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**VALUATION OF BENEFITS CONNECTED TO CONSERVATION OR IMPROVEMENT OF
ENVIRONMENTAL QUALITY IN LOCAL WATERCOURSES IN NORWAY
Norwegian Case Study on Biodiversity Incentive Measures**

by **Kristin Magnussen and Espen Rymoen**

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FOREWORD

This paper is one of a series of 22 case studies that describe practical experiences in OECD Member countries with the use of incentive measures for the conservation of biodiversity and the sustainable use of its components. These case studies were submitted by OECD Member countries to the OECD Working Group on Economic Aspects of Biodiversity as a contribution to the OECD study of the design and implementation of appropriate incentive measures for biodiversity conservation and sustainable use. In order to ensure maximum comparability between the case studies, all were developed under the common methodology described in “Incentive Measures to Promote the Conservation and the Sustainable Use of Biodiversity: Framework for Case Studies” [OECD/GD(97)125].

The practical experiences described in the 22 case studies were used as the basis for the policy advice developed in the *Handbook of Incentive Measures for Biodiversity: Design and Implementation* (OECD, 1999). This *Handbook* combines the lessons learned through the various experiences described in the case studies – covering a wide range of ecosystems, economic pressures on biodiversity, and utilising various incentive measures – with sound economic theory to develop a practical, step-by-step guide for policy-makers on the design and implementation of successful incentive measures for the conservation and sustainable use of biodiversity.

This paper was provided by the Norwegian Government and was written by Kristin Magnussen and Espen Rymoen of the Østfold Research Foundation, Fredrikstad, Norway. It is released as an unclassified document under the responsibility of the Secretary-General of the OECD with the aim of bringing information on this subject to the attention of a wider audience.

This study, and the other 21 case studies submitted by Member countries, are available on the world wide web at <http://www.oecd.org/env>.

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VALUATION OF BENEFITS CONNECTED TO CONSERVATION OR IMPROVEMENT OF ENVIRONMENTAL QUALITY IN LOCAL WATERCOURSES IN NORWAY

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EXECUTIVE SUMMARY

For this case study, a valuation was conducted of the benefits associated with undertaking programmes to ensure the conservation or improvement of environmental quality in two Norwegian waterways. The benefits were estimated using contingent valuation studies informed by expert panels, and they included the benefits from improved water quality, recreation and biodiversity. The main pressures on the waterways are high nutrient levels, which stem from municipal wastewater and agriculture, with some large discharges of nitrogen from industrial point sources. Development and land clearance on the banks of the rivers was also identified as a pressure on the water quality. Compensation is currently offered to landowners or farmers for creating a new field or river margin, and 41% of farmland is now set-aside, but this has not been as effective as hoped because it does not target erosion-prone lands. Restrictions on development and the provision of better sewage treatment facilities were also recommended. The study emphasised in particular the need to develop holistic programmes for managing the waterways and the importance of public education and participation of local residents in these programmes.

Ecosystem studied: inland freshwater ecosystems

Incentive measures used: economic valuation, regulations, positive subsidies

Main lessons learned: Significant variations in WTP values were found for different rivers (so these results are not transferable); non-use values of the waterways were found to be particularly high; a range of measures for providing information, building capacity and involving stakeholders should be used; and undertaking WTP studies can be costly and time-consuming.

1. GENERAL DESCRIPTION

1.1 Introduction

Norwegian environmental policy is rather decentralised, 'locally adapted' environmental policy, and the trend is towards even more local influence (self-government). Pollution policy in particular has been so-called 'recipient-orientated'. That is, it has been emphasised that pollution control and reduction objectives could and should differ between different watercourses, rivers, lakes and fjords. This is necessary because of differences in these recipients' buffer capacity, use and existence of alternatives etc. Norway as a country has national goals for pollution reduction and biodiversity preservation. It is recognised, however, that even though the objective for instance in the North Sea Plan Area, is to reduce nutrient inputs (nitrogen and phosphorus) by 50%, this does not necessarily mean that leaching from every source, or even reduction in every lake, should be 50%.

In Parliamentary Report no. 58 (1996-97) «Environmental Policy for Sustainable development», it is written that because remaining nutrition leaching problems are mainly local problems, municipalities themselves should take on increasing responsibility in order to secure the water quality requirements. The municipalities are encouraged to set environmental objectives for their watercourses. In so doing measures regarding local watercourses shall be brought in as a natural part of the planning process in municipalities.

Municipalities should carry out effort-analysis, including assessing benefits and costs of different environmental objectives and improvement measures for the watercourses. The procedure consists of four steps:

1. Setting preliminary objectives.
2. Measurement analyses (cost-benefit analysis assessing benefits and costs of different measures).
3. Decision about final objectives.
4. Following up results.

The standards for environmental quality, which should be the basis for setting environmental objectives are given as minimum demands for the different user and conservation interests.

Standards are developed for:

- conservation of biodiversity;

- drinking water quality;
- angling;
- fish farming;
- swimming and recreation.

To aid this process The State Pollution Control Authority (SFT) and The Directorate for Nature Management (DN) have developed a framework for 'Environmental objectives for watercourses - recommended directions/guidelines for municipalities' setting of environmental objectives and environmental quality standards'. The aim of that project is to motivate and guide the municipalities in their task of setting suitable environmental objectives for their watercourses. The starting point for setting environmental objectives is recommended environmental quality standards for the municipalities. These include standards and quality criteria related to different uses and conservation, which are assumed to be the basis for environmental goal setting in municipalities. In setting environmental objectives municipalities should begin with the user and/or conservation interests which are related to the different watercourses, or which one would want to develop, or favour in the future.

The new and interesting feature of this is that one aims to include both water quality itself and the surrounding nature quality (biodiversity) as well as environmentally sound recreation management near-by the watercourses. This, in many ways, can be seen as a natural consequence of the locally adapted environmental policy. The benefits of considering water quality and surrounding nature quality together may in many cases, be large. For instance, when improving water quality so that it is suitable for swimming, one can enhance the total benefits by combining this with environmentally sound recreation management (i.e. improving access by establishing paths and bathing places).

Considering biodiversity management and water quality improvements together can also improve the benefits obtained. For one thing, pollution, like eutrophication, can reduce biodiversity, or at least change biodiversity from what is «natural» in the watercourse. It is also important, however, to see biodiversity on shore in relation to water quality improvements and recreation management. Recreation management without consideration for biodiversity in the shoreline zone, which is often an important habitat for several plant and animal species, can actually reduce biodiversity and plant and animal life. Awareness of biodiversity in this zone can however increase people's benefits related to water.

Most Norwegian municipalities do have several watercourses, rivers and lakes, and many also have fjord and sea area. This means it is important to keep both water quality, biodiversity and recreation management in mind, when setting environmental objectives and management plans for each one of them. It might be the case that one should differentiate/ separate between the different water recipients with regard to objectives related to water quality, biodiversity and recreation management in order to achieve the largest overall benefits.

1.2 About the case study

As already mentioned, The State Pollution Control Authority (SFT) and the Directorate for Nature Management (DN) encourage the municipalities in Norway to set environmental objectives and plans for their watercourses. Environmental quality in watercourses means both water quality itself, nature quality of the bottom of the sea, the shore and adjacent areas as well as the availability and preparations for conservation and use of the watercourse.

It should be noted at the outset that the study which is the basis for this chapter was a survey of benefit components connected to different user and conservation interests associated with watercourses (Magnussen et al. 1997). It was not a case study on experience with implementation of incentive measures. However, the valuation study may be seen as a first step in implementing incentive measures.

The project reported here focused on the benefit side of the cost-benefit analysis. A complete cost-benefit analysis assess benefits and costs. Benefit evaluations will, together with calculated measurement costs, give a picture of the socio-economic profitability of reaching a given environmental goal.

The purpose of the study was to identify the benefits related to changes in environmental quality, in and near-by the watercourses. Ideally, the results of the study should be such that they could be used in the municipalities' management of watercourses and as examples for other municipalities in their work with environmental objectives.

It was decided that the most adequate method available for this purpose, was the Contingent Valuation (CV) Method. This method was to be used, complemented with some form of expert panels.

In order to achieve the objectives listed above, two municipalities were chosen as study-sites: Ski and Melhus. These were chosen by SFT and DN, based on certain criteria. One of the most important criteria was that they should have watercourses for which the municipalities were in the process of setting objectives. The authorities also wanted them to be in different parts of the country, and of course they had to be willing to participate, because the study's success would, to a certain degree, depend on their co-operation.

Municipality Ski is located in south-eastern Norway, approximately 30 kilometres outside Oslo, Norway's capital. It is a densely populated municipality, but much of the population is situated in the most central parts of the municipality. There are less densely populated, agricultural and woodland areas in the less central part of the municipality. The watercourse under study (Langen) is situated in this less populated area. There are also some other smaller lakes in the area. Ski is situated not very far from the coast, the closest sea-shore is approximately 20-30 kilometres away.

Municipality Melhus is located in central Norway, neighbouring Norway's 3rd largest city, Trondheim. It is a sparsely populated municipality, with much agriculture, and some commuters working in Trondheim and living in central parts of Melhus. One large watercourse, Gaula, runs through the municipality. Most of the interest in water in the municipality has been focused upon this watercourse. The site for our study was the much smaller watercourse Gaustadvannet/Ånøyavassdraget, located in a less central part of the municipality. Melhus is not situated far from the sea, even though it does not have sea-shore within the municipality.

2. IDENTIFICATION OF CAUSES AND SOURCES OF PRESSURE

Nutrient problems in fresh water occur mainly in south-eastern, south-western and central parts of Norway. Local problems have been observed in other parts of the country, as well. There are also signs of nutrient enrichment along parts of the coast and in fjords in southern Norway. Both Norwegian discharges and long-range transport with ocean currents contribute to elevated inputs of nutrients to coastal areas. The problems are particularly marked in the outer and central parts of the Oslofjord and from the border with Sweden to the island of Jomfruland where Norwegian input predominate.

The dominant sources of phosphorous inputs are discharges of municipal waste water. Discharges of raw sewage are also a health hazard since disease-producing organisms are released into the water and may cause problems for any activities involving contact with water. The agricultural sector and municipal wastewater account for the largest inputs of nitrogen. Inputs from the industrial sector consist of a few relatively large point discharges of nitrogen.

The main problem in the Langen watercourse is discharge of the nutrients nitrogen (N) and phosphorus (P) causing so called nutrition enrichment or eutrophication. Some local problems are connected to a high bacteria content. A large part of the pollution is coming from municipal wastewater. In turn, a large part of this is stemming from separate sewage treatment facilities in sparsely populated areas. There is also some need for improvement in the municipal wastewater treatment plant and system. Discharges originating from the agricultural sector are very limited in this area.

The main problems concerning ground water quality in the Langen area are related to leakage of sewage from badly functioning sewer systems in the sparsely built-up areas nearby the watercourse.

The current situation is much the same in the other watercourse evaluated, the Gaustadvannet/Ånøya watercourse. In this watercourse the main problem is also nutrient leaching. However, in this watercourse agriculture is an important source in addition to household sewage.

As regard the causes of loss of biodiversity, the cause-effect (or dose-response) chains are less well known. In general one can say that both pollution and pressure on land use are the main causes. Sources and causes of pollution are already dealt with. Pressure on land in general may have many causes. There is land use pressure in more or less all sectors of society. The trend in agriculture has been to exploit the land as much as possible, including ploughing as close to the river or lake side as possible, closing brooks running through the fields etc. Some of this has been due to the increasing efficiency requirements in agriculture. Since one is paid per kg output, one has to adjust to producing as many kilograms as possible, regardless of where these kilograms are produced. To some extent, this also might be due to lack of knowledge and/or awareness about values related to these areas. During recent times there have been several programmes in Norway evaluating how one can re-establish and preserve vegetation zones between watercourses and agricultural land. This is in order to both reduce pollution and

preserve biodiversity. In other areas biodiversity is exposed to pressure due to discontinuation of agricultural activity; for instance former (often marginal) grazing land which is no longer in use.

Also other sector's land use put pressure on biodiversity in general. Private housing, other buildings and infra structure (roads etc.) are important factors.

At the study sites reported here, some quite local and specific parts of biodiversity were selected for valuation. The effects on these also seemed local and specific. The pollution problems from the municipal and agricultural sector have already been mentioned. Land use pressure comes from several sources. Removal of vegetation zones along the watercourses is, in part, due to agricultural practice, as mentioned above. Along Langen there are lots of permanent as well as summer residents. Each property owner has some interest in cutting trees and other vegetation in order to get a better view of the water from his residence. It is uncertain if there are any preventative measures available for this. The best method may be information. The owners are probably not aware of the consequences on biodiversity and landscape resulting from each and every owner cutting vegetation. Another threat to biodiversity resulting from this private summer residency is that former forest or meadowland is cultivated into lawns, resulting in very low biodiversity. Again preventative measures for this are (probably) lacking, except for information. At the river mouth area in Melhus pollution, buildings and technical operations/encroachment are the main problems.

3. IMPACTS ON ECOSYSTEMS

Water in rivers and lakes is the basis for water supplies, power generation, fishing, fish farming, tourism and many forms of recreation, like swimming and angling. During their use quite a lot of pollution components are discharged into these watercourses. Different demands and needs from different users have led to conflicts and increased pressure on watercourses and their surroundings. It is possible, however, to both reduce pollution in watercourses and to improve environmental quality in their surroundings. Several measures are, or will be, carried out in order to strengthen work with holistic management, which should be able to secure a sustainable use of water resources.

Rising inputs of nutrients (phosphorus and nitrogen) to water lead to nutrient enrichment (eutrophication) in rivers, lakes and salt water. Nutrient enrichment results in deteriorating water quality, a high content of planktonic algae and reduced light penetration. This creates problems for various types of use, and particularly for drinking water supplies. One of the most serious effects in fresh water is the occurrence of massive blooms of toxic blue-green algae. Blooms of harmful algae in salt water are more closely associated with particular wind and weather conditions, but an increase in nutrient inputs and changes in the balance between phosphorus and nitrogen are also important factors (SFT 1996).

Both the watercourse at Langen and at Gaustadvannet/Ånøyavassdraget consist of several small and middle sized lakes and several rivers and brooks connecting the lakes. In both watercourses nutrient enrichment results in a high content of planktonic algae. This results in reduced light penetration, the water gets turbid and less suitable for swimming and other outdoor activities. In periods of the year lake Langen has also suffered from massive blooms of one particular toxic algae (*Gonyostomum semen*) which gives skin irritation, itching and allergic reactions. Blooming of blue-green algae also has been a problem some years. During these periods the lake is unsuitable for most uses. The 'problem algae' (*Gonyostomum semen*) is not observed in the other watercourse, Gaustadvannet/ Ånøyavassdraget.

Ground water is also an important part of water resources. Ground water and watercourses are connected and their size and quality influence each other. Ground water pollution may result in bacteria enrichment in drinking water wells. It is particularly clay and sand, which protects and partly cleans water in the ground such that pollution on the ground does not reach ground water. The danger of pollution of ground water increases with digging and removal of clay, sand and soil and mining of rocks.

Biodiversity for watercourses is the presence of many different animals and plants in or nearby the watercourse. Nutrition leaching (with algae blooming) in itself results in a situation where one algae species completely dominates and hinders the growth of the others.

Another factor which reduces biodiversity on shore and in the water is the destruction of original green zones along the shore, and particularly along the tributaries. Such vegetation zones are important both because they reduce pollution and because they are habitats for birds (including ducks) and animals.

They are also a source of nourishment for water living insects, which are in turn source of nourishment for fish.

The vegetation along watercourses and rivers has been under a great pressure from agriculture, road building, regulation of watercourses and front buildings. This has caused removal of, and damage to vegetation. The types of vegetation along watercourses are highly productive and important. They help maintain biological diversity; act as corridors for dispersal of animals and seeds; are an important element in the cultural landscape; allow recreational activities and reduce erosion and pollution from nearby areas.

The effects of removal of vegetation along watercourses are: the river edge is more exposed for erosion, the maximum temperature is increased and there are larger fluctuations in temperature. This temperature effect is caused by reduction in shadow effects in warm periods with little water flow. Further effects are reduced nourishment for animals living on the bottom. The reduced shadow may also result in water temperature above what some species can tolerate. There is a reduction in cover effects for fish from over-hanging vegetation. Increased growth of algae and water plants occurs due to increased radiation. The effects on water quality can be reduced oxygen content when water temperature increases, and an increase in erosion and pollution from neighbouring areas in the water. The effect on landscape is loss of landscape elements. The value of watercourses as elements in landscape may then be reduced. For recreational use the area may lose recreation value. A reduced population of fish would result in a reduced value for angling (Directorate for Nature Management 1994).

Biodiversity in general is difficult to value. The case studies therefore did not aim at valuing 'biological diversity' as such. Specific local aspects of biological diversity were studied. This will be described in more detail in chapter 4.

Installation amenities for swimming, angling and canoeing etc. in the watercourse can increase its use. There is not very much done to increase use of the two watercourses at the study sites. Nature friendly initiatives can also be employed here. Fish cultivation could be introduced in order to improve fishing/angling and fish quality in lakes and rivers. Establishing paths, bathing places and increasing accessibility to the watercourse would improve amenities for swimming etc.

4. IMPACTS OM ECONOMY AND WELFARE

Improved water quality, biodiversity and recreation management may have some, but not many 'direct' economic effects, which can be measured through market prices. Such direct economic effects would be: increased fish catch for sale, increased tourism, reduced costs necessary for cleaning of drinking water, etc. However, most effects of improved environmental quality in these case studies, are what are often called 'intangibles'. These values are not traded, and hence they are more difficult to measure. However, they are important in assessment of benefits to society resulting from improved environmental quality.

There are methods available which can assess these kinds of benefits in monetary terms. In valuation of environmental goods one tries to assess their total value. The total value consists of two main components: use-value and non-use value. Use-value means that people value environmental goods because of their own present and/or potential use of the good in question. Non-use values are values, which are not motivated from actual or possible future use of the good, but from a wish to preserve environmental goods for the future, so that they are accessible for future generations.

The method used in this survey was the Contingent Valuation (CV) Method, complemented by the use of expert panels. The CVM is a stated preference method. CVM uses survey questions to elicit people's preferences for public goods by finding out what they would be willing to pay for specified improvements in them. It thereby circumvents the absence of markets for public goods by presenting consumers with hypothetical markets in which they have the opportunity to buy the goods in question. The respondents are presented with material, in this case in a personal interview conducted face to face, which mainly consists of three parts:

1. A detailed description of the goods being valued and the hypothetical circumstances in which they are made available to the respondent.
2. Questions which elicit the respondents willingness to pay (WTP) for the goods being valued.
3. Questions about respondents' characteristics (for example, age, income), their preferences relevant to the goods being valued, and their use of the goods.

If the study is well designed and carefully pre-tested, the respondents' answers to the valuation questions should represent valid WTP questions. We will not describe the method in more detail here. The accomplishment of the study itself will also not be described in much detail. We would say, however, that the survey was conducted according to state-of-the art knowledge in the method. For more information about methodology and surveys see Magnussen et al. (1997).

As described in chapter one, two local surveys were accomplished for the lower parts of watercourse Langen, in Ski municipality, and one related to watercourse Gaustadvannet/Ånøyavassdraget in Melhus municipality. People interviewed expressed the feeling that it was 'nice' that the communities were interested in their views on these issues. Several of them said that they received new and useful information through the survey. This subject is of interest to people.

In addition to the willingness-to-pay questions we also registered the respondents use of, connection to and interest in the respective watercourses. Further they were asked whether they would use the watercourse more if the environmental quality is improved.

Three components connected to environmental quality in watercourses were valued in this study:

1. Improved water quality.
2. Improved (environmentally sound) recreation management.
3. Preservation/ improvement of biodiversity.

In this study the aim was to value 'all' environmental qualities related to the watercourses in question. This includes water quality, biodiversity and recreation management.

Improved water quality due to eutrophication has been valued several times before in Norway, using SFT's water quality criteria system. Using certain water quality criteria it is possible to distinguish between five classes of water quality. This classification system has been tested several times. The water quality situation before and after improvement measures is presented using coloured maps. Different colours illustrate different water quality classes. These different classes are illustrated and explained by using pictures and key words for describing quality and suitability for use. These are shown to and explained for the respondents. Experience shows that this works well and that the respondents recognise and understand the changes described this way.

At the time of the study water quality in the watercourses in both municipalities was in water quality class II/III, i.e. 'good'/'less good'. The improvement valued was for 1-1.5 classes improvement, i.e. the water quality after improvement would be in class I/II, i.e. 'very good'/'good'. In community Ski protection of wells/ ground water was also emphasised in the survey.

Neither improved recreation management nor preservation of biodiversity has been valued this way before in Norway. Before conducting the survey, it was uncertain as to what degree biodiversity and (to some extent) recreation management could be included into monetary benefit estimates. 'Biodiversity' is a broad and difficult concept, particularly in a local context. Both for biodiversity and recreation management presentation of the measures/ improvements was a challenge. There was not a corresponding system for quality classes available for these as there was for water quality. This, combined with less plain objectives and knowledge about current and potential improvements in the municipalities, meant that the changes valued had to be less specified. In order to present these components on the same basis as water quality, we made posters illustrating and describing the relevant elements of biodiversity and recreation management. However, we were not able to represent before and after situations because the measures were not specified clearly enough. We chose to pick some central aspects related to biodiversity in the municipalities/ water courses in question, instead of trying to value an 'unspecified' biodiversity. This was judged to be the only realistic way of conducting this kind of study. A broader approach would have meant the goods to be valued were too vague and so the answers obtained would have been too. The disadvantage of this procedure is that one may lose some of the overall picture as regards biodiversity, by

focusing on single aspects/measures. This implies that it is vital to select important aspects related to the watercourse. This was attempted in co-operation with the municipalities.

The biodiversity aspects valued in Langen were to preserve vegetation zones along the watercourse. In watercourse Gaustadvannet/Ånøyavassdraget the biodiversity aspects valued were establishment of vegetation zones along the watercourse and preserve the river's mouth at Eidåa.

Our experience was that this way of presenting the goods for valuation, worked well. Relating biodiversity to specific features related to the local watercourse in this way makes it possible for the respondents to evaluate. One might, however, lose some of the values for biodiversity as such as previously mentioned.

Recreation management is at first concrete and easy to relate to. The problem in this study was that the municipalities did not have plans ready in this area. They did not value particular bathing areas with specified facilities, as they found it too early in the municipal planning process at that time. Valuation, therefore had to be related to more unspecified measures.

Improvement measures for outdoor life, which were valued in Langen were establishment of a bathing place, establishment of paths and increased accessibility to the watercourse. Improvement measures for outdoor life which were valued in Gaustadvannet/Ånøya were improvement of an existing bathing place in lake Gaustadvannet, establishment of paths along the watercourse and fish cultivation in lake Gaustadvannet and lake Ånøya.

Those who were interviewed were divided into two sub-samples where the sequence of WTP-questions differed. Sub-sample 1 first received a question about their WTP for improved water quality. Then came a WTP question about biological diversity and adjustments for outdoor life connected to the watercourse taken together (the measures were described in more detail in the questionnaire). Sub-sample 2 first reported their WTP for the total of improved water quality, biological diversity and adjustments for outdoor life by the watercourse taken together (again the measures were described and illustrated in detail in the questionnaire). In the next step then divided this total WTP into WTP for one and each of the three components. The different procedures resulted in some differences in estimated WTP for the different components and the total, as shown in table 1. There is a certain amount of uncertainty in such estimates.

Table 1. Average willingness-to-pay

	Melhus		Ski	
	Sub-sample 1	Sub-sample 2	Sub-sample 1	Sub-sample 2
Environmental goods				
Total (T) NOK	NOK 831	NOK 565	NOK 1031	NOK 872
Water quality (in % of Total)	72%	48%	78%	45%
Biodiversity (in % of Total)	15%	27%	14%	27%
Outdoor life adjustments (in % of Total)	13%	25%	8%	28%

A large proportion of the stated WTP is according to the respondents self reporting related to the wish for preservation of environmental quality in the watercourse for the future (table 2). While WTP related to their own use of the watercourse and possibilities for their later use is evaluated quite similarly.

Those categories correspond in the outset to non-use-values, and use-values (here including so-called option values), respectively. The results indicated that non-use values are substantial even in a local survey like this. Use values are relatively low in this study, due mainly to the fact that only relatively few of the respondents actually use the watercourses in question currently. They are, however, still interested in preserving environmental quality in these watercourses. However one should be aware that people may have difficulties in distinguishing between the share of WTP related to different motives.

Table 2.: Division of willingness-to-pay related to different motives

	Melhus		Ski	
Environmental goods	Sub-sample 1	Sub-sample 2	Sub-sample 1	Sub-sample 2
Total (T) NOK	NOK 831	NOK 565	NOK 1031	NOK 872
Own actual use (in % of Total)	23 %	22 %	16 %	18 %
Possibilities for later use (in % of Total)	27 %	28 %	24 %	13 %
Preservation for future (in % of Total)	50 %	50 %	60 %	69 %

The results indicated that average WTP in Ski was somewhat higher than in Melhus. The factors, which seem to influence average WTP are current use of the watercourse and if there would be increased use if water quality was improved. Distance between watercourse and residence, income, education and to some extent their 'relationship' with the watercourse all had some influence. These factors changed a little between municipalities and different WTP measures (see Magnussen et al. 1997 for more details).

In this study the emphasis was on one watercourse in each municipality. From earlier studies it is known that focusing on one watercourse (or any other environmental goods) may induce higher willingness-to-pay than if one is also supposed to pay for more inclusive, or several environmental goods.

Average willingness-to-pay (WTP) for environmental quality improvement in Melhus and Ski was approximately NOK 565-830 and NOK 870-1030 per household per year, respectively. The number of households in community Melhus is approximately 4 500 and in Ski approximately 8 800. Total WTP in the communities therefore can be estimated to approximately NOK 2.5-3.7 millions per year in Melhus, and approximately 7.7- 9 millions per year in Ski. In these estimations it is anticipated that only the population in the respective municipalities do have WTP for the improvements in the watercourses. Any possible WTP among people living outside the municipalities would result in a higher total WTP.

In a cost-benefit analyses (measurement analysis) the estimated benefits (WTP) should be compared to the improvement costs resulting in the actual environmental improvements. Cost calculations are not carried out as a part of this project, but out of existing reports and information, earlier calculations etc. Costs connected to the necessary improvements are roughly estimated in community Ski. Yearly costs for improved water quality, biodiversity and recreation management are roughly estimated to approximately NOK 3-4 million per year. In Melhus there was not enough information to do similar calculations.

If one compare yearly benefits and costs of the environmental improvements, one can see that the environmental improvements in Ski have a clearly higher benefits than costs (NOK 3.7-6 million higher benefits than costs).

One can see that in Melhus the yearly costs must be less than approximately NOK 2.5-3.7 million in order for the environmental improvement to be socially beneficial.

This shows how this kind of benefit estimates can be used in policy.

As already mentioned, two expert panels were conducted in each municipality, one before and one after the survey was accomplished. In the expert panels people with political and administrative positions in the municipalities took part. The purpose of the expert panels before the surveys was to provide information about the project and these kind of valuation studies. This was done in order to encourage participation from the municipalities in information gathering, carrying out the study and using the results afterwards. It was also important to gather information and secure the quality of questionnaire descriptions etc. Realistic environmental objectives were discussed, and local knowledge was gathered.

In the expert panels conducted after the survey, the experts performed a valuation using the same questionnaire as in the survey, one by one. Thereafter a discussion based on the results from the survey and their own response was conducted. Several of the expert panel participants expressed surprise that the inhabitants of the municipality had given as high values as they did. There was a certain distrust in this holding true 'in practice'. However, average WTP from the expert panel was considerably higher than in the population. The expert panel felt that the distribution between values for water quality, biodiversity and recreation management should be somewhere between the results of sub-sample 1 and 2 in the survey of the population. The expert panel also expressed surprise that such a large proportion of people's WTP was distributed to ('non-selfish') non-use-values. Their own distribution was mainly in accordance with the population's distribution.

Those who loose (benefits foregone) due to pollution, loss of biodiversity and recreation activities are first and foremost the users (and potential users) of the area and water. These are both those who do not use it, because of low environmental quality and those who use it, but less, or with less benefits, because of low environmental quality. The potential users could also include future generations, especially for loss of biodiversity, which may be lost forever. Those who gain from inaction are those sector interests mentioned earlier as responsible for the effects. The most affected sector would probably be the agricultural sector. Also singular households would be affected of measures directed towards separate sewage treatment facilities. The losses in monetary terms suffered would depend on which measures and which economic arrangements are chosen. However, the gains of inactivity for these groups may also be limited, as they may also be interested in the benefits of recreation and biodiversity. This implies that information is important because many effects are probably/may be caused by ignorance.

5. IMPLEMENTATION OF INCENTIVE MEASURES AND CONTEXT

Norway is implementing the objective of the North Sea Declaration by means of a number of measures in the agricultural, industrial and municipal sectors. Anthropogenic inputs of nutrients to the stretch of coastline from Østfold to Vest-Agder county inclusive (The North Sea Plan Area) were to be reduced by about 50% by 1995, using 1985 as the base year. The measures implemented so far reduced inputs of phosphorus by rather more than 40% and inputs of nitrogen by about 30% by 1995, in relation to the 1985 level.

In the North Sea Plan Area, waste water from built-up areas corresponding to 5 000 population equivalents or more is to be connected to sewage treatment plants. It will undergo chemical, biological or equally effective treatment, unless it can be demonstrated that the discharges do not cause pollution. The necessary renovation of wastewater treatment facilities shall, as a general rule, be completed by the year 2000 throughout the country.

It will probably not be possible to cut nitrogen inputs by 50% until about the year 2000. This is because it has been difficult to find acceptable means of ensuring full implementation of measures in the agricultural sector. The construction of nitrogen removal facilities for municipal wastewater has also taken rather longer than expected. If phosphorus and nitrogen inputs are halved, water quality will be improved in most rivers, lakes and fjords from Østfold to Vest-Agder. Plans for the rest of the country are not as comprehensive (SFT 1996).

The construction of sewage treatment plants is an important means of reducing discharges of nutrients and organic matter into rivers, fjords and coastal waters. Chemical treatment is the most common process and removes phosphorus very efficiently. Sewage treatment capacity has grown substantially during the past 20 years. Discharges of nutrients and organic matter with municipal wastewater have been greatly reduced. However, there are still local problems especially in sparsely populated areas not easily connected to large central sewage treatment plants. This is the case in both our study sites.

In the agricultural sector, soil management programmes are the most important means of reducing soil erosion and inputs of phosphorus to rivers and lakes. In 1993, farmers left 41 percent of the cereal and oil crop acreage in southern Norway unploughed. However this has probably not had the expected effect, because the programme was not always applied in the areas that are most vulnerable to erosion. The largest reductions in nitrogen inputs to lakes and rivers should be obtained by means of fertiliser application programmes. Calculations based on the period 1993-1994 show that only relatively small reductions have been achieved so far. If these programmes are to have the expected impact, they must be implemented much more widely. The amount of fertiliser applied per unit area will probably have to be substantially reduced as well (SFT 1996).

Regarding the sites for the case studies, it should be noted that municipality Ski is located within the «North Sea Plan Area», while municipality Melhus is not. The measures applicable in the local study sites are much the same as in the country as a whole. However, at both sites, a large part of the pollution coming from municipal wastewater is stemming from separate sewage treatment facilities in sparsely populated areas.

Improved water quality makes the water more suitable for different uses. Only small reductions of pollution into watercourse Langen are required in order to make it more suitable for different uses. Not very big pollution reductions are required in order to make it suitable for example for swimming. In the level of phosphorus is reduced to below a certain level, the 'problem algae' will disappear, or be reduced to a level where it does not do any harm. Such an improvement in water quality will result in other positive effects, like improved angling and that the water is more suited for agricultural watering.

Measures in the area will also quickly result in improved water quality in the tributaries. These brooks/streams often run through dwelling areas. Measures improving water quality in watercourse Langen will also secure ground water quality. This ground water is the drinking water source for this area.

The measure required to secure ground water resources is first and foremost an improved sewage system. Control of and more consciousness about polluting activities is also important. Measures to secure wells against local pollution, or penetration of polluted surface water directly to the well are also important.

Measures to reduce phosphorus (P) leaching to the northern part of watercourse Langen have already been carried out. This has produced results, in that water quality is improving and algae blooming are reduced, light penetration is increased and bacteria content is reduced.

The proposed water quality improvement in Melhus is of the same order of magnitude as that for watercourse Langen.

Measures are put in place in order to protect and preserve vegetation zones, along both the watercourses in the case studies. This is in order to preserve biological diversity, reduce pollution and preserve the wooded landscape so that it seems 'untouched'. These measures will contribute to preserve and increase biodiversity associated with the watercourse. Since the need for revegetation along the watercourses has been evident. The landowners get economic compensation when creating a new field or river margin. A lot of methods have been used in this work. The simplest measure to take is to do nothing and wait for natural restoration. There is, however, a need for ground preparation or soil adding in many cases. This will prepare the site for revegetation and restoration. Native species are preferred.

At the river mouth area in Melhus pollution, buildings and technical operations/encroachment are the main problems. The recommendation for management here, is that it is emphasised that the mouth of the river Eidåa is one of the very few river mouths intact in the county. The area should be secured through regulations in the municipality's plan for the area.

Additionally measures for environmentally sound facilitation of outdoor activities are put in place. These are preparation of a new bathing place in Langen, establishing a path in the area along Langen, and securing accessibility to the water in several places along Langen in order to improve the potential for fishing, angling etc.

6. POLICY RELEVANT CONCLUSIONS

Co-operation and basing of the study and results in the municipality was emphasised. This operation started with holding meetings with the local administration in Ski and administration and politicians in Melhus. Information about the project was given out and information about the municipality, watercourses chosen etc. received. A survey of the area to observe the watercourses and their surroundings was also performed. The next step was the establishment of the so-called expert panels of politicians and bureaucrats. There after followed the forming of focus groups among inhabitants and thorough pilot testing locally before the survey was conducted. After the survey, another expert panel meeting consisting of the same participants, was conducted. There were also several rounds of comments on the questionnaire, gathering of information etc. from the administration in the municipality and central environmental authorities between these meetings.

The results cannot directly be transferred to other watercourses, but gives important information about the size of benefits. Statistically 'benefit transfer' (transferring willingness-to-pay collected for some environmental goods (watercourse) to say something about the value of other environmental goods (other watercourses) is difficult.

Different conditions in different communities, related to the watercourse itself (such as how polluted it is, how big the change is, which alternatives are available, how much it is used, water temperature, surroundings etc.) and the population (income, education, attitudes, activity pattern etc.) can influence willingness-to-pay (WTP) and thereby estimated benefits from the environmental improvement. The level of precision demanded of benefit estimates will be different in different applications. Even though one cannot directly transfer the results from this survey to other communities' watercourses, the results give an important indication of the order of magnitude of WTP for improved environmental quality in watercourses.

The value of improved environmental quality in watercourses locally is large, and non-use-values are an important part. The results of the case studies show that there is a substantial willingness-to-pay locally for improved environmental quality in watercourses. WTP is largest for improved water quality, but also very substantial for preservation/ improvement of biological diversity and improved amenities for outdoor life.

The results also show that non-use-values are very substantial in such local investigations. The use-values were relatively low in this study. This is due to among other things, the fact that there was actually a relatively large proportion of the respondents who did not use the watercourses at that time. It was, however, still important to them to preserve environmental quality.

The role of benefit assessment in cost-benefit analysis and planning processes is important.

The results show that there is considerable interest in, and WTP for, improved environmental quality in watercourses.

This implies that it is important to include this kind of benefit assessment in the process of evaluating which and how many improvement measures should be carried out on watercourses. This is in order to get a complete picture of which benefits and costs are connected to different measures or packages of measures.

When projects of this kind are performed in the future, it is important to include cost-benefit analysis at an early stage. One must be able to evaluate potential improvement measures using cost-benefit analysis. At the same time it is important to have enough time to perform the necessary investigations, management, administration and political activities. These can take place alongside the planning process.

In a cost-benefit analyses (measurement analysis) the estimated benefits (WTP) should be compared to the improvement costs resulting in the actual environmental improvements. Cost calculations are not carried out as a part of this project however.

The method used is suited for the valuation of different user and conservation interests, but it is relatively time and cost consuming. Carrying out surveys of the kind reported in this chapter is relatively time and cost consuming. It also demands special expertise in some areas. Therefore it is unlikely such studies will be carried out for every watercourse in every local community. One most certainly can gather lots of interesting information by conducting more simple investigations among inhabitants of municipalities. Even though one does not go as far as collecting the inhabitants' willingness-to-pay for different changes, surveys can be important documents. They can be the basis on which the municipalities' priorities of improvement measures are assigned, registration of use of waterways etc.

It will be a big step forwards if benefits and costs related to different environmental quality improvements are considered. In order to do this, one has to consider and characterise different benefits for different groups and different costs for different groups. By doing this, one will obtain an improved basis for decision making. One of the main advantages of doing surveys like this is that one has to characterise and describe status for the environmental situation at present and what is achievable in the (near) future. Another important advantage of these surveys (with or without willingness-to-pay questions) is that the population of the communities are allowed to express their views, not just 'the establishment'. This often gives a somewhat different picture than what is expected. By asking and involving the population, before improvement measures are put in place this also creates understanding. The necessity and reasons for taking measures (which may result in costs in some way or another for some of the involved groups) is then understood.

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