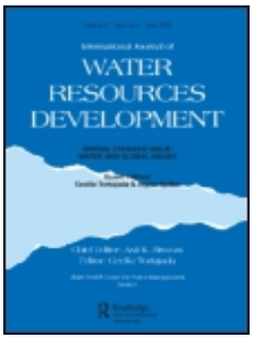

International Journal of Water Resources Development

ISSN: 0790-0627 (Print) 1360-0648 (Online) Journal homepage: www.tandfonline.com/journals/cijw20

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To cite this article: Bodil Liedberg Jönsson (2004) Stakeholder participation as a tool for sustainable development in the Em River Basin, International Journal of Water Resources Development, 20:3, 345-352, DOI: 10.1080/0790062042000248583

To link to this article: https://doi.org/10.1080/0790062042000248583

Water Resources Development,
Vol. 20, No. 3, 345–352, September 2004

Carfax Publishing
Taylor & Francis Group

Stakeholder Participation as a Tool for Sustainable Development in the Em River Basin

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ABSTRACT *The Em river watershed in south-east Sweden is an example of involving local organizations and people in river basin management that implements practically integrated water resources management and the philosophy underlying the United Nations Educational, Scientific, and Cultural Organization (UNESCO)/Swedish International Hydrological Programme (IHP) Hydrology, Environment, Life and Policy (HELP) programme. The Em River Stakeholder Association has applied a bottom-up perspective. Stakeholders have been participating in several river basin projects over several years. Stakeholder participation was of special importance when working with issues of local importance, such as water economizing, fish migration, storm-water characterization and nutrient reduction. Eight task groups have carried out projects within different fields of expertise. The river basin cooperation started as a project in 1992. In 2004, the permanent Em River Union will be formed to work towards sustainable development integrated water management, good ecological conditions and economic growth in the Em River basin.*

Introduction

The Em River is one of the most valuable rivers in Sweden. It is in the south-east of the country (Figure 1). The river system, including the lakes, has a high biodiversity with 32 species of fish, the freshwater pearl mussel *Margaritifera margaritifolia*, the kingfisher, the otter and many other rare animals. The terrestrial fauna and flora are also extremely interesting with several eastern, and extremely continental, beetle species. The traditional agricultural landscape has a very rich pasture flora. There are also several old growth forests with a diverse lichen and moss flora. Swamp forests have developed along the rivers and near lakes. Areas along the main channel of the river and several of its tributaries are European Union Natura 2000 areas and of Swedish national value.

The river system has been populated since the end of the last Ice Age. Nomads followed the rivers fishing, hunting and gathering food in the forests. When the first settlers decided to stay in the area, they chose to live on well-drained soils near the river.

Conflicts arose as man developed new techniques to use the force in the river for different industrial purposes. Industry and municipalities used the river as

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DOI: 10.1080/0790062042000248583

Figure 1. The Em River Basin, Southeast Sweden.

a recipient for wastewater. Several water bodies were severely polluted by heavy metals, nutrients, polychlorobiphenols and other substances.

In addition, modern agricultural techniques made it possible to plough the heavy soils on the floodplains. Land that had been used for haymaking was converted into fields for cereal and potatoes as on the Mörlunda flood plain (Figure 2). Suddenly, the naturally flooding river that earlier was looked upon as a resource to fertilize the hay meadows was now considered a threat to farmers and their crops.

Em River Basin

The watershed area is 4500 km^2 and the river system, including the tributaries, is about 800 km in length. The main channel of the river is 220 km from source to mouth. The average annual precipitation measures 450 mm in the eastern part and 800 mm in the western and upstream parts of the catchment. The annual runoff at the mouth of the river is 210 mm/year and the mean annual discharge is 28.6 m^3/s. The river basin has a hilly topography with sediment-filled valleys. The highest elevation is in the western part of the river basin where peaks reach 400 m above sea level. The mouth of the river is at sea level in the Baltic. There are about 950 lakes in the catchment. Most are oligotrophic, but some are also mesotrophic. Land uses are illustrated in Figure 3.

Figure 2. Mörlunda flood plain. Photo: Leif Gustafsson.

Stakeholder Participation

Conflicts along the river increased as the self-supportive agricultural society developed into an industrial society. At the beginning of the 1990s, conflicts were more problematic than ever before. Therefore, the municipalities, together with the Regional Administrative Boards and local non-governmental organizations (NGOs), decided to create a forum in which to discuss potential solutions to several problems in the area and to work together for economic and environmental sustainability in the river basin. The watershed cooperation had already started in 1992 on a small scale. Today, eight municipalities, two Regional Administrative Boards, the Farmers' Union, NGOs, fish water owners, angling organizations and local history associations are cooperating in this watershed

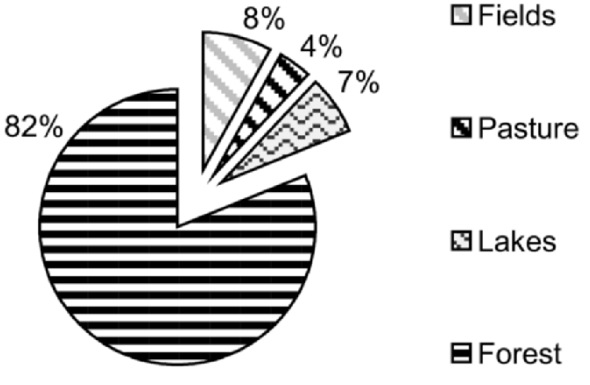

Figure 3. Land use in the Em River Basin.

Table 1. Who is on the Board of Directors in the Em River Basin Stakeholder Association?

Type of organization	Number of members on the board
Municipalities	4
Regional administrative boards	2
The Em River Basin water board	1
Farmers' union	1
Fish water owners	1
Angling associations	1
Local history associations	1
Nature conservation associations	1

project. One of the main objectives for cooperation in the river basin is to create an economically and environmentally sustainable society in the Em region. The current river basin organization is preparing for a new development. Starting in April 2004, the organization will include all 12 catchment municipalities, all four Regional Administrative Boards, industry and all other stakeholder groups in a strong river basin institution.

The Stakeholder Association's approach to water management has been informal. It is extremely important that all stakeholders are given the opportunity to take part in the planning process. Most decisions about how to proceed are made by the project's Board of Directors (Table 1), with members from all the organizations mentioned above. The municipalities are in the majority with four seats out of 12. The chairman is always from one of the municipalities.

The organization is described in Figure 4. Work groups specialize in different fields of activity. They plan and carry out the work. Each work group has a chairman who is responsible for handpicking the work group members, who are often civil servants from the municipalities, the Regional Administrative Boards, national authorities or representatives of the different stakeholders.

Throughout the planning process, all stakeholders are invited to give their view on the project. Decision-making is by consensus. If common agreement on an action cannot be reached with a large majority of the stakeholders, then the action is not taken.

Examples of Decision-making from the Em River Basin

Several examples of successful projects where the stakeholders were involved and where their involvement was essential for the outcome are illustrated below.

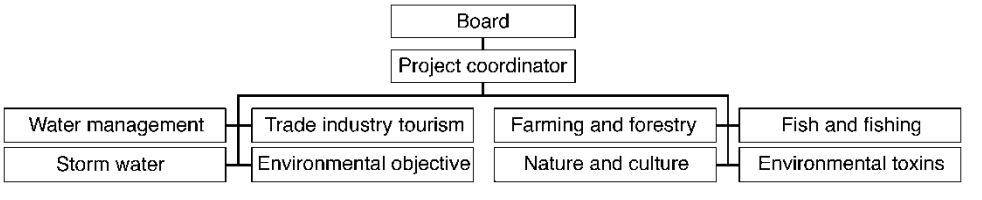

Figure 4. Em River Basin Stakeholder Association with eight task groups.

Saving Water to Guarantee a Minimum Discharge

There are large variations in water flow in the Em. During extremely dry summers, the discharge can be less than 2 m^3/s at the mouth of the river. In contrast, during a very intense melt water season (statistically once every 200 years), it might be as high as 200 m^3/s. Both extremes create problems for those along the river and for the biological life within the river itself. During a dry summer, there is barely enough water for the different water uses and needs. These uses include fish migration, drink water production, industrial uses and irrigation.

On the coast south of the river mouth is a large paper pulp factory that depends on the river for its supply of process water. This industry must not withdraw any water in August if the flow downstream of the withdrawal point is less than 3 m^3/s. This rule ensures there is sufficient water flow for trout and salmon to find their way into the river during the spawning season.

To solve this conflict between fish reproduction, paper pulp production and other water uses, the Stakeholder Association asked the Swedish Meteorological and Hydrological Institute to develop a water economizing plan for the river (Sanner, 2000). The plan's main objective is to guarantee a minimum water flow of 4.5 m^3/s upstream of the mouth of the river.

There are 45 hydropower plants with dams in the Em River basin. The water flow at nine of those dams will be regulated according to the water economizing plan, which is based on historical meteorological and hydrological data over 30 years (1965–95).

The plan has been introduced to all owners of water rights and hydropower companies that will be affected by the changes. Several meetings have been held to discuss the pros and cons for all stakeholders. They have agreed to test the water flow management plan for a period of 3 years. In 2002, 12 water flow stations were installed at critical points in the main channel and the tributaries. The data are transmitted by a mobile telephone net to a computer. Three important stakeholders (the pulp factory, a paper mill and a municipality) have agreed to finance the test.

Restoring Fish Migration

The Em River has the largest and probably the fastest growing natural brown trout population in the world. A world record for fly-fishing was set in the river in 1993—the trout weighed 15.3 kg.

Until the late nineteenth century, migrating salmon and brown trout could swim 140 km upriver (Sjöstrand, 1999). The migrating fish used to be of great economic value to those along the river (Dedering, 2001). When hydropower plants were built on the river system in the early 20th century, the hydropower companies were required to build fish ladders for salmon and trout. In the 1940s, this obligation was substituted by an obligation to introduce the spawn of salmon and brown trout into the lower part of the river each year. The wild salmon and brown trout were shut out from a large area and were only able to travel 25 km upriver. In 1990, it was commonly agreed that introducing artificially raised spawn was harmful to the wild population and this practice was discontinued.

The angling organizations and five municipalities along the river have been trying to restore fish migration in the river for 15 years. The municipalities have agreed that the migrating fish should have access to all areas that used to be open for migration and spawning before the hydropower plants were built. The municipalities have also agreed to cooperate to help each other negotiate with the power-producing companies, and to take responsibility for planning and building seven new fish bypasses at seven hydropower plants.

The Em River Basin Stakeholder Association has been negotiating with one of the power companies about fish bypasses at four hydropower plants for several years. An important first step was taken in 2000 when two new bypasses were built to circumvent two power plants at Finsjö. The local municipality (Mönsterås) agreed to accept ownership of the bypasses. The hydropower company agreed to accept a reduction in power production up to an equivalent of US$6250/year during an evaluation period of 5 years. All five municipalities have agreed to share the other costs for the bypasses during this time. The bypasses at Finnsjö cost about US$362 000. The cost was covered by the Em River Basin Stakeholder Association, the National Board of Fisheries and by the European Union's Objective 5b initiative.

Today, brown trout and salmon have access to another 20 km of river. The spawning grounds have increased by 20%. The Stakeholder Association has tried to increase the repopulation rate upstream of the bypass by introducing 400 spawn from lower parts of the river.

This year the Stakeholder Association is investigating the possibilities for fish bypasses at two hydropower plants further upriver. Hopefully, these will be built some time during the next few years. The ultimate objective is to restore the migration for salmon and trout to all the remaining spawning grounds in the main channel within the next 10 years through a cooperative effort of all stakeholders—the hydropower companies, the angling associations, the owners of fishing rights, the municipalities and the fishing authorities.

Plans to Decrease the Impacts of Storm Water

During the last 20 years, pollution of the river by storm water has come into focus. The Stakeholder Association created a storm-water workgroup to work on the issue. Storm-water production in the towns and on the roads was mapped using a geographic information system and each municipality received a report with information about the volume and the chemical pollution of storm water in their storm-water catchments. All storm water collected on hard surfaces, such as roofs, tarmac or in industrial sites, is included in the investigation. It also includes a risk assessment for each storm-water area. This risk assessment is based on calculated information about the magnitude of pollution of the water resources as well as impacts on the biological and recreational values and the retention capacity of the recipient streams. The reports also suggest possible measures to reduce the environmental impacts.

A special report presents the environmental risk classification from a watershed perspective (Tholén, 2000). Thirty-three storm-water areas of concern are identified. Most of these 'hotspots' are in the upper part of the river basin. The Em River basin municipalities have agreed on a common storm-water policy. The next time they revise their general plans, they will include in them measures for storm-water treatment.

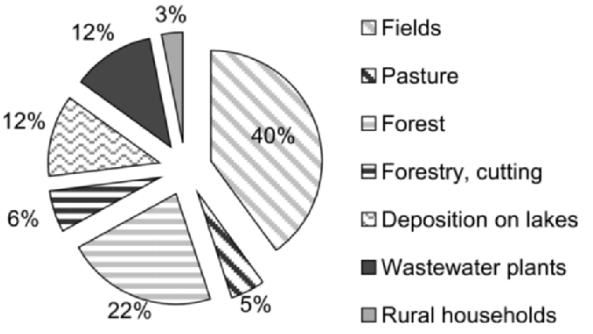

Figure 5. Nitrogen sources in the Em River Basin (after Larsson, 2000).

The storm-water workgroup also delivered a report describing the storm-water production along the road net (Envall, 1999) in the watershed to the Swedish National Road Authority. The entire road net is described from a storm-water perspective and the environmental impact on the water system is calculated. Hotspots were identified and the report also includes classification of traffic, road material, bridges, salt use and accidents. The report is a useful planning tool for the road authorities when they prioritize different measures for the road net.

Plans of Nutrient Reduction in the River and to the Baltic Sea

Different sources pollute the river with 1490 tons of nitrogen each year (Figure 5). The river transports 834 tons of nitrogen into the Baltic (Larsson, 2000). In the river basin, the arable acreage is only 12% of the total land area. Still 45% of the nitrogen and 36% of the phosphorus in the water emanate from the arable land. Farming and forestry together are responsible for 73% of the nitrogen and for 62% of the phosphorus discharged annually into the Baltic. Municipal wastewater is only responsible for 12% of the nitrogen and 8% of the phosphorus that reaches the Baltic through the river mouth.

When planning to reduce nitrogen and phosphorus pollution, it is necessary to reduce the pollution from the arable land and the forests. Landowners must be persuaded to recognize and accept that they must play an active role in the planning of nutrient reduction.

The Em River Stakeholder Association and its Farming and Forestry Workgroup have encouraged landowners to start 'watercourse groups'. About 330 landowners, owning 35% of the arable land in the river basin, are active in 19 watercourse groups. Each group is planning how to decrease water pollution by nutrients from their farms and forests. So far, 80% of farmers have estimated the nutrient balances for their farms. This year, 210 farmers in the Em River basin participated in an educational programme on the theme 'take hold of your nutrients'.

Conclusions

Four watershed projects in the Em River basin are described above. In all, there are eight different workgroups addressing water issues of importance in the

basin and each group has carried out several projects within its area of responsibility. Examples of other useful river basin projects carried out in the river basin include the development of an eco-museum with visiting sites at 27 different locations within the river basin. The goal of this project is to increase awareness about both the environmental and historic values in the watershed.

Hopefully, this will encourage the public to become more interested in, and to take part in, the water-management planning process, especially if they are more aware of what values are at stake. Similarly, the Stakeholder Association hopes that the inhabitants in the Em River basin municipalities will grow prouder of living in their home districts and will take part in the development of the area locally, as well as on a river basin scale.

Another example of a project is the biotope mapping carried out in 1998 and 1999. More than 800 km of rivers and streams were mapped. All biotopes in the water bodies and along the shores were described and the results are available in printed reports and on a CD-ROM. This information is extremely valuable for water management, municipal planning and tourism-development purposes. These projects and the experience gained by the Em River Basin Stakeholder Association could be readily transferred to other river basins in Sweden and Hydrology, Environment, Life and Policy basins around the world.

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