litter</td>
<td>karike</td>
<td>grovdetritus</td>
<td>strøfall, vindfall, organisk materiale</td>
</tr>
</tbody>
</table>

**Fishing - kalastus – fiske – fiske**

<table>
<thead>
<tr>
<th>English</th>
<th>Finnish</th>
<th>Swedish</th>
<th>Norwegian</th>
</tr>
</thead>
<tbody>
<tr>
<td>angling</td>
<td>onginta</td>
<td>fiske (mete)</td>
<td>Sportsfiske, meiting (with worms)</td>
</tr>
<tr>
<td>fish</td>
<td>kala(t)</td>
<td>fisk(ar)</td>
<td>fisk</td>
</tr>
<tr>
<td>gill net</td>
<td>kalaverkko</td>
<td>fisknät</td>
<td>fiskegarn</td>
</tr>
<tr>
<td>roe</td>
<td>mäti</td>
<td>fiskrom</td>
<td>rogn</td>
</tr>
<tr>
<td>young fish</td>
<td>kalanpoikanen</td>
<td>fiskyngel</td>
<td>yngel</td>
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<tr>
<td>fish kill</td>
<td>kalakuolema</td>
<td>fiskdöd</td>
<td>fiskedød</td>
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<tr>
<td>fish rich</td>
<td>kalaisa</td>
<td>fiskrik</td>
<td>fiskerik</td>
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<tr>
<td>predatory fish</td>
<td>petokala</td>
<td>rovfisk</td>
<td>rovfisk</td>
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<tr>
<td>fish fauna</td>
<td>kalasto</td>
<td>fiskfauna</td>
<td>fiskfauna</td>
</tr>
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<td>freshwater fish</td>
<td>makean veden kala</td>
<td>sötvattenfisk</td>
<td>ferskvannsfisk</td>
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<td>fly fishing</td>
<td>perhokalastus</td>
<td>flyfiske</td>
<td>fluefiske</td>
</tr>
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<td>trolling</td>
<td>uistelu, heittokalastus</td>
<td>spinnfiske</td>
<td>slukfiske</td>
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<tr>
<td>fishing rod</td>
<td>vapa</td>
<td>fiskespö</td>
<td>fiskestang</td>
</tr>
<tr>
<td>spawning</td>
<td>kutu</td>
<td>lek (fisk)</td>
<td>gyte</td>
</tr>
</tbody>
</table>

**Hiking - retkeily – vandring – friluftsliv**

<table>
<thead>
<tr>
<th>English</th>
<th>Finnish</th>
<th>Swedish</th>
<th>Norwegian</th>
</tr>
</thead>
<tbody>
<tr>
<td>canoeing</td>
<td>melonta</td>
<td>paddling</td>
<td>kanopadling</td>
</tr>
<tr>
<td>camp-fire, open fire</td>
<td>muutio</td>
<td>lägereld</td>
<td>leirbål</td>
</tr>
<tr>
<td>path</td>
<td>polku</td>
<td>stig</td>
<td>sti</td>
</tr>
<tr>
<td>ski track</td>
<td>laatu</td>
<td>skidspår</td>
<td>løyve</td>
</tr>
<tr>
<td>scenery</td>
<td>näköala</td>
<td>utsikt</td>
<td>utsikt</td>
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<tr>
<td>tent</td>
<td>teltta</td>
<td>tält</td>
<td>telt</td>
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<tr>
<td>wading place</td>
<td>kahluupaikka</td>
<td>vadställe</td>
<td>vadested</td>
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<tr>
<td>sheltered</td>
<td>suojainen, suojaisa</td>
<td>avskärmad, avskiljte</td>
<td>laut, skjermet</td>
</tr>
<tr>
<td>fence</td>
<td>aita</td>
<td>stakket, stängsel</td>
<td>gjerde</td>
</tr>
<tr>
<td>gate</td>
<td>veräjä, portti</td>
<td>grind</td>
<td>grind</td>
</tr>
<tr>
<td>wilderness area</td>
<td>eräämaa-alue</td>
<td>vildmark</td>
<td>villmark</td>
</tr>
<tr>
<td>resting place</td>
<td>lepo- tai taulo-</td>
<td>rastplats, vila</td>
<td>rast</td>
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</tbody>
</table>

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Appendix VI – Fish management workshop

Land Based Business Training Project

“Fisheries Management” Workshop
28th February 2007, Cairngorm Hotel, Aviemore
09:30 – 16:30

This one day training course is aimed at land managers, farmers, crofters and outdoor recreation providers, who have an interest in the rivers of the Cairngorms in terms of fisheries management. Using the River Spey as an example the workshop seeks to increase awareness about fish species present within the river; to identify threats to existing populations and examine management options to minimise these; to examine water use within the river and the effects on fish populations; to examine recreational access within the river and look at potential ways to minimise conflict.

Programme Outline

- 09:30  Registration and Coffee.
- 10:00  Fish Species, distribution and ecology
- 10:30  Fisheries Organisations and Structure
- 11:00  Fish Research and Management
- 11:30  Fish Protection
- 12:00  Economic Value
- 12:30  Lunch
- 13:30  Threats to Fish Populations
- 14:00  Water Use and Regulations
- 15:00  Angling, Canoeing and River Access
- 16:00  Finish and depart

Course Facilitators
The course will be delivered by Robert Laughton, Senior Biologist, Spey Fishery Board and other invited experts from the field of water use, recreational access and fisheries management, including the CNPA’s LBAP officer, Stephen Corcoran, and Access Officer, Fran Pothecary.

Course Fee
The course is free of charge for people working for land-based businesses which are located within or adjacent to the Cairngorms National Park.

Booking Procedure
Places are limited so please book in advance
To book contact Kate or Sam at CNPA, The Square, Grantown-on-Spey PH26 5HG Tel 01479 870 535/537

Email addresses:  katechristie@cairngorms.co.uk
                sammasson@cairngorms.co.uk
Appendix VII – CD-ROM contents

NORWAT GOOD PRACTICE MANUAL

Contents of the CD-ROM attachment

NorWat Good Practice Manual
Whole publication as PDF document (NorWat Good Practice Manual.pdf)

APPENDIXES

Appendix I
IA Wastewater clarification checklist for the surveyor in a village
Word document (Wastewater clarification checklist.doc, 39 kB)
IB Wastewater treatment report
Word document (Wastewater treatment report.doc, 242 kB)

Appendix II
Riverbank Resource List
Word document (Riverbank resource list.doc, 538 kB)

Appendix III
IIIA Fish studies: Emilys’s work on water temperature
Word document (Fish studies a_Emilys’s work on water temperature.doc, 3.1 MB)
IIIB Fish studies: Declan’s analysis on salmon lengths
Word document (Fish studies b_Declan’s analysis on salmon lengths.doc, 2.9 MB)
III C Fish studies: Christhoper’s frequency graph on salmon
Word document (Fish studies c_Christhoper’s frequency graph on salmon.doc, 924 kB)

Appendix IV
IVA Reference Guide to Invertebrates
PDF document (Reference guide to invertebrates.pdf, 246 kB)
IVB Volunteer Monitoring Record Sheet
PDF document (Volunteer monitoring record sheet.pdf, 4 kB)

Appendix V
Small Environmental Dictionary (English, Finnish, Swedish, Norwegian) for Camp Schools
Word document (Small environmental dictionary.doc, 110 kB)

Appendix VI
Fish Management Workshop
Word document (Fish management flyer.doc, 471 kB)

Appendix VII
Contents of the CD-ROM attachment
PDF-Document (CD_Contents.pdf)
Appendix VII – CD-ROM contents

SLIDE SHOWS

The Town Planning of Storslett (Norway)
PowerPoint presentation (Town Planning of Storslett.ppt, 195 MB)

Salmon go to School (Scotland)
PowerPoint presentation (Salmon go to School.ppt, 31 MB)

THESSES

Jyväskylä University of Applied Sciences


University of Joensuu

Honkanen, S. 2006. Saarijärven reitti nuorten mielikuvissa (in Finnish)
English summary: Saarijärvi watercourse in youngsters' images. PDF document (HonkanenS_thesis.pdf, 3.1 MB)


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<th>Year</th>
<th>Authors</th>
<th>Title</th>
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<tr>
<td>14/2002</td>
<td>Lerkkanen, J.</td>
<td>Koulutus- ja uravalinnan ongelmat, Koulutus- ja uravalinnan tavoitteet saavuttamista haitteraajat sekä niiden yhteys ammattikorkeakoulut- ja opintojen etenemiseen ja opiskelijoiden ohjaustarpeeseen.</td>
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<td>Valppu-Vanhainen, A.</td>
<td>Yksilökohtainen palvelunohjaus vanhustyön menetelmäksi, Yksilökohtaisella palveluohjaussella joustavuutta hyvinvointipalveluihin.</td>
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<td>21/2003</td>
<td>Vuorimaa, V.</td>
<td>Tiedon taidot verkkopalveluina ja Tietotekniikan perusuunnitelma, Tietotekniikan perusuunnitelma.</td>
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<td>Partanen, E.</td>
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28/2003 Kantola, I. & Gates, M. (EDS.) Internships and project studies as workbased learning environments in professional higher education – international benchmarking. *Ammattikorkeakoulujen yhteisjulkaisu*


44/2005 Äänismaa, P. Nummi, M. (EDS.) Bioenergy Environment and Development. Regions of Central Finland, Finland; Hadeland, Norway; Brandenburg, Germany. Jyväskylä. Institute of Natural Resources


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