

B 53



**INSTITUTET FÖR VATTEN- OCH LUFTVÅRDSFORSKNING**

DROTTNING KRISTINAS VÄG 47 · 114 28 STOCKHOLM · TELEFON 08 - 22 25 40 (VÄXEL)

INSTITUTET FÖR VATTEN-  
OCH LUFTVÅRDSFORSKNING

NATURE CONSERVANCY IN SWEDEN - ORGANIZATION AND RESEARCH  
Stig Freyschuss and Leif Bruneau

B 53  
~~Stockholm~~  
September  
1969

Nature Conservancy in Sweden - Organization and Research

Stig Freyschuss and Leif Bruneau,  
Swedish Water and Air Pollution Research Laboratory, Stockholm

The interest in and the debate on the human environment and its preservation is extremely intense in Sweden. So great a significance is attached to these questions that all political parties have nature conservancy as an important point on their programmes.

Nature conservancy, as considered in Sweden, comprises in its widest sense all efforts directed to the preservation and protection of nature and the human environment against the phenomena which may threaten it. The chief threat to the environment is considered to be pollution of water and of the atmosphere.

The entire nature conservancy field in Sweden is in a stage of transformation and renewal. Since 1966 the following has occurred:

- the governmental authorities have been reorganized and merged into one central unit, the Nature Conservancy Office
- a new legislation - the Environmental Protection Act - covering air and water pollution as well as noise has been made effective
- a special secretariat has been organized for supervising and coordinating the applied environmental research
- a research institute for industrial water and air pollution problems supported by the industry and the State jointly has been set up

### Legislation

The statutes regulating the judicial conditions relating to nature conservancy appear at several points in the laws of the realm. The reason for this is chiefly historical.

In recent years, however, attempts have been made to group together and coordinate the legislation covering major sectors of nature conservancy. The most important laws at present in the nature conservancy field are:

1. The Nature Conservancy Act
2. The Environmental Protection Act
3. The Public Health Statute

Among other legislation affecting the nature conservancy field may be mentioned building legislation, the Industrial Safety Act, the law relating to general water and sewage arrangements, and the law concerning measures against the pollution of water by ships.

The permission to discharge pollutants into water was regulated by the Water Conservancy Act until 1.7 1969. This part of the Water Conservancy Act was introduced in 1941.

The fundamental meaning of the new legislation is that everything technically possible has to be undertaken to prevent the pollution of air and water, provided the economic effects on the community or the industry are reasonable. The industry has to prove also that their wastes do not cause any harm to the environment. Most types of industries will have to obtain a concession from the Concession Board for Protection of the Environment before the construction of new or enlargement of existing facilities is begun. A concession will have legal validity for ten years provided no changes of importance take place. An alternative is to obtain a permit, having the legal character of an exemption, from the Nature Conservancy Office.

This has not the validity of a concession, however. The considerations preceding a concession or a permit include not only pollution problems but also aspects on the proper localisation of the particular type of industry.

The requirements for pollution control measures are not based on any water or air quality standards but rather on what can be achieved technically. When certain toxic materials and sulphur dioxides are concerned, there has been recommendations set up, however. Further sets of recommendations concerning air pollutants are to be expected. Examples of these types of recommendation are shown in the attached table.

All communities having a population exceeding 200 must have the procedure for discharging the sewage regulated a concession or exemptive permit.

#### Administrative authorities

Since July 1, 1967, a new administrative organization covering the entire nature conservancy field has been functioning in Sweden. The central authority is the Nature Conservancy Office and the regional organizations the Nature Conservancy Departments of the County Councils.

The responsibilities have been divided between the central and the regional organizations in such a way that that of the latter is restricted chiefly to the supervisory function within the respective regions. Matters of more complicated or principal nature are the responsibility of the central office.

The organization of the National Nature Conservancy Office will be seen from fig. 1. The office thus has experts in all main fields of nature conservancy. The Nature Conservancy Departments of local councils consist of personnel with technical, biological and chemical training.

TABLE I

Discharge directly to the recipient where ten-fold dilution is expected

Iron, Fe	5.0 ppm
Copper, Cu	1.0 "
Cromate, Cr	1.0 "
Cyanide, CN	1.0 "

Discharge to community sewage treatment plant:

	sedimentation	biological	
Copper	1.0	1.0	ppm
Cromate	5.0	5.0	"
Cyanide	0.5	0.1	"
pH	>6.0		

TABLE II

Swedish immission limits for sulfur dioxide:

Concentration ppm	Concentration mg/m <sup>3</sup>	Sampling period	Frequency for exceeding
0.05	0.14	1 month	-
0.10	0.29	24 hours	once a month
0.25	0.72	30 minutes	1 % of time

### Subsidies and incentives

The costs for construction of municipal treatment plants may be subsidised by the government. The size of the subsidies depend on the degree of treatment as follows:

Reduction of BOD	Reduction of phosphorus		
	<50	50-89	>90
	subsidy, percent		
60-74	30	35	40
75-89	30	35	45
>90	35	40	50

The Swedish Industry has accepted as a principle that the investment and maintenance costs for pollution control should not be subject to incentives or subsidies but considered as part of the total production costs. A provision is that all facilities for pollution control may be depreciated following the same rules as those applying to machinery.

Such industrial plants which were constructed before the present legislation will form an exception in this respect. The Government has assigned 250 million Sw.Cr. for a five-year period to assist these plants to meet the new requirements. The subsidies will be maximised to 25 per cent of the investment costs.

### Financing and control of research

Nature conservancy research is financed primarily out of public funds, but also by private funds and industry.

The bulk of the funds are allocated by special organs and go to special projects or research fields. Interested institutions are free to use the general research grants for nature conservancy research.

The bulk of the special funds are intended for applied research and are allocated by the Research Board of the Nature Conservancy Office. For the budget year 1969/70 the Board has some 9,5 million Swedish crowns to allocate.

Funds for projects of a more general research character are allocated chiefly by the Natural Science Research Council and the Swedish Board for Technical Development.

The amounts allocated to nature conservancy during the budget year 1967/68 totalled some 7 million Swedish crowns.

Since the special funds are allocated to clearly defined projects, the allocating organizations can control the research by giving priority to projects which are considered most urgent.

The contributions of industry assume the form partly of research and development work within business enterprises and industrial research institutes and partly of grants to the Swedish Water and Air Pollution Research Laboratory, amounting at present to about 0.7 million Swedish crowns.

#### Government research institutions

The bulk of the research in the nature conservancy field in Sweden is done at the scientific institutions at our universities and other schools of corresponding status. There are therefore five geographical centres at which research is concentrated, namely Stockholm, Uppsala, Lund, Gothenburg and Umeå.

Institutes of technology exist in Stockholm, Gothenburg and Lund. The latter is under construction, but is expected in a few years to be the largest of its kind in Sweden.

The choice of subjects for research at a university in Sweden is decided chiefly by the head of the respective department, the professor. The latter has a very great freedom in this

respect. Which departments engage in nature conservancy research is, therefore, to a large extent, dependent on the direction of the professors' interests. This has meant, for example, that the head of the Department of Inorganic Chemistry at the Chalmers University of Technology is one of Sweden's foremost experts on atmospheric pollution, while a professor of nuclear chemistry is a prominent expert on mercury in the natural environment.

In the case of other institutions, their interest in problems associated with nature conservancy is apparent from their title, for instance the Institutes of Limnology and Oceanography, as also the institutes for sanitary engineering.

Apart from the research conducted at institutions associated with the seats of learning, there are other government institutes and organizations whose main job is research and which in some cases have administrative duties as well. Examples of organizations engaged on environmental research are the National Institute of Public Health, the National Institute of Occupational Health, the National Bacteriological Laboratory, the Research Institute of National Defence, the Swedish Meteorological and Hydrological Institute, the Board of Fisheries laboratories, etc. Research organizations of these kinds, however, can take up environmental problems only insofar as they are concretely related to the aims of the organization. All of these institutions and organizations are under government control.

In an important field of nature conservancy, namely research on the problems of industrial water and air pollution, the government and industry have established fruitful cooperation. This is dealt with in the next section,



### Industrial contributions

Certain branches of industry started to take an interest in water pollution questions as early as the 1940's. These were chiefly the mining, sugar and pulp industries, and these industries have continued to take a leading part in research and development in this field.

These industrial activities resulted in 1966 in the forming of two organizations dedicated to industrial pollution problems: Swedish Water and Air Pollution Research Laboratory and Industrial Water and Air Pollution Control Co.

The Institute is financed by equal contributions from government and industry. Its chief function is to conduct applied research concerning water and air pollution questions. The Institute's budget amounts to some 1.6 million Swedish crowns.

The Company carries out investigations and surveys of primarily industrial emissions into water and the atmosphere and acts as consultant to industry. It has a turnover of some 2.8 million Swedish crowns.

### Questions of special interest in Sweden

#### 1. The pulp industry

The pulp industry holds a predominant position as regards industrial pollution questions in Sweden. It accounts for some 65 per cent of the water consumption and for some 90 per cent of the water consumption and for some 90 per cent of the biologically decomposable substance discharged into water-courses. It is therefore natural that the activities in the field of environmental technology are to some extent concentrated to this industry.

In Sweden the tendency has been to attack pollution problems primarily by means of internal measures. By modification of processes or subprocesses, through the reuse of suitable spent

process water etc., the attempt has been made as far as possible to reduce the quantity of pollution leaving the factory. Only when all technically and economically defensible measures "inside the fence" have been taken, has the question of external measures been discussed. The most common type of external measure has been the separation of suspended material, either directly or by flocculation. Biological processing of industrial waste water is done only in special cases except when combined with the processing of household sewage.

On the question of pollution-limiting measures of an internal character, efforts have been made for several years past to seek the active participation of designers and suppliers of processing equipment. Advantages of a given aspect have become an increasingly important sales argument. A by no means insignificant stimulus in the search for an improved environmental technology has been that technological solutions have often brought benefits in the form of reduced cost of chemicals and of water and of increased yield of product.

The Swedish pulp industry of the future, sulphate pulp will be the predominant product. From the water pollution aspect this has distinct advantages. The emission of odorous sulphur compounds from sulphate pulp mills, however, has meant that an, in itself, attractive establishment or extension of a production unit within the richly timbered areas of south and central Sweden cannot be accepted as a matter of course. Extensive development work aimed at limiting the odours has been necessary. This has resulted in partially other solutions than those adopted in the United States and Canada.

## 2. The phosphate problem

Since the mid-fifties there has been a considerable construction of municipal sewage treatment plants in Sweden. Despite the extensive investments in sewage networks and treatment plants, however, insufficient funds have been allocated to

research and development in processing technique. The designers have adopted a conservative attitude and to a large extent have followed the developments on the continent. One consequence is that the majority of biological treatment plants must now be regarded as inadequate from the processing point of view and in need of additional equipment or reconstruction.

The reason for this is that the conditions which decide the need for purification measures are to some extent very different in Sweden and on the continent. The majority of regions in Sweden have a sufficient number of large recipients in relation to the population density to preclude any problem due to oxygen deficit in the discharge area. On the other hand we have to take into account in Sweden the fact that many recipient waters consist of lake systems with a tendency to eutrophy and of coastal areas with restricted water turnover. For these reasons it is the contents of nutrients, especially phosphorus, in the waste waters which must now attract the chief interest.

Following on the realization of the significance of nutrients for the polluting effect of waste waters, efforts are being made to develop improved methods of chemical processing of waste water as well as of producing precipitation chemicals suited for the purpose.

As regards precipitation methods the aim is to find optimized combinations of a preceding mechanical or biological processing and of a subsequent chemical, without neglecting the demands for purification imposed by the conditions in the recipient. An example of this philosophy is the purification procedure involving a rough separation of easily sedimented material followed by a direct chemical precipitation with aluminium sulphate. The procedure is suitable in the many cases when the oxygen supply in the recipient is satisfactory, and causes a 90-95 per cent reduction in phosphorus, some-

times rather more. Despite the absence of a biological step the reduction of the oxygen-consuming substance (BOD) is as high as around 70 per cent.

With a view to the coming great increase in the need for precipitation chemicals the Boliden company has developed a cheap grade of aluminium sulphate specially for the purpose.

In conjunction with this "phosphate problem", common to Sweden, Finland and Switzerland, among other countries in Europe, the interest has been focussed on household detergents. Investigations have shown that about 50 % of the phosphate contents of domestic waste water derives from detergents. In Sweden this question has been taken up by a joint industrial committee organized by the Association of Swedish Chemical Industries, in which public authorities and detergent manufacturers as well as their raw material suppliers are represented. The council has animated and supported research work concerning the conditions from a water pollution point of view for a partial replacement of these phosphates by trisodium nitrilotriacetate (NTA). The investigations were conducted on a fairly wide front and the results were such that the authorities found, at all events, no reason to advise against the use of NTA on a limited scale in household detergents. For the time being, however, no steps are being taken to recommend a far-reaching change-over to the use of NTA-based detergents. The Nature Conservancy Office has instead pointed out very clearly that further studies of the possible effects of NTA on the environment are required.

### 3. The mercury problem

A great interest has been devoted in Sweden also to the increasing use of biocides for different purposes. The public authorities are attempting by means of advice, directives or prohibition, to create order and safety within this economically

important and, from the environmental aspect, often hazardous field, which has earlier been poorly supervised. Thus the use of DDT will be prohibited for three years in Sweden from January 1, 1970. The use of mercury for seed dressing and for control of microorganisms within the pulp and paper industry raised a particular interest when the negative effects were made obvious. It was discovered around 1960 that the seed disinfectants of methyl-mercury type used in Sweden caused severe damage to the higher fauna. Certain species were decimated, in some cases up to the limit of extermination. This type of seed disinfectant was prohibited and replaced by alkoxy-alkyl mercury-based compounds which, as far as now can be judged, are non-hazardous in this respect.

In the investigations which preceded the prohibition the observation was made that fish from certain fishing grounds contain abnormal quantities of mercury. Values of up to 10 mg/kg were recorded (natural contents for freshwater fish 0.05 - 0.2 mg/kg). It was also found that the mercury in fish exists in methylated form to the extent of at least 90 - 95 %. The methylation takes place in the food chains, often with a good yield. The substrate is, in the practical cases, inorganic mercury or phenolmercury derivatives.

In view also of the Japanese catastrophies at Minamata and Niigata, where a large number of persons died or were disabled as a result of eating methylmercury contaminated fish, the authorities now consider the discharge into the environment of industrial or otherwise processed mercury to be undesirable.

The highest values for mercury in fish were traced to the present or previous use of organic mercury compounds in paper mills and mechanical pulp mills (for slime control and impregnation purposes), but the discharge of mercury from chlorine plants, from the processing of sulphide minerals etc., also became noticeable in the form of high levels of

Hg in aqueous organisms downstream of the discharge.

The discoveries led, among other things, to the prohibition of mercury pesticides for purposes involving a risk of discharge into watercourses. The authorities also stipulated that industries handling metallic or inorganic mercury should promptly take measures to effectively reduce the pollution of water and of the atmosphere.

#### Summary

Since 1966 the following has occurred:

- the governmental authorities have been reorganized and merged into one central unit, the Nature Conservancy Office
- a new legislation - the Environmental Protection Act - covering air and water pollution as well as noise has been made effective
- a special secretariat has been organized for supervising and coordinating the applied environmental research
- a research institute for industrial water and air pollution problems supported by the industry and the State jointly has been set up

The active cooperation - to a large extent in mutual confidence - between public authorities and industry in Sweden is a partially unique feature in the field of pollution.

Since industry informally, and under full guarantee of secrecy, can discuss anticipated pollution problems with the authorities at an early stage of planning, the conditions are favourable for an all-round evaluation. Expensive mistakes are more easily avoided.

Between individual companies as well there is more or less well developed cooperation within the pollution field. This may be in direct form or via joint organs such as the Swedish Water and Air Pollution Research Laboratory, at which experience gained can be examined, analysed and passed on to others. In general, the interest of the various cooperating parties may be said to constitute a clear manifestation of their will to an active policy on nature conservancy problems, as has been expressed by industrial organizations on several occasions.

244/69  
26.9.69

ORGANIZATION

of

The National Nature Conservancy Office

