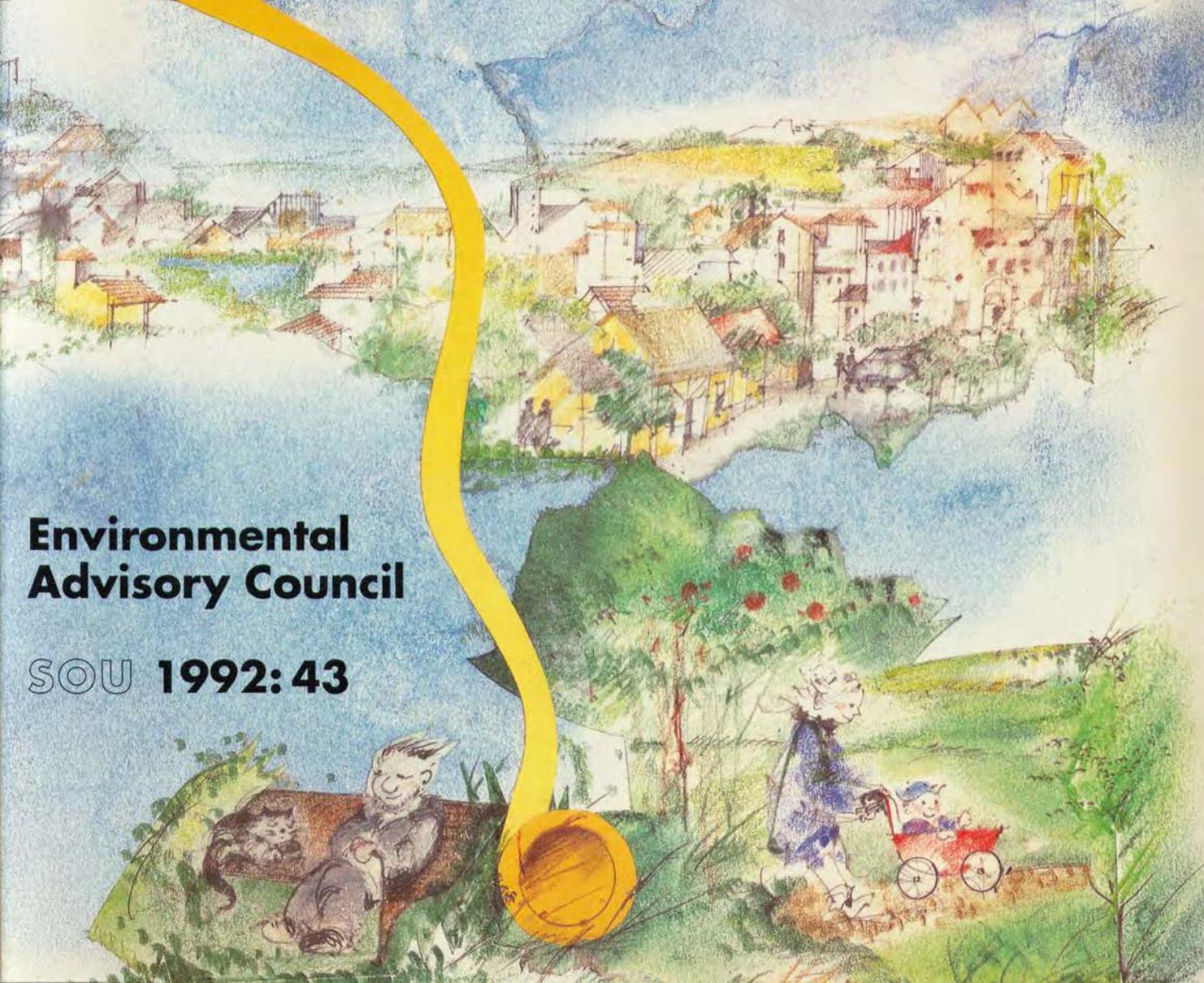


ECO CYCLES

*The Basis of Sustainable
Urban Development*

**Environmental
Advisory Council**

SOU 1992: 43



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its 286 local authorities to
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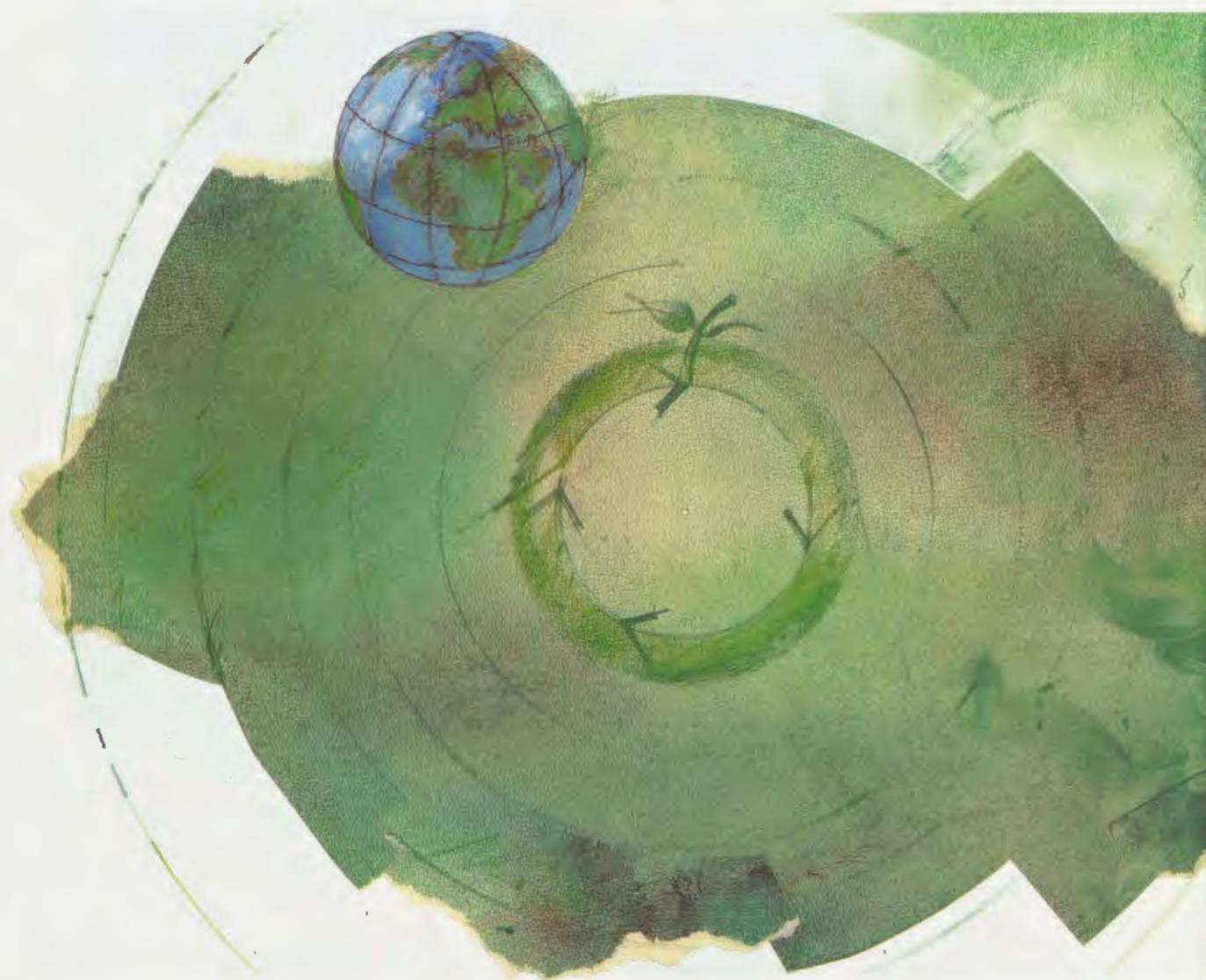
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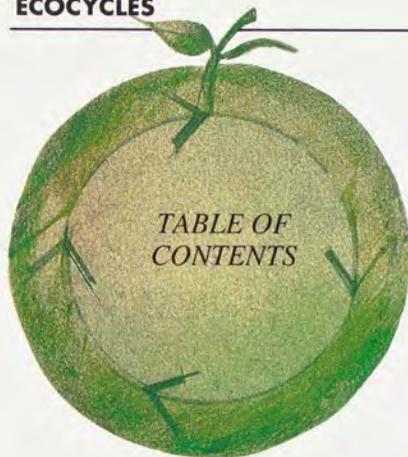


CYCLES

*The Basis of
Sustainable
Urban
Development*

Editor: TOMMY MÅNSSON





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EDITOR'S AFTERWORD

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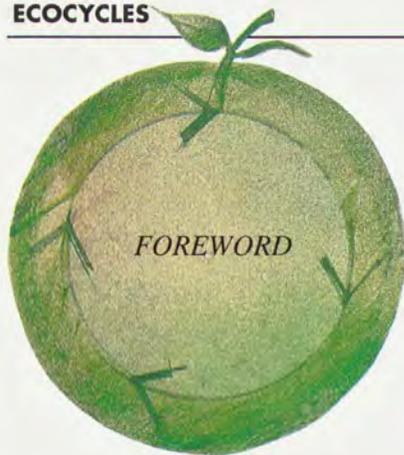
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WE MUST BRING THE ECOLOGICAL CYCLES FULL COURSE

Today, 86 per cent of the population of Sweden lives in cities, and half of all the people in the world are city dwellers. We have made our cities centres of knowledge, trade and power. The more important cities have become, the greater force of attraction they exert, drawing more and more people to them. Cities are, however, also centres of poverty, health and environmental problems: the places where these problems become visible and acute.

From a strictly ecological viewpoint, cities have become impossible as they are totally dependent on their surroundings to continue growing. To survive, cities have to import their food, energy and other resources from constantly expanding surrounding areas. In doing this, cities consume more and more resources and export corresponding amounts of residual products such as air and water pollution, and solid waste. This negative trend has to be broken. In the long run, our ecological cycles must come full course if humanity is to survive.

Today, nature cannot remedy the existing imbalance between urban and rural areas. If we want to save our cities and ourselves from ecological breakdowns, it is high time to begin seeing our cities from the perspective of ecological cycles. Strategies for urban development cannot be applied in a limited sense to cities only — they will have to be applied to their rural surroundings, as well.

Shaping a sustainable society requires the involvement, active participation and co-operation of all society's actors — the state, municipalities, trade and industry, and individuals. This means, *inter alia*, that everyone must have the right to receive information and to participate in democratic decision-making processes. Decisions should be made and measures implemented as close as possible to those affected by them. This makes the local level fundamental, because it is there all agreements, policies and programmes, international and national will ultimately be transformed into concrete action.

The purpose of this book is to raise awareness of the extensive efforts being made in the Swedish municipalities to improve the environment. We have selected a number of examples of creative thinking, both technological and organisational. We are aware that these examples are not always the best solutions to all our problems, and that the approaches and instruments used will have to keep changing in pace with development and change. It is our ambition to show what is being done here and now to achieve more sustainable development. We are also aware that local situations vary widely, as do the existing points of departure, and that this is true both



**Mr. Lars-Eric Ericsson and
Ms. Görel Thurdin.**

Photo: BOSSE JOHANSSON

within Sweden and when comparing Sweden with other countries with different historical and cultural backgrounds as well as different technical and financial resources.

It is our hope that the examples presented in this book will serve as an inspiration and a challenge, encouraging development and creative thinking elsewhere, in Sweden and abroad. If we are to achieve sustainable urban development, we must all do our best, wherever we are active, to implement measures to bring our ecological cycles full course.

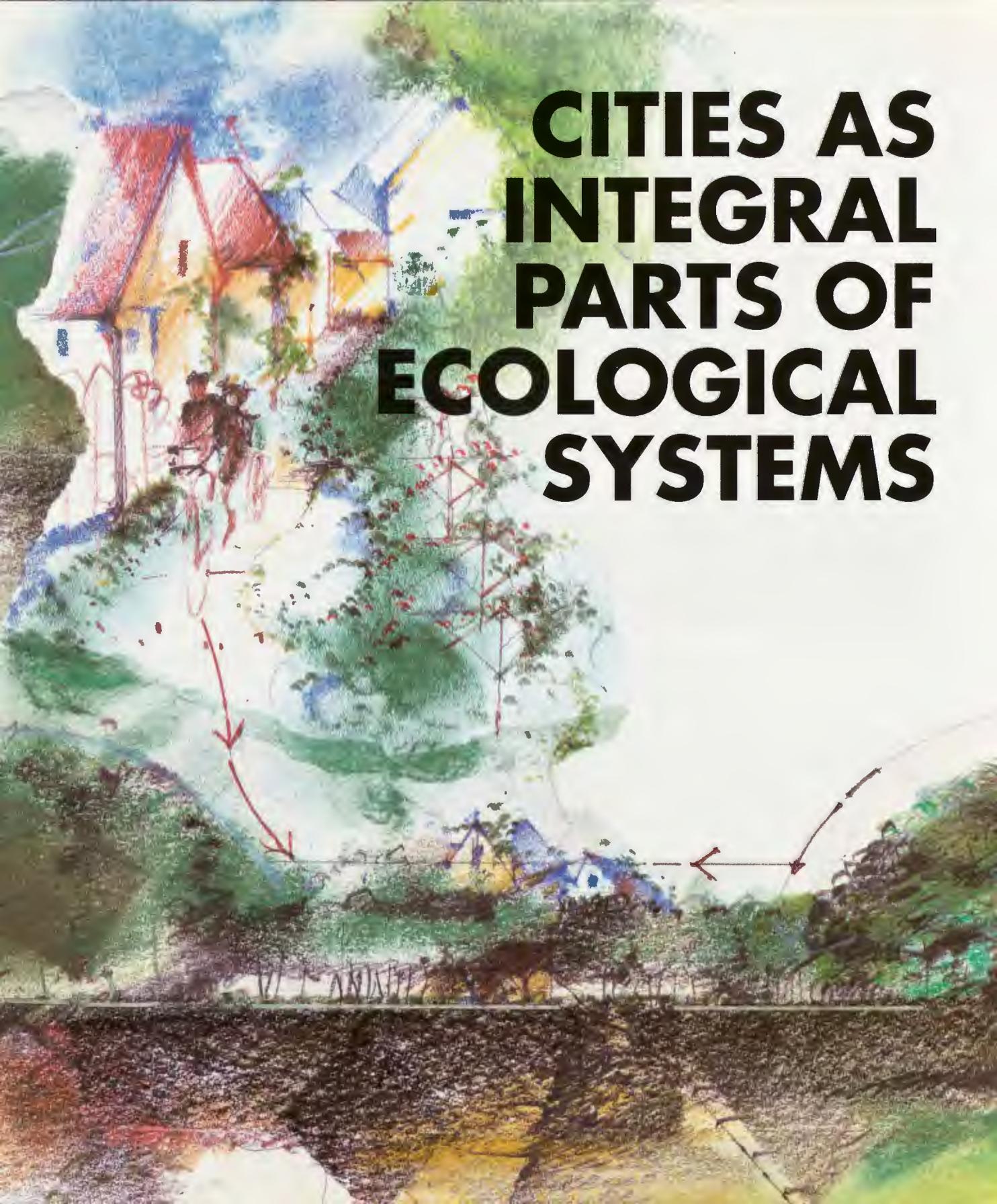
Stockholm, May 1992

Görel Thurdin

Sweden's Minister for
Physical Planning and
Vice Chairman of the
Environmental Advisory Council

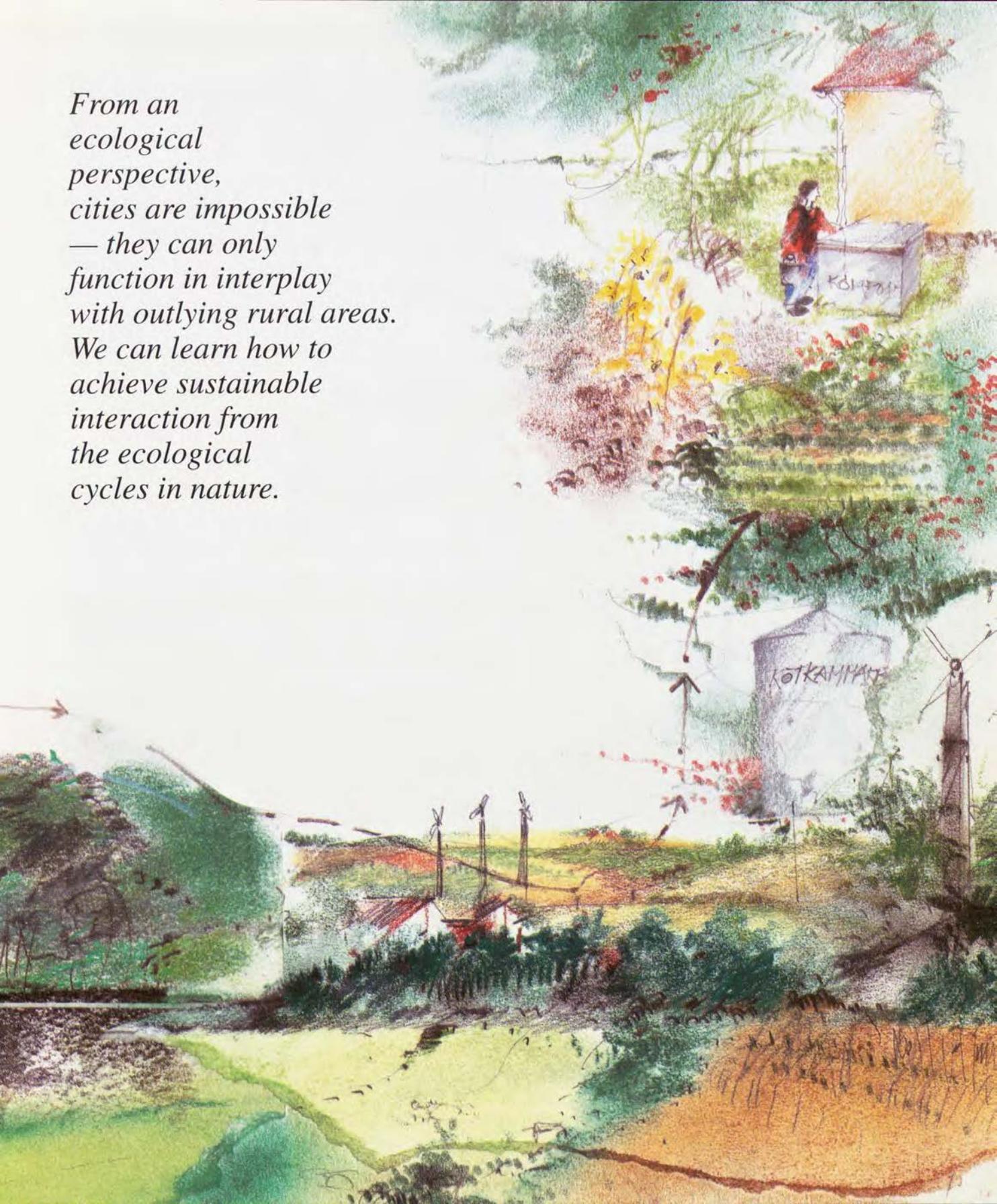
Lars-Eric Ericsson

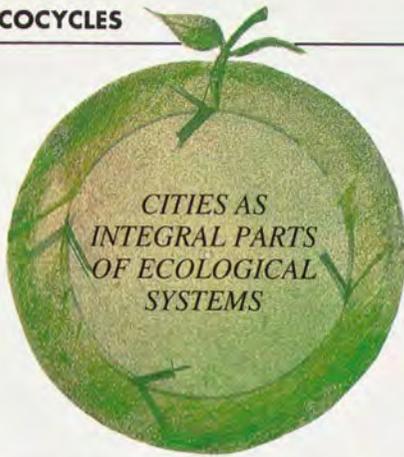
Chairman,
The Swedish
Association of
Local Authorities



CITIES AS INTEGRAL PARTS OF ECOLOGICAL SYSTEMS

From an ecological perspective, cities are impossible — they can only function in interplay with outlying rural areas. We can learn how to achieve sustainable interaction from the ecological cycles in nature.





Imagine putting an enormous bell jar over a city. What would happen? Just as no animal can cope on its own, no city can manage without its outlying rural areas.

Cities, cultures and civilisations are concepts which have gone hand in hand, historically, and which we subconsciously tend to equate with one another. In human civilisation, cities have become the centres of knowledge, trade and power. Cities mirror the philosophies and understandings of their times, as well as — to some extent — being locked into their historical heritage. But cities are also subject to the laws of nature.

Today we are seeing more and more of what happens when cities shortsightedly ignore these laws — environmental problems are simply shifted in time and space.

When we regard cities as parts of ecological systems, we can analyse their potential to move towards sustainability. In these terms, a city may be defined as a system surviving on its ability to import most of what it needs. Cities satisfy very few of their needs themselves. They import food, energy and other resources both from the rural areas in their vicinities and from far distant nations. Cities consume resources and export the residual products as air and water pollution and solid waste.

Illustration: BIRGIT ELIASSON



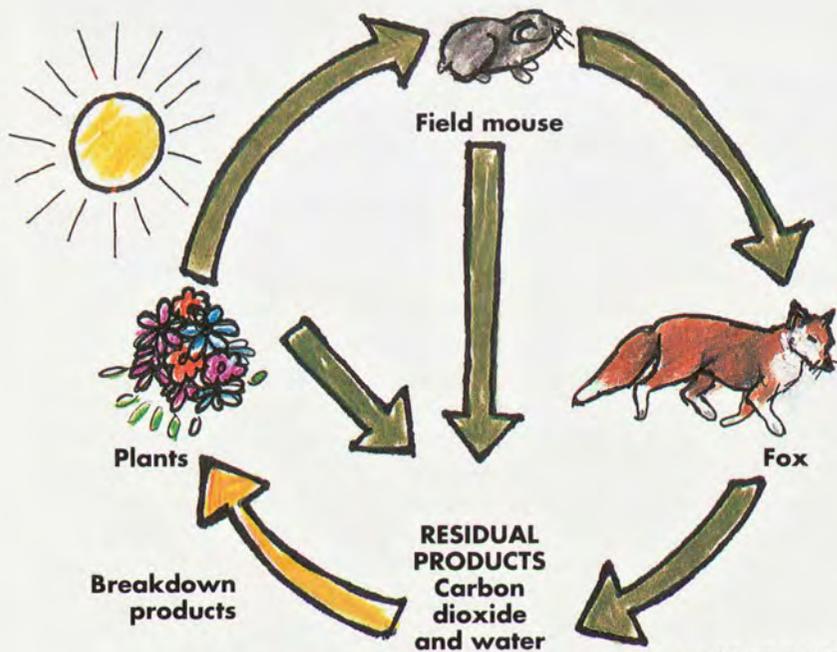
WHAT IS AN ECOLOGICAL CYCLE?

Nature is made up of ecosystems, or natural cycles. Take the example of the fox. The fox eats the field mouse that, in turn, has eaten various plants. The plants live on photosynthesis between carbon dioxide and water under the influence of sunlight.

Most of the nutrition the fox gets from eating the field mouse is very quickly returned to the earth as urine and excrement, which are broken down into carbon dioxide and water, which again serve as a basis for plant photosynthesis. Thus an ecological cycle has run full course.

Examining this ecological cycle in physical terms, we can see plant photosynthesis as a resource-generating process. It allows plants to grow, with sunlight as its fuel (source of energy).

*CITIES
AS INTEGRAL PARTS
OF ECOLOGICAL
SYSTEMS*



A natural ecological cycle. The yellow arrow indicates a resource-generating process, and the green ones resource degrading processes.

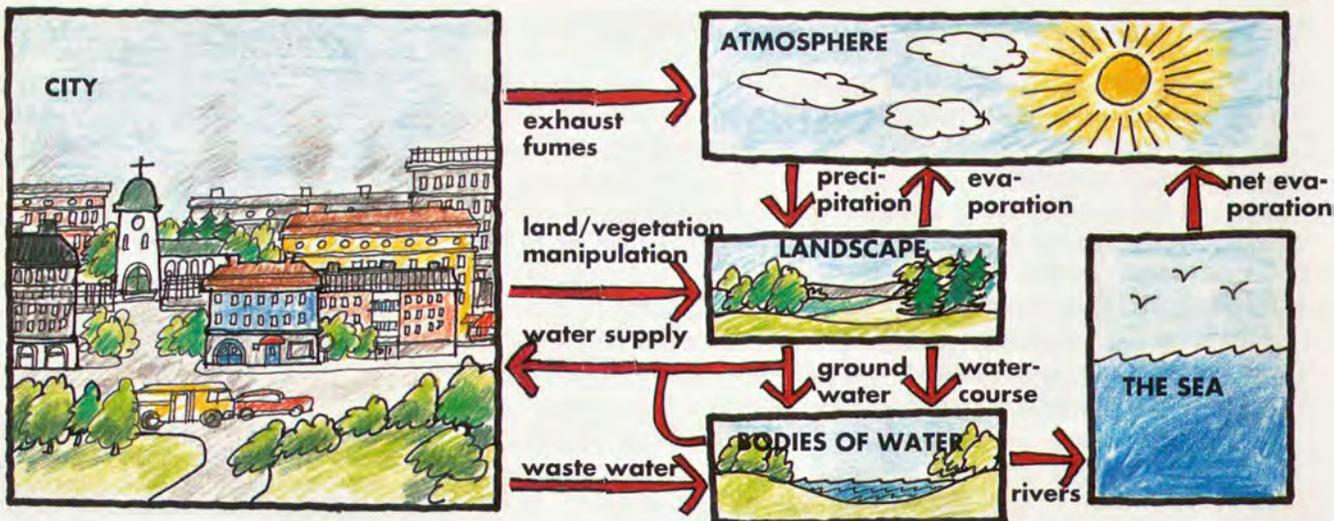
Illustration: BIRGIT ELIASSON

The resource-generating processes in the ecological cycle formed by the plants, the field mouse and the fox are simultaneously balanced by various degrading processes. The field mouse consumes and digests plants, and the fox consumes and digests the field mouse. The urine and excrement of both animals and dead vegetation are all degraded. Processes of degradation also give rise to solid, liquid or gaseous wastes.

Another example of an ecological system is the hydrological cycle. Water is a renewable resource, constantly running in a global course, and anthropogenic pollution of any part of this ecocycle may impact on other parts.

Combustion is one example of a degradation process. Wood burns, for

Illustration: BIRGIT ELIASSON



Water is a prerequisite for life. When water is polluted, this causes an automatic chain reaction impacting on the flora and fauna and even on human health. Water is in constant movement, always on its way somewhere. It is also chemically active, and has unique solvent properties. All this means that pollutants emigrate from soil to the ground water, lakes, watercourses and the sea. From MALIN FALKENMARK.

instance, with the aid of the oxygen in the air, and the process results in ash, smoke, and heat. (This is, in principle, the same process our bodies carry out when they digest the food we eat, although it takes place at a slower tempo).

Smoke and ashes contain the same atoms as wood and oxygen, but it is more difficult to change the state of smoke and ash. We cannot simply heat them, i.e. add energy, to make new wood and oxygen.

In order to bring the cycle full course, the more disorganised atoms of the waste products (the smoke and ash) have to be arranged into the more organised forms (the wood and oxygen). This organisational process (resource generation) is carried out with the help of the sun as photosynthesis. Plants are more effective than the most sophisticated contemporary anthropomorphic technological systems, by an order of magnitude raised to the power of ten, when it comes to the reorganisation of atoms at this level!

Other resources and waste have corresponding processes. For example, sooner or later all steel constructions give way to rust. In this process the iron becomes water soluble and is spread into the environment. It is virtually impossible to find a technical process for transforming this disseminated iron into new iron objects, no matter how much energy we have available. On the other hand, the sun powered and resource-generating processes in nature are extremely effective. For example, they precipitate iron into bog ore at the bottom of lakes. Similarly, most of the resources stored in the earth, including fossil fuels, ores and minerals, have come into being through processes ultimately fuelled by the sun.

Contemporary societies use these finite resources at a pace many thousand times faster than the pace at which these resources are recreated. This means that sooner or later we will find ourselves in a shortagesituation. An even greater current problem is the enormous collection of waste which results from nature's inability to keep pace with human consumption in transforming the waste to new resources.

We also create new substances, alien to nature, which are often highly stable chemical compounds. Nature's resource-generating processes cannot handle them; they are foreign to the ecological cycle. So alien substances often have the effect of poison for the highly-refined equipment that is living cells. Another very common phenomenon today is that naturally occurring substances reach unnatural levels, with similar negative effects. The society we live in is not a sustainable one, in the long run.

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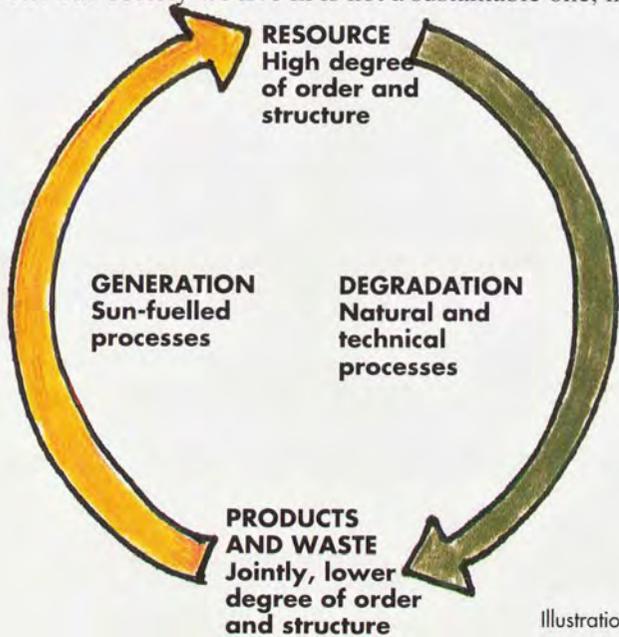


Illustration. BIRGIT ELIASSON

Schematic sketch of natural ecological cycles. The yellow arrow indicates resource generation, and the green one degradation. Resource-generating processes are characterised by being sun-fuelled. An ecological cycle has come full course when the resource-generating and degrading processes are in equilibrium.

WE MUST BRING THE ECOLOGICAL CYCLES FULL COURSE

Cities are primary contributors to the man-made processes of degradation that are growing increasingly dominant, and to the increasing pace at which the space for and capacity of sun powered resource-generating processes are shrinking. The long-term production resources of the land, the forests and the seas are being reduced, and thousands of species are being made extinct.

If we allow the gap between the processes of resource generating and degradation to go on growing, we will gradually destroy the survival potential of higher organisms.

We must exploit our natural resources selectively, to allow them to be generated as part of our ecological cycles. The waste from certain types of biological resources can, for example, be used for resource generation.

Waste of a non-biological origin, such as metal packaging materials, crushed glass, used batteries, etc. will not re-organise into new resources on its own. We can return this waste to natural sun powered cycles by separating it at source. We will be able to bring our ecological cycles full course with the aid of biofuels, wind and hydropower, solar energy, etc.

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Illustration. BIRGIT ELIASSON

Trees are good examples of natural solution multipliers. Trees provide us with protection, beauty, energy and clean air — if we just make it possible for them. We would benefit greatly from increasing the amount of green space with trees in our cities as trees:

- muffle noise
- clean the air
- manage rain water
- give energy
- protect people and animals
- provide shelter from the wind
- beautify our cities

WE MUST SEEK HOLISTIC SOLUTIONS

Edward Goldsmith, a British ecologist, coined the expression “You can’t do only one thing”, in the sense that anything we do has numerous consequences, and we must always take them into account. Most things done in society are done because they will be advantageous to someone. But in societies so highly sectoralised as ours, it is easy to let ourselves be blinded by what is advantageous to us, and ignore the disadvantages that our choices give rise to in other sectors. This is how most of our environmental problems came into being.

Goldsmith discussed “solution multipliers” — measures which solve several problems at a time. Looking for solution multipliers means implementing a holistic view of mankind, nature and society. It implies having a “both-and” perspective on satisfying human needs sustainably.

The opposite solution multipliers are “problem multipliers” — measures which may solve one or more problems, but which simultaneously create several new ones. “Problem multipliers” are illusory solutions, with an “either-or” perspective, symptomatic solutions which conceal or counteract treatment of the fundamental problem.

WE MUST APPLY THE PRECAUTIONARY PRINCIPLE

Today’s environmental situation is the result of decisions made in our society one or more decades ago. In many cases it takes several decades for the full consequences of a measure on the environment to become clear. Nor is it always possible to predict such consequences exactly.

Although nature does have a fantastic capacity for self-healing, that ability has its limits. Many types of environmental damage are extremely difficult or expensive to remedy once the harm is done. Large scale soil acidification is one good example. It is also very costly to clean up local land or waters that have been polluted with toxicants. And it is virtually impossible to recreate species or types of genetic variation once they have been lost.

The complexity of natural systems makes the whole picture even more difficult to grasp. Many factors work in interplay, and some work against one another as well. We do not know everything we need to know, nor can we, but we can choose one of two strategies to operate on.

The first is to simplify the interrelations, entirely neglecting the factors and processes which cannot be predicted. According to this strategy, which has often been applied in the past, we simply experiment at full scale, hoping the consequences will at least be remediable, and not too grave.

The alternate strategy is to choose to apply the precautionary principle, refraining from implementing measures if we are uncertain as to whether they will do damage to the environment and our life-sustaining systems.

LET US ASK THE RIGHT QUESTIONS!

Twentieth century social progress has led to environmental problems of increasingly wide scope, that are more and more difficult to solve. One thing that is clear is that the solutions implemented to date are insufficient. They have often been nothing but a way of postponing or shifting the problem, with the result that it has gradually resurfaced in a new, even more problematic gestalt.

One of the main reasons that society has failed, to date, to solve its environmental problems is that the economic system today is incompatible with demands for long-term sustainable development. Because there is seldom a price tag on environmental effects, they rarely appear in calculations or on balance sheets.

Using environmental impact assessments (EIAs) when major decisions are made, and levying more environmental surcharges, "green taxes", are the main instruments available for moving society in the direction of greater sustainability. However, the way these instruments are now being used in Sweden and elsewhere is only the very first step towards the far more extensive, integrated action programme we will need if environmental effects are to be made visible.

Demanding EIAs before decisions are made will not solve any problems alone. An EIA just provides facts and figures. When a decision is made, whether by an individual, a local organisation or a national government, environmental issues will be weighed in the balance against other issues, including social and financial ones. If we are to move towards sustainable development, we must have greater insight into the consequences of being nonchalant about the environment, and we must have the will to change.

But how can we know if a measure, an investment or an urban development project will result in increased environmental problems in the long run? What are the most important questions to ask and answer before a decision is made?

We can find these things by making a focused analysis — asking a number of basic questions about potential effects. If the six questions below can be answered with "yes", we know that the planned project or measure leads towards sustainable development:

1. Does it reduce energy consumption and move us towards greater use of renewable sources of energy?
2. Does it increase biodiversity and the resource-generating capacity of nature?
3. Does it bring ecological cycles full course?
4. Does it keep us within the limits of what mankind and nature can withstand?
5. Does it solve more problems than it creates?
6. Does it observe the precautionary principle?

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Järnbrott – an example of a solution multiplier

When an apartment house in the Järnbrott area in Göteborg was renovated five years ago, solar cells were installed on the roof, and coupled to a circulating air heating system. A greenhouse was also built along the southern facade of the building, and the tenants were offered the opportunity of raising vegetables there. Their interest in gardening proved to be so great that the lawn adjacent to the building was converted into allotments which, in turn, gave rise to a need for fertilisers and other soil improvement materials, and so the apartment dwellers began composting their organic household waste.



Photo: CHRISTERS ARKITEKONTOR

The building is three stories high, with twenty-four apartments. Although there are twenty to thirty thousand such buildings in Sweden, no others have yet followed this example. One probable explanation is that the sectoral view we generally apply, rather than the holistic one we could apply, makes it difficult for us to realise all the benefits this renovation has brought to the inhabitants and to society as a whole. The only economic benefits which show up in the accounts are the profits accruing from heating energy savings. And not even that profit may appear in the accounts, owing to the fact that district heating rates are paid on the basis of a high fixed tariff and a low consumption-related one.

By a focused analysis it is possible to identify many other benefits which have probably accrued from this renovation

project. A few examples of real and potential profits are given below.

Insulation improvements have meant energy conservation, and 40 per cent of the energy needed to heat the building is now available from the solar heat, a renewable source of energy. The people living in the building who now grow their own vegetables contribute to energy conservation in terms of saved food transport costs. The composting project means that less waste has to be transported from the building. (The transportation required for annual waste collection just from the Hisingen area of Göteborg alone is equivalent to twenty-five trips around the world!) We can also assume that the time people spend gardening means savings in transportation to and from other recreational activities. The interest in gardening and the consequent enrichment of the social life of the people involved, may also mean that they are less interested in material consumption, which is also positive from an energy-saving point of view.

When the apartment dwellers decrease their energy consumption, raise some of their own vegetables and manage some of their own waste, the land surrounding the city bears correspondingly less of a burden for these functions. On a larger scale, this would be beneficial to biological diversity.

The gardening and composting give rise to a complete on-site organic cycle. The fact that a considerable portion of the heating needed for the building is supplied by the solar heat instead of by combustion of fossil fuels improves the balance between regenerative and degenerative processes.

The advantages described above all contribute to reductions in per capita resource consumption and energy use.

The renovation of the building in Järnbrott is a solution multiplier. It may be of special interest to highlight the conceivable social, cultural and pedagogical benefits. The people living in the building have gained a strengthened sense of community, they derive pleasure from gardening and seeing things grow, and they gain concrete insight into what it means to bring ecological cycles full course.

Finally, this kind of small-scale cultivation may be done with minimum use of chemical pesticides and artificial fertilisers, which is beneficial to the environment.

It is possible to apply the precautionary principle.

How the solar heating in a building in Järnbrott works:

- Air is heated by the sun's rays in the solar panel on the roof.
- The air which has been heated by the sun is fanned down inside all the outer walls through an air shaft between the old wall and the insulation. This hot air heats the inside walls.
- On cold days it may be necessary to use some additional heat from the old hot water heating system.
- The greenhouse is not technically connected with the solar heating system, but it extends the short Swedish summer, for the building and the people living in it.

Architect: CHRISTERS ARKITEKTKONTOR, ASKIM

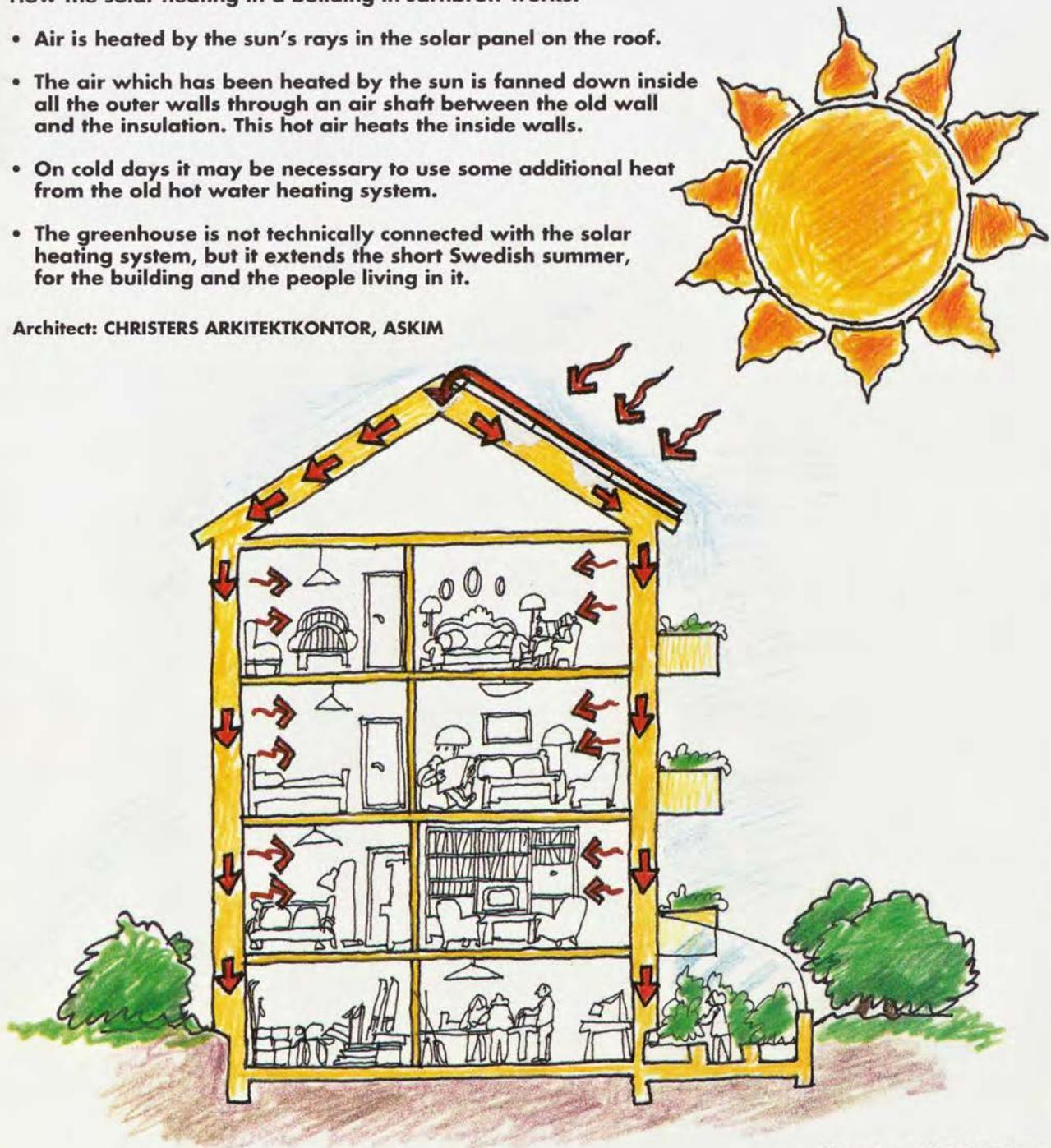
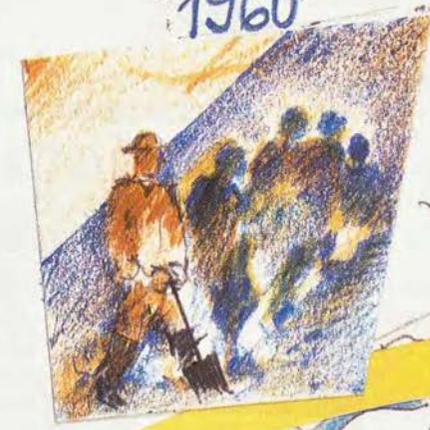
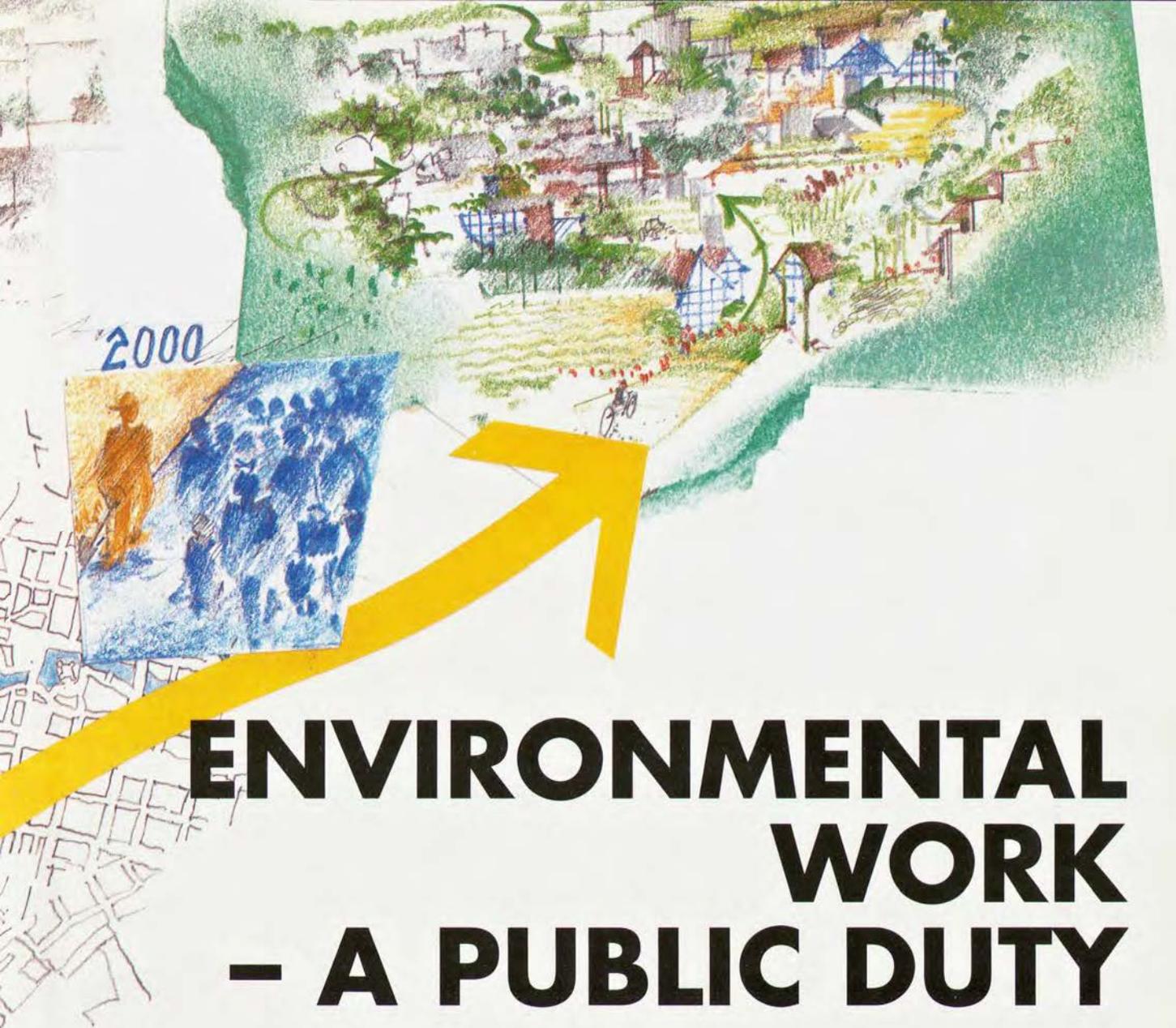


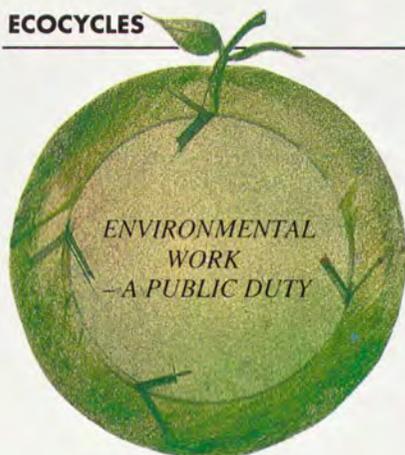
Illustration BIRGIT ELIASSON





ENVIRONMENTAL WORK – A PUBLIC DUTY

To build sustainable cities, all the actors in society must become actively involved – the national government, local governments, trade and industry, and individual citizens. In Sweden, the "right of public access" gives everyone equal rights to share the benefits of nature. But the right also implies obligations – we must handle nature on nature's own terms – this is a public duty.



Environmental protection is a deeply rooted value. Sweden has a tradition known as “the right of public access”, by virtue of which everyone may move freely about the countryside, and the love of nature this has engendered makes people active in safeguarding their landscape. In Sweden, a sound environment is regarded as a basic human right. Environmental policy is founded on this right, in accordance with democratic principles.

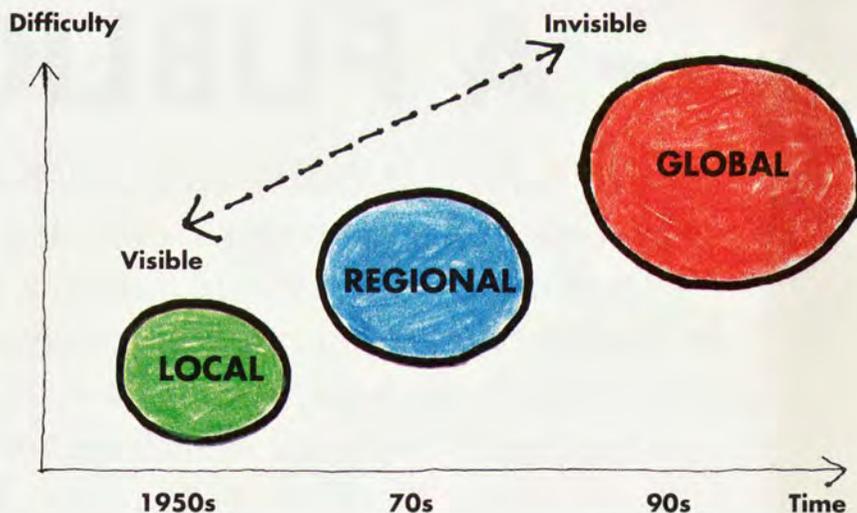
As in other industrialised nations, Sweden’s environmental problems were first detected in urban areas. For this reason, the roots of Swedish environmental policy are in early twentieth century urban health care. At that time sanitation was a major problem in the cities, and city dwellers often suffered from poor health or serious illness. Waste water and refuse were transported from urban to rural areas, in the belief that lakes and watercourses served as natural means of purification. With the advent of sewage pipelines, the water closet came into use. Physicians advocated its speedy introduction, seeing it as a solution to the grave urban health problems.

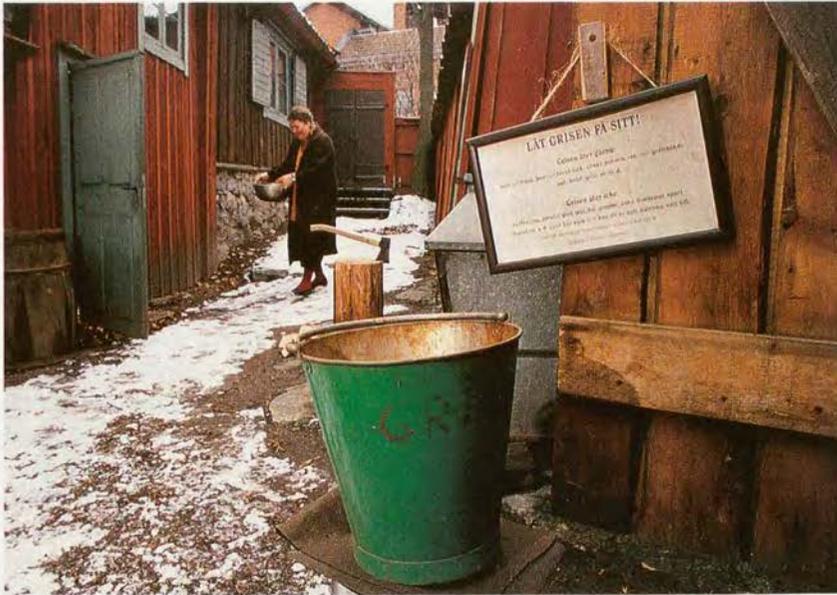
Ironically, this early local health care work gave rise to new environmental problems on a regional scale. This was mainly because the early problems were simply shifted, from one place to another and from one generation to another, rather than being solved.

During the 1980s, Swedish environmental policy began to change in various ways. Previously, the main aim had been to monitor and reduce major point emissions with local and regional effects. Now environmental work has shifted to cover diffuse emissions from traffic, agriculture, goods and materials. To achieve a sustainable development, environmental policies will have to focus more on finding means of solving problems at source, before they occur — we must begin to implement the precautionary principle.

This altered view has also led to changes in the roles played by the state

We have been postponing dealing with our environmental problems. The methods we have implemented in managing local environmental problems have, instead, given rise to regional and environmental ones, like acidification, forest death, the greenhouse effect, threatened species, and the depletion of the ozone layer. These environmental problems are more difficult to see and grasp, as well as being harder to solve. From NILS TIBERG.





Waste management was long the task of the local sanitation authorities. Until the early 1900s, the job was done by local farmers, who recycled most of the waste, or used it for soil improvement or as swine fodder.

- ◀ One small museum area in Stockholm reminds us of what it was like when the pigs used what people did not — a predecessor of contemporary source separation (small photo).
- ▼ As waste quantities grew, railway transport of waste from urban areas was organised. The waste was taken to large outlying garbage stations, where there were also pigs to feed — the ecocycle was brought full course (large photo).

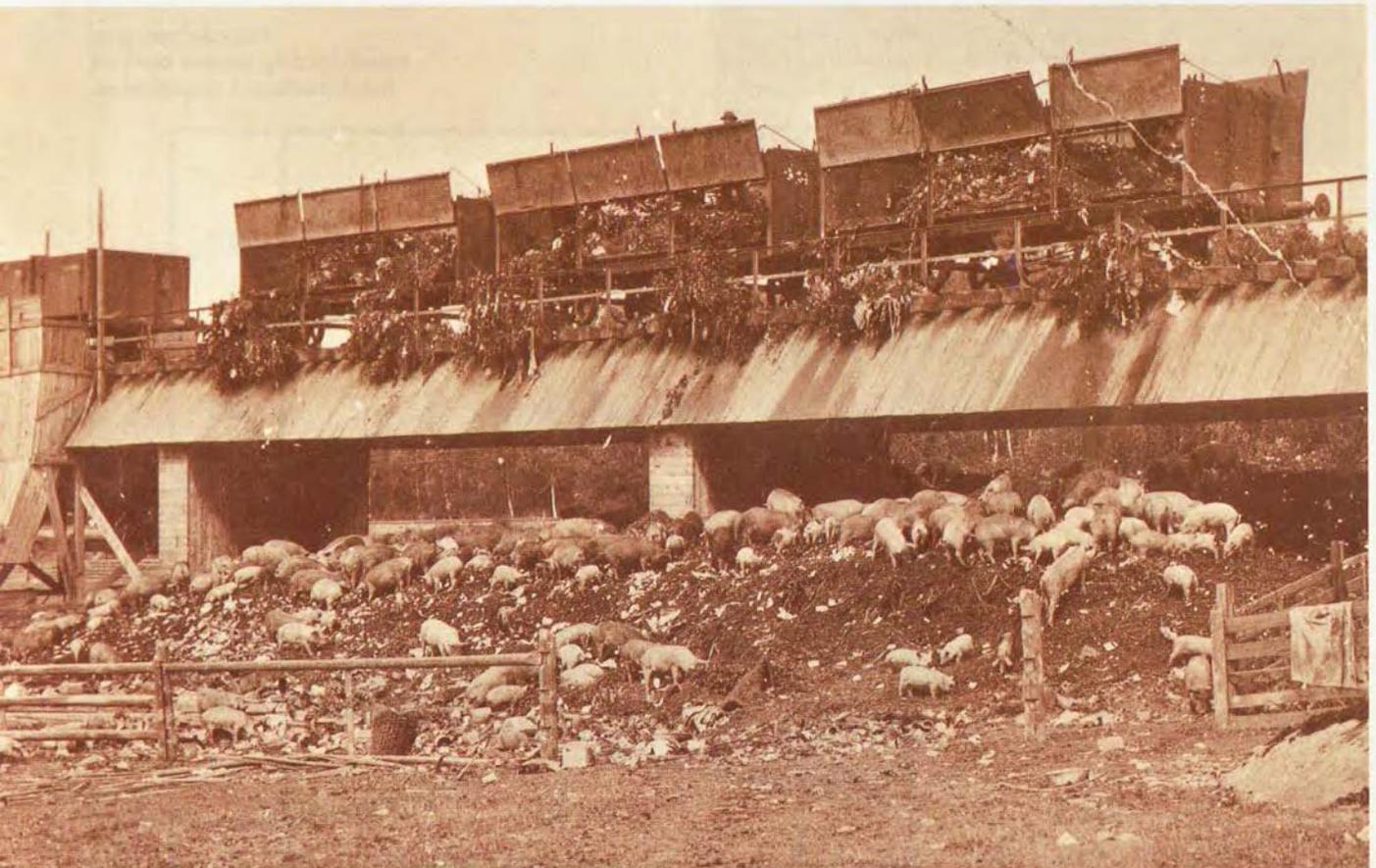


Photo. STOCKHOLMS STADSMUSEUM

*ENVIRONMENTAL WORK
- A PUBLIC DUTY*

contra the municipalities, with increasing amounts of responsibility being shifted to the municipalities so that problems will be able to be solved in practice and more tangible steps taken towards shaping a society based on the principle of ecocycles.

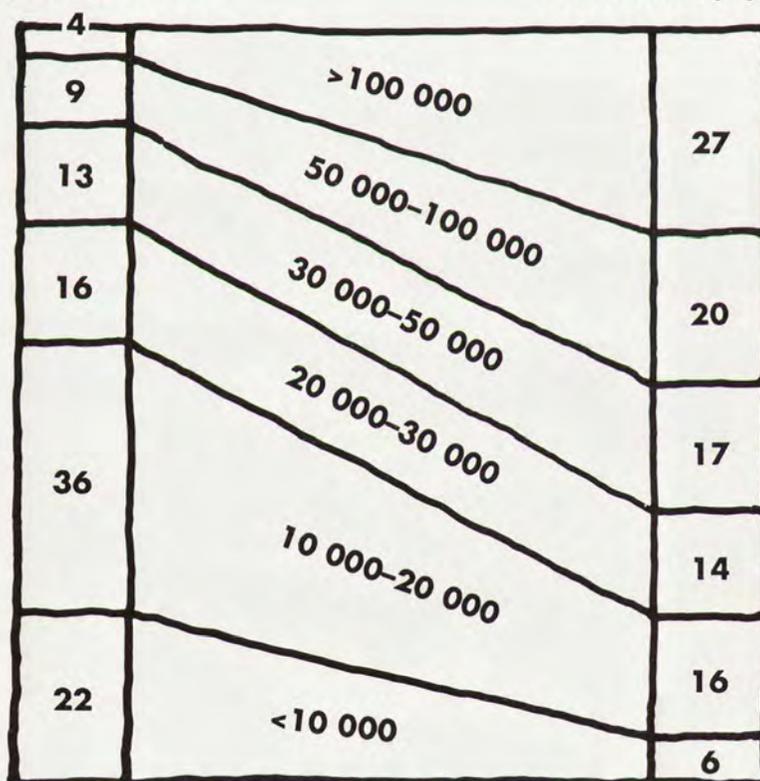
Politically, Sweden has a long democratic tradition. Despite our relatively small population, we have the most highly decentralised local administration in the world — with 286 municipalities. Each municipality levies its own taxes and bears responsibility for many day-to-day aspects of life: day nurseries, education, care of the elderly, libraries, waste management, sanitation, etc. The state subsidises the municipalities to some extent for this work.

In most respects, it is also up to each municipality to make its own decisions with regard to land utilisation, what will be built and where, and the municipalities alone have the right to draw up and adopt physical plans for their areas.

Since 1 January 1992, municipalities are also free to establish their own organisations, i.e. what agencies and boards they want to have. In the past, this structure was centrally determined in relation to legislation, and municipalities were required to have a building board and a health and

Population distribution amongst Sweden's 286 municipalities.

Number of municipalities as per cent of total **Population per municipality in per cent of total national population**



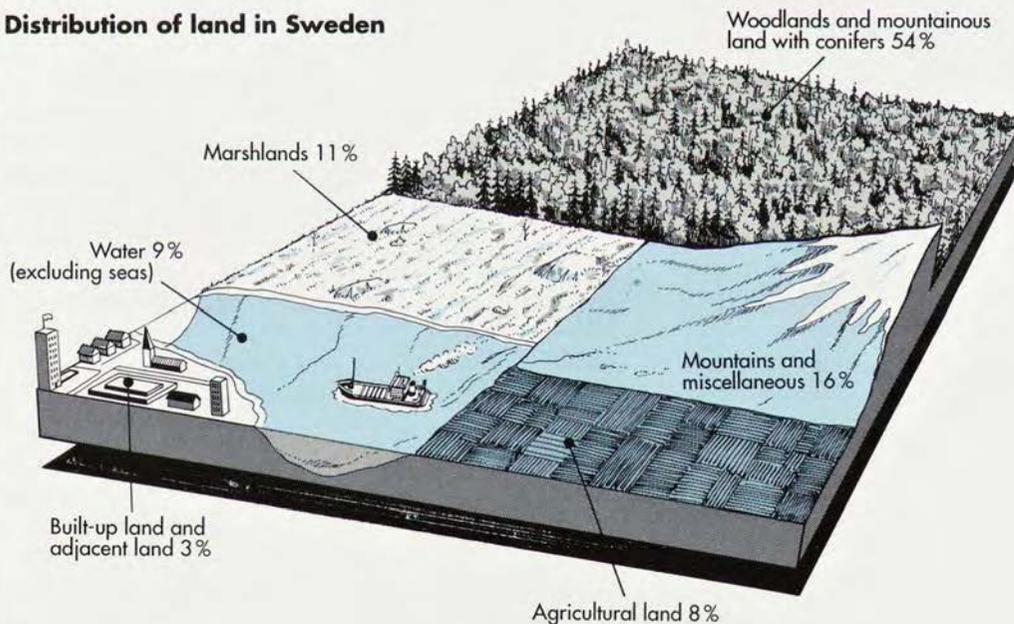
Sweden

– a favoured nation

The population of Sweden is 8.5 million, and 86 per cent of these people live in cities. More than one-third of the total population lives in one of the three main metropolitan areas — Stockholm, Göteborg and Malmö. Sweden, as compared with many other countries, is a favoured nation with regard to natural resources, and to the amount of land available for agriculture, forestry, recreation, etc. If Sweden's land were evenly distributed among the population, each inhabitant would have some 50,000 m².



Distribution of land in Sweden



*ENVIRONMENTAL WORK
– A PUBLIC DUTY*

environment board, for example. Generally speaking, Swedish municipalities have a great deal of influence in many important areas.

In the area of the environment, for example, each municipality is responsible for:

- Comprehensive environmental planning pursuant to the Natural Resource Act and the Planning and Building Act.
- Management both of operations which disrupt the environment and which contribute to improving it, such as collection and treatment of waste water and refuse.
- Production of energy and water, and public transport.
- Education on environmental issues in schools and pre-schools.
- Dissemination of information about the environment in the municipality.
- Supervision of environmental and health protection pursuant to various statutes including the Environment Protection Act, the Health Protection Act, the Food Products Act, and the Chemical Products Act.

The division of responsibility that has gradually been introduced in Sweden in many areas, including the environment, means that local influence is strongly emphasised. This ensures both the traditional democratic rights of individuals and also safeguards the rights of nature. Every individual in all his or her roles, in the city, in the countryside, at work or driving a car, must shoulder responsibility for the environment — we share our living environment with all species of plants and animals.

FORCEFUL LEGISLATION

Historically, the main role of the state in environmental work has been to make demands and monitor their implementation. Legislation, planning, and franchise issuing have been the main instruments of execution.

The first environmental legislation took the form of health protection measures. Sweden was early to legislate in this area, with a Public Health Statute in 1874, the aim of which was to solve the health and environmental problems brought in the wake of industrialism and the consequent rapid increase in urbanisation. Its most recent successor, the Health Care Act, has been in effect since 1984. It contains stipulations covering domestic hygiene, hygiene on public premises, hotels and swimming centres, as well as regulations for the water supply, water and air pollution, sanitation, animal care, etc. The Health Protection Act is the instrument used to prevent the occurrence of sanitary inconveniences.

The 1969 Environment Protection Act stipulates the conditions under which environmentally hazardous operations may be carried out. The Act is quite generally worded, leaving the National Swedish Franchise Board for Environment Protection or the County Administrative Boards or municipalities to decide on individual cases of environmentally hazardous operations, and what level of pollution is permitted for each plant. Permit reviews examine technical potential, economic feasibility, and environmental justification. A separate environment protection statute

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Paraply för bättre miljö

Följande lagar är kopplade till NRL:

- Plan-och bygglagen
- Miljöskyddslagen
- Vattenlagen
- Naturvårdslagen
- Väglagen
- Ellagen
- Rörledningslagen
- Luftfartslagen
- Torvlagen

Nu anknyts också:

- Farledslagen
- Kontinentalsockellagen
- Minerallagen

NATURRESURSLAGEN (NRL) är paraplyet som spänner över alla lagar om hur mark-och vattenområden ska användas. Kravet på hushållning med naturresurserna har med NRL fått en ny och bredare innebörd. Den ger en gemensam utgångspunkt för besluten oberoende av vem som ska fatta dem eller vilken lag som åberopas.

NRL är särskilt viktig för att lösa de konflikter som uppstår vid förändringar av den yttre miljön.

NATURRESURSLAGEN HAR KRITISERATS för att vara vag och allmän och därmed svår att tillämpa. Lagens allmänna bestämmelser måste konkretiseras i planer och beslut.

En genomarbetad och tydlig översiktsplan är ett viktigt stöd i det arbetet. I planen kan de gemensamma intressena göras konkreta och begripliga. Därmed blir tillämpningen av NRL effektiv.

An umbrella for a better environment!

The following laws are subordinate to the Natural Resource Act:

- The Planning and Building Act
- The Environment Protection Act
- The Water Act
- The Nature Conservation Act
- The Roads Act
- The Electricity Act
- The Pipeline Act
- The Aviation Act
- The Peat Act

And the following will soon be made subordinate:

- The Navigation Route Act
- The Act on the Continental Shelf
- The Mineral Act

regulates what type of activities must have a franchise to operate, what type must have a permit from the County Administrative Board, and for what type it is sufficient to notify the municipal board of health and environment.

The current legislation on land planning and construction, the Natural Resource Act and the Planning and Building Act, has been effective since 1987. The purpose of the Natural Resource Act is to achieve long-term economisation, particularly of land and water resources, taking ecological, social and socio-economic considerations into account, and safeguarding areas of national interest.

The Planning and Building Act further reinforces the responsibility of the individual municipalities for physical planning. Every municipality must draw up a master plan accounting for its utilisation of land and water, planning developments, and the areas of national interest in the municipality. These plans then serve as guidelines for protecting areas of natural value. Sometimes it is sufficient to issue a construction ban pursuant to the planning and building act, while in other cases, the articles for protection

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Land, water and the physical environment in general shall be used so as to promote positive long-term economisation from an ecological, social and socio-economic point of view.

(The Natural Resource Act, article 1).

of nature reserves pursuant to the Natural Resource Act must be implemented.

The Natural Resource Act is the umbrella act, the piece of legislation with the highest priority in relation to all regulation of water and land utilisation. It provides a common point of departure for decisions, irrespective of by what body they are taken or pursuant to what act. The Natural Resource Act is particularly important in solving the conflicts that arise when the outdoor environment changes.

Special requirements have been adopted with a view to increasing environmental consideration. According to these new requirements, an environmental impact assessment must be carried out before any permit can be granted pursuant to the Natural Resource Act and some other Acts as well. Adoption of future municipal master plans will also be subject to the carrying out of environmental impact assessments.

THE INDIVIDUAL IN FOCUS

Political concern for environmental issues increased throughout the 1980s in Sweden and internationally. The environmental movement has grown stronger and more competent to serve as a driving force in society. People's interest in and involvement with environmental issues has also grown steadily. But up to now there has been far more global talk than local action. This makes the main challenge for the 1990s to transform the global perspective and the realisation that we are living on a planet with limited resources into practical action at the local level.

Environmental problems are a mixture of large and small. Many measures can be implemented quickly and simply, while other problems cannot be solved without long-term, comprehensive changes in our social structure and lifestyles. Thus practical environmental work is waiting to be done at all levels today, and every individual can participate in determining whether or not we can succeed in reversing the trend and moving in the direction of a sustainable society.

There are already many examples of individuals shouldering responsibility for environmental issues, trying to develop alternative solutions, and placing demands on producers, public authorities and others to make environmental alternatives available. The great interest in "ecological" building and eco-municipalities are examples of local initiatives coming from the grass roots level.

To date, environmental work has mainly been characterised by a top-down perspective, focusing on the Riksdag (the Swedish parliament), the government and the authorities. In the future it is probable that there will be more of a bottom-up view. One of the reasons for this perspective shift is that now that there are fewer environmental disturbances from point sources, it is becoming clear that we must change our lifestyles and stop wasting our natural resources. This changes the role of the individual from passive to active, as well as increasing the role of the municipalities.



Local autonomy

Swedish society is based on the exercise of local autonomy by county councils and municipalities. The Swedish electorate appoints municipal representatives in general elections held every three years, at the same time as the members of the Swedish Riksdag (Parliament) are elected.

Each of the 286 municipalities conducts its own affairs, subject to the general guidelines laid down in the Local Government Act. Each individual municipality finances its activities by taxation levied from municipal residents and by levying charges for various activities. Certain activities also qualify for State grants. As a result of the municipal power of taxation, taxation rates vary from one municipality to another.

Sweden's municipalities are going through a process of democratic transformation. Developments are moving from central control, towards a decentralisation of responsibilities and activities, within both the politic and administrative organisation.

The relationship between the State and the local governments is characterized by continuous collaboration in a multitude of forms. There are constant changes in the division of labor between these levels of government. It is up to the Swedish Government and Parliament to establish the overall framework of public activities. There is general consensus that within these limits, the municipalities and county councils should enjoy a large measure of freedom to draw up and implement public programs on the basis of local conditions.

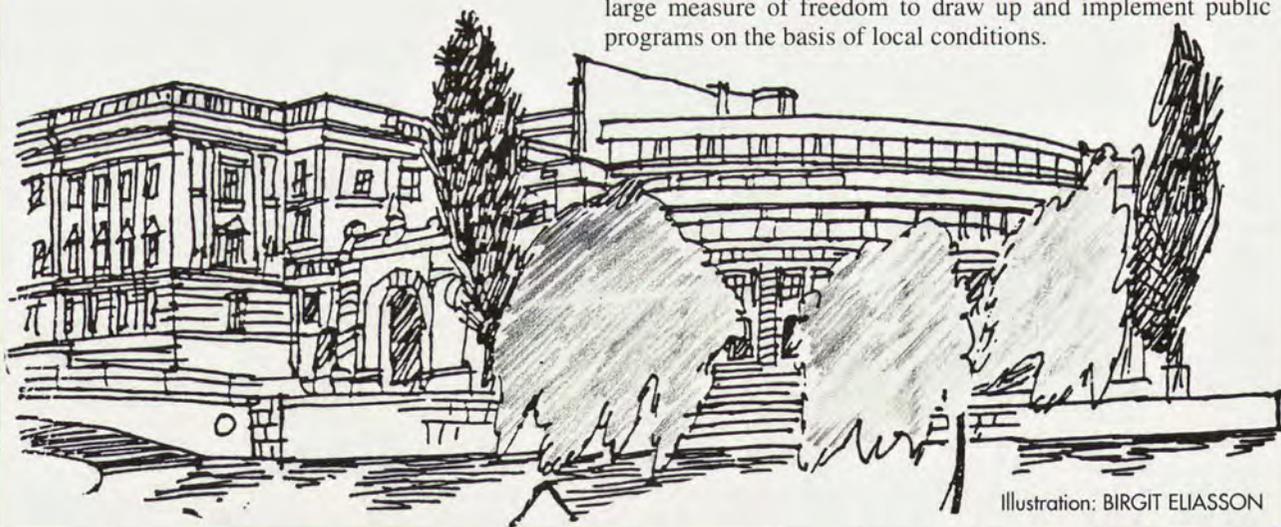


Illustration: BIRGIT ELIASSON

*ENVIRONMENTAL WORK
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The trend towards increasing local initiatives and measures will probably continue throughout the 90s. The fact that Swedish municipal budgets are being tightened up may also serve as a catalyst for an increased sense of responsibility for the local environment and for small-scale local solutions to problems relating to waste management, waste water and refuse, energy, etc.

NEW ACTORS AND NEW ROLES

The municipalities will go on bearing primary responsibility for ensuring the environmental quality of urban and rural environments, expanding on the existing involvement and interest in improving the local environment. Municipalities can engineer management of our natural capital in many ways — in their role as authorities they regulate and monitor, in their role as producers they supply water, energy, day care and parks, for example, and in their role as creative pioneers they can develop new ideas, projects, etc.

In recent years, more and more municipalities have tried to find new forms for their environmental work. Some have begun to label themselves

During the 1920s and 30s, dustbins in the yard began to be replaced with garbage chutes from every storey of the building. The Swedish co-operative apartment company HSB obtained a patent that made this possible. Today, HSB is active in developing methods for source separation and apartment house blocks with full ecocycles (see the example of Tusenskönan in Västerås).



Photo: HSB:s Riksförbund.

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"eco-municipalities" or environmental municipalities, to indicate their involvement. Their aim has been to draw attention to environmental issues both among municipal officials and the general public. This is a way of signalling the priority of environmental issues, and the necessity of becoming involved in solving environmental problems. We can look to such municipalities to get ideas about how environmental work for the future can be carried out, as they are often at the cutting edge of developments. All these municipalities have begun by formulating environmental goals, following them up and revising them regularly. This may be a guiding principle for future environmental work.

The role and responsibilities of the municipalities are also changing in step with increased decentralisation of responsibility and increased political interest in market solutions and privatisation of nationalised operations. Many municipalities are undergoing substantial restructuring today, and this may lead to radical changes in the ways municipal environmental work is carried out. This work, driven primarily by financial and ideological interests rather than consideration for the environment, contains the potential both to impede and to promote sustainable development.

This trend towards increased emphasis on the local level and toning down of the importance of the national level can be seen elsewhere in Europe as well. The principle of subsidiarity, implying that decisions are to be made at the lowest possible level, is one expression of it.

Municipalities are also tending to join forces regionally, finding various ways of strengthening their identity, attractiveness, and negotiating power. The Mälardalen region is one example of such co-operation. These new, more dynamic regional bodies may, in the long run, be able to bring about substantial changes in the roles and responsibilities of regional organisations such as County Administrative Boards, local authorities and regional planning associations.

Many housing companies are running ambitious programmes to interest and involve their tenants in working on their immediate environments. They are testing new ideas in building and housing. When these ideas become realities, they will imply new roles for the municipalities, and new responsibilities, for example for urban supply systems for water and sewage, garbage, energy. For instance, if they obtain the right response from the authorities, tenants and the owners of apartment buildings may take over some of the operation and maintenance tasks in their local environments, such as the routine work which accounts for 70–80 per cent of the operating expenses of the parks administration.

URBAN RENEWAL

Structures and planning of building are constantly changing, although major shifts take time. Looking back a century, a great deal of change can be seen. One hundred years ago, cities were concentrated and often concentric, which facilitated transports. But the sanitary and health conditions in these densely-populated areas were already being criticised.

The infrastructure determined urban development

The Stockholm underground was expanded during a period when the population of the region virtually doubled. Because the planning for the expansion of the underground system and of residential areas was co-ordinated, most Stockholmers now live close to an underground station.

Stockholmers make extensive use of their mass transport system. At rush hour (between 7:00 and 9:00 a.m.) 70 per cent of the people going to and from the city centre travel by mass transportation. This high percentage is attributable to the co-ordinated planning of extended housing and the underground and commuter train system during the expansive period from 1945 to 1974.

However, since the mid-1980s travel by public transport has dropped, and travel by car has increased.

In the 1940s the greater Stockholm population increased by 214,000, or 27 per cent. It continued to increase over the following decades – by 160,000 in the 50s and 186,000 in the 60s – and then stabilised at about 1.4 million during the 70s. Initially, housing construction did not keep pace with the population boom, but it picked up gradually and climaxed in the 60s and early 70s with a period of intense activity.

The decision to build an underground in Stockholm was made in 1941, and work began in 1945. This made it possible to plan new residential areas which would have good access to mass transportation. On the southern outskirts of town beginning in the late 40s and continuing through the 50s, suburban centres grew up around the underground stations, with service institutions at the core and housing at the periphery. These centres were pure commuter towns – the vast majority of the people who lived there worked in the city centre. The western suburb of Vällingby came into being in the 50s, and represented a new way of thinking about urban planning, an area where people were supposed to be able to find all the city functions, work, housing, shops and services (and therefore not have to travel as much). Parts of the Vällingby concept were later applied to other new areas on the outskirts of Stockholm.

The City of Stockholm went on expanding within the metropolitan area, in co-ordination with the extension of the underground network. The underground was owned and operated by the City. Slowly but surely all the Stockholm land was utilised, and more and more people worked in Stockholm but lived in the outlying municipalities. In 1965 30 per cent of the population of the greater Stockholm area lived in the city centre and 40 per cent on the

outskirts of the city, with 30 per cent living in other municipalities. A forecast made that year predicted that more than half the population of the greater Stockholm area would live beyond the city of Stockholm by the year 1990. This trend spoke strongly in favour of efforts to co-ordinate public transportation in the greater Stockholm area.

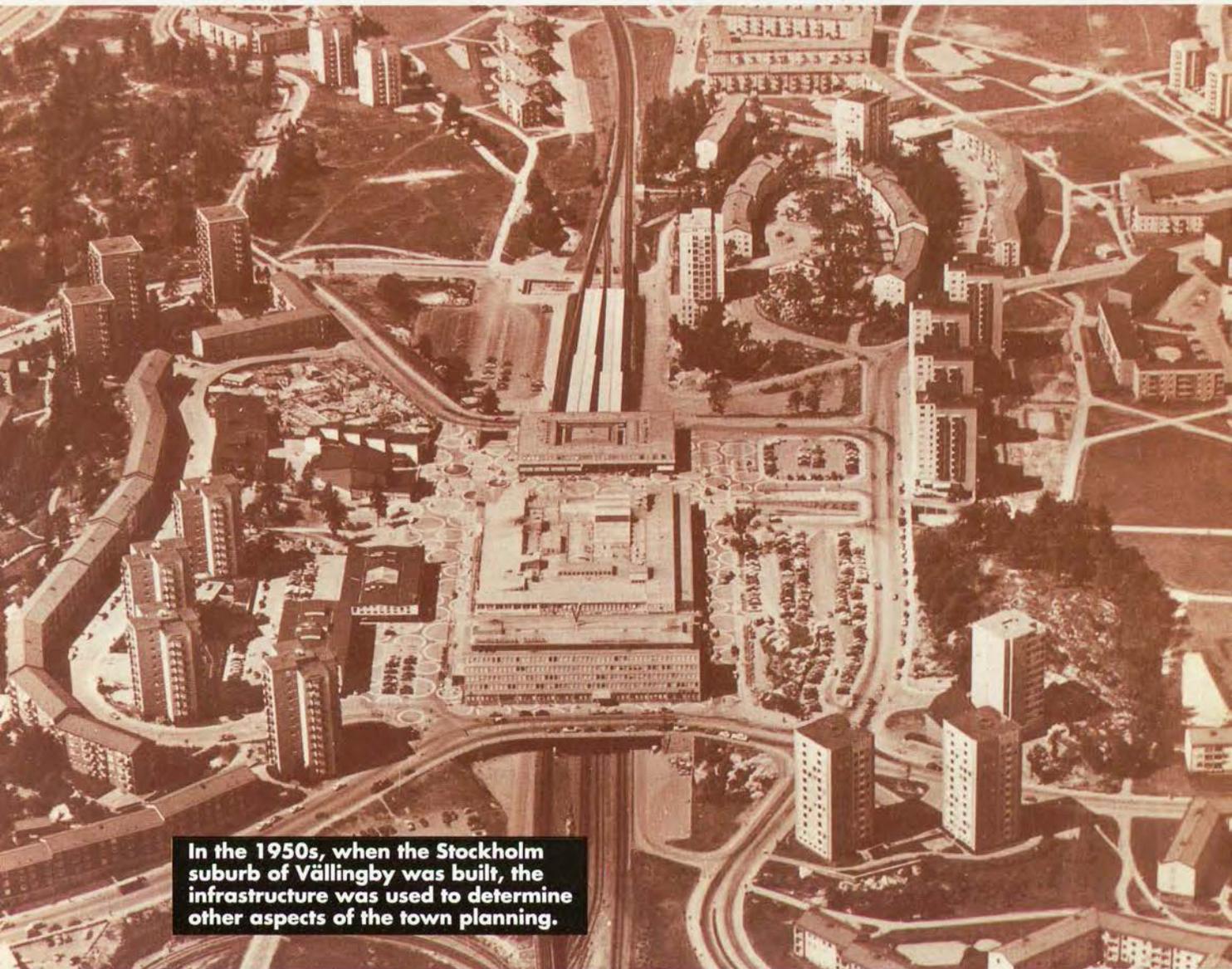
In 1963, Stockholm's City Commissioner for Finance Hjalmar Mehr presented a co-ordination proposal for the municipalities in the greater Stockholm area, saying confidently: "Local government officials all over the world will see us as a textbook example". This proposal led to an agreement including the development of a public transport company, SL (Stockholm Local Traffic), that now serves the whole of the greater Stockholm region. Previously, there were a large number of private and public transport companies, with very little if any co-ordination of timetables and fares.

This co-operation agreement was later superseded by the 1971 agreement to establish a joint county council district/municipality, "the Stockholm County Council", with responsibility for mass transportation, health and medical care and overall regional planning. This decision was twenty years in the making, owing mainly to conflicts with regard to the future of municipal self-determination.

The right to self-determination was maintained, which meant that each municipality has a planning monopoly with regard to its building activities.

Traffic system co-ordination was vital, to keep travelling smooth, but problems arose owing to the conflict between collaboration with regard to mass transportation and independence with regard to construction planning. A municipality could theoretically "toss up a lot of little houses in any old meadow" and leave responsibility for mass transportation in the area to the joint County Council, and in practice this has happened in places. Since the mid-1970s when apartment house construction was complete in nearly all suburban areas, priority has been given to one-family houses. Consequently, although many of the recently-built residential neighbourhoods are accessible by public transportation, it is too irregular to encourage the people who live there to leave their cars at home.

Further expansion of the underground system has been proposed, but has met with resistance from a couple



In the 1950s, when the Stockholm suburb of Vällingby was built, the infrastructure was used to determine other aspects of the town planning.

Photo: STOCKHOLMS STADSMUSEUM

of the suburban municipalities which claim that “troublemakers come along with the underground”.

In recent decades, metropolitan Stockholm has promoted an explicit policy of decentralising workplaces. This has led to a demand for better cross-town public transportation. The underground and commuter train systems are all routed in and out of Stockholm, and their purpose is to transport people rapidly to and from the City. The cross-town routes are serviced by slow,

infrequent bus lines, and the decentralisation of workplaces has not been followed up with corresponding public transportation services. This has contributed to increased car travel. There is also a trend towards fewer and fewer people living within walking distance of an underground or commuter train station, as the population density is decreasing. Today, roughly half of the households in Stockholm are single person households, and on an average there are fewer people per apartment than there have been in the past.



Photo: BOSSE JOHANSSON

► The infrastructure determined urban development



The expansion of satisfactory public transport services takes decades, and for that reason systems must be developed making it possible for contemporary technology to go hand in hand with future technologies. The large photo shows a transfer point for switching from an old tram to a modern underground train. In the future both these systems must be able to co-operate with the light rail city trains being considered for several cities (small photo).

Industrialised society then tried to solve its environmental problems by dividing city areas up by function, into zones.

During the 1960s and 70s town planners were preoccupied with the quantitative problems resultant from rapid urbanisation — the construction of one million apartments with all the necessary infrastructure, including traffic systems and highways, large-scale supply systems for water, waste water and energy. During this period, structures demanding increased mobility continued to be built.

The 1980s were characterised by a transition to urban renewal and environmental-improvement measures. This has led to increased awareness of the fact that city environments — architecture, public spaces, parks and open, green areas — all deserve more attention. Quality has become more important than quantity. Renewal to date has mainly been at local level, including renovation and renewal of individual buildings and residential neighbourhoods. The 90s are expected to be marked by an increasing demand for more extensive urban renewal, not only of individual buildings but of large portions of city structures, including the infrastructure.

There are many signs in Sweden and internationally that interest in cities and improving urban environments is on the march. This means that urban renewal may be an important feature of the 90s. One example of this interest is the *Green Paper on the Urban Environment*, presented by the Commission of the European Communities, 1990. The seven points below summarise the purpose of this Green Paper:

- To promote versatile land use in cities so that urban environments can be characterised by interplay among many different people and activities.
- To maintain and strengthen the identities of cities by reinstating the vital connections between places and their histories.
- To channel urban development and growth to parts of cities whose original uses have become outdated, instead of using virgin land on city perimeters.
- To reduce the need to travel by private car in urban environments.
- To maintain the quality of outdoor environments and green areas.
- To use regulations for energy economising and cautious use of natural resources as patterns for political management of issues relating to the urban environment.
- To ensure that the inhabitants of a city participate in decision-making with regard to changes in their city and management of their urban environmental problems.

Thus there are many indications that urban developments in the future will mean even greater urban density. This may both pose new threats and new potential for the sustainable structures of our cities. In urban renewal projects, parks and green areas in central and semi-central parts of the city are often threatened, as that land is highly desirable for uses that would increase the density of the city. The green environments in cities have not been prioritised to date, despite the fact that people have often expressed

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GREEN PAPER



ON THE
URBAN

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very clearly, in conflict situations, that they find green areas decisive to their appreciation of a neighbourhood.

INFRASTRUCTURE RENEWAL

The demand for a sustainable environment means that we must find completely new ways of solving the problems associated with urban waste water and refuse, and new means of ensuring reliable, environmentally-adapted energy and water supplies. We will also have to find ways of managing the residual products which we will still have from traffic, industry, agriculture and forestry after measures at source have been implemented. Today, residual products such as waste from industry, storm water polluted by traffic, and nitrogen leached from agriculture are often mixed into the supply system for household waste. In the future, in addition to decisive measures at source, these flows must also be separated.

The main challenge for the future is to design and test new infrastructure systems based on the principle of ecological cycles. Because we have already made enormous investments in infrastructures, and built up our cities around them, we must find ways of gradually developing and adapting these urban infrastructures. Eco-villages in peripheral areas beyond the reach of the present infrastructure may be useful as experimental sites, but they can never represent more than marginal elements in the process of converting the infrastructure to serve as the basis for a society organised around ecological cycles.

An environmental philosophy based on the principle of ecological cycles cannot gain ground without extensive renewal of our technical supply systems, and interplay between the technical infrastructure and the green infrastructure. For this to take place, new technical and organisational solutions will have to be designed and tested. We will have to acquire more know-how about the potential for interplay between technology, nature and mankind.

WE STILL NEED PLANNING — BUT NEW KINDS

Although individual interest is expected to go on growing, there are limits to the potential effect of individual initiatives. Changing patterns of building and of the infrastructure also takes time and requires intensive teamwork on the part of many actors. Of course there is an inherent risk that the interest displayed by individuals in environmental alternatives for household use, etc. such as source separation may be undermined and replaced by passivity if it seems to individuals that "the system", e.g. the municipality, or the waste management companies, are not working in environmentally sound ways. The taxation system must also give the necessary incentives to encourage continued household economising.

For all these reasons, it remains important that the central government and the municipalities go on co-operating actively to move society in the

direction of a good environment. Planning of the physical environment is central — and new forms of planning are vital.

Paradoxically, increased European integration and regionalisation will be the primary cause of increased planning demands.

Physical planning and land utilisation planning are deeply rooted in Sweden, and building and land use are tightly regulated. This planning has been effective in times of major expansion, and it has attracted international attention, for example, during the time of rapid urbanisation in the 1960s and 70s, owing to its success in keeping increased building and expansion of the infrastructure in step. The success of Swedish physical planning was attributable to three factors:

- it expressed its aims in a clear vision;
- it enabled co-ordinated urban expansion in a way that went hand in hand with the existing legislation;
- the physical planners had good basic understanding of the technical supply systems and were therefore capable of communicating well with the technologists.

In other words, the purpose and the means and language for achieving it were so well co-ordinated and defined that it was possible to institute comprehensive, collaborative planning. In retrospect it is also easy to see that this planning was blind to the environmental and social problems inherent in it.

Today, however, as we explore new forms of planning, the purpose and the means and language for achieving that purpose have very little in common. The basic assumption of physical planning, that there must be new land for every new facility, no longer holds true. Adaptation of existing structures and facilities is becoming the new trend.

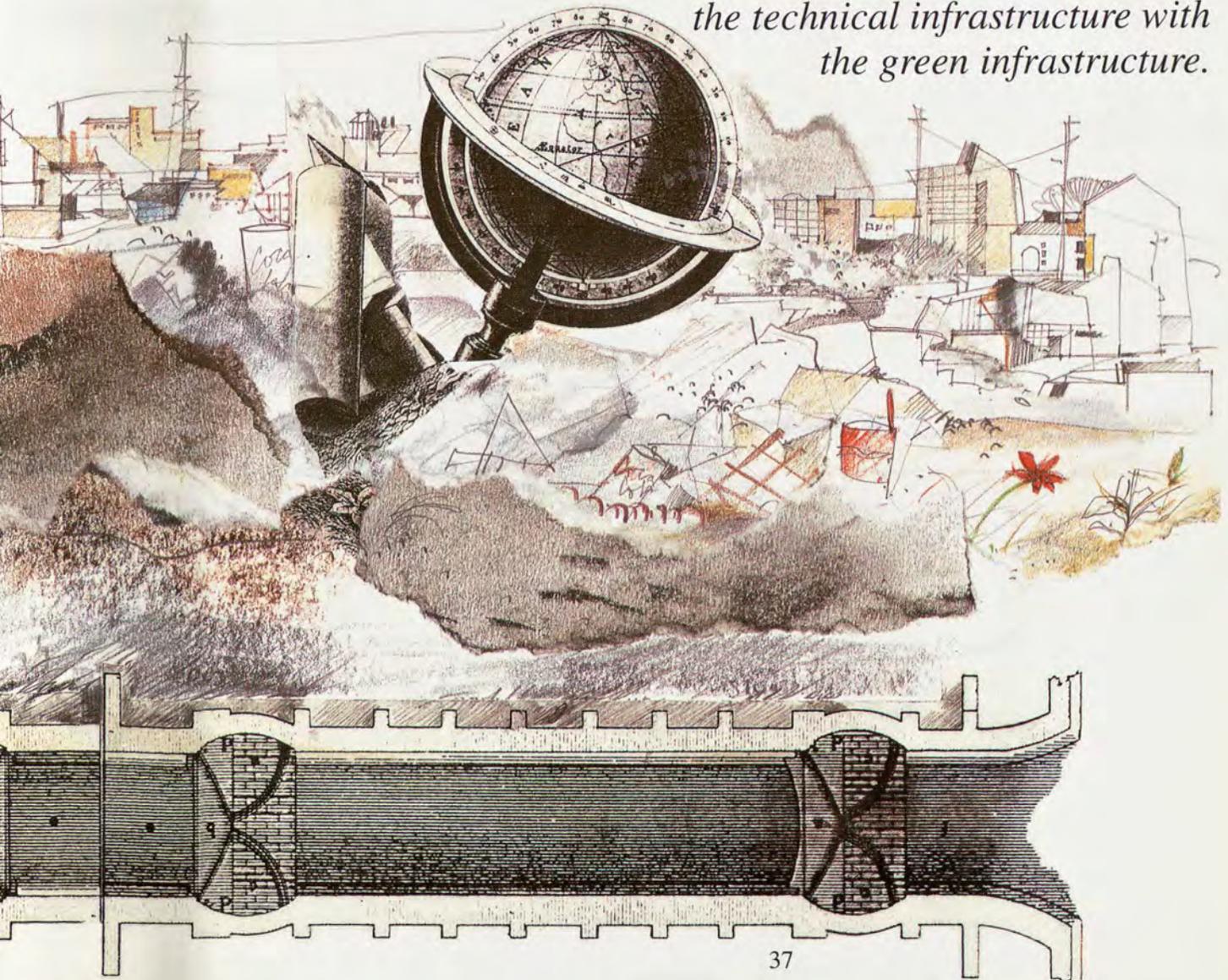
With regard to the interplay of natural resources and environmental issues in physical planning, the general approach has been from the perspective of building and exploitation. At this time classical nature conservationists also began to work with the interplay of planning and environmental issues, but using a different theoretical and methodological approach than the legal and technical regulatory structure. They used biology and natural geography instead, with a view to indicating areas worthy of conservation and then safeguarding them. In the 1990s we face the challenge of integrating these two planning traditions and their radically different points of departure. This endeavour to develop planning into a strategic instrument for improving the environment requires a large measure of increased expertise in conjunction with creative thinking.

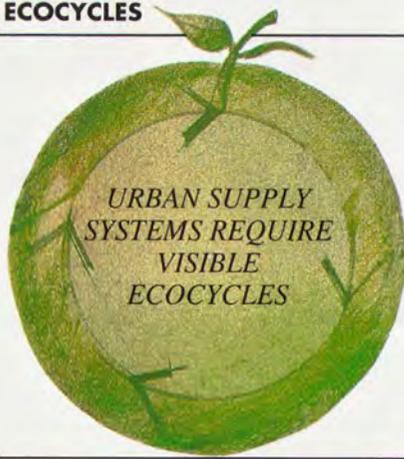
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URBAN SUPPLY SYSTEMS REQUIRE VISIBLE ECOCYCLES

If urban ecological cycles are to come full course, there will have to be active integration of the technical infrastructure with the green infrastructure.





Many of the environmental issues in relation to sustainable cities are associated with the infrastructure. Supplying a city with water, food, energy and transportation gives rise to many environmental problems, including waste, air and water pollution, noise. In order to improve the environment, we must adapt urban supply systems to the environment.

Mainly, supplies flow into cities, where they are then consumed. Waste products from cities are not returned to the places from which the original resources came. Instead, by-products are stored in the soil or spread to the air and water. Energy and staple goods are transported over long distances — today supplies to a city may come from all over the world. These are

Tusenskönan – a block of apartments in Västerås with

Source separation is the key to increased waste circulation in sustainable cities. Individuals must shoulder greater responsibility for their own waste management. Source separation also gives less contaminated waste than central sorting.

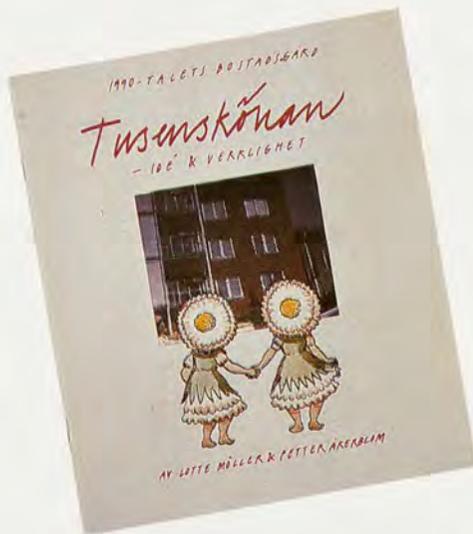
Composting biological household waste has proven to be something of a key to good source separation. In Swedish apartment buildings with composting, separation of other waste fractions has also improved, and total waste quantities have decreased. One of the best examples of this is the condominium block in Västerås known as Tusenskönan. It was built in 1990 in central Västerås, and has 69 apartments.

All biological waste is composted in thermally-insulated composters. There is a composting room alongside every entrance hall to the block. After two years of operation, it has been established that the local sanitation department only collects 40 per cent as much waste from Tusenskönan as from other comparable blocks, that the inhabitants of Tusenskönan turn in twice as much paper and nearly four times as much glass for recycling as other people in Västerås.

Source separation begins in the kitchen, and the kitchens in Tusenskönan were designed to make room for several waste containers. In addition to the compost rooms, there are also recycling rooms where the inhabitants put all their recyclable waste. If you need a bit of paint, you can have a look at the shelf for hazardous waste, and if you like the armchair your neighbour has decided to scrap, you are free to take it.

However, Tusenskönan is more than source separation and thermal compost. In the courtyard there is a compost corner where composted material ages before being used in the block's garden allotments. There is also a covered workbench for re-potting plants and other small projects.

The storm water from the roofs and courtyard is conducted to a little stream which runs into a shallow pond at one end of the property. In dry periods, water is pumped through the stream to improve the environment. In rainy periods, overflow water from the pond is conducted to the municipal storm water pipeline. All this provides a lovely addition to the environment, and has some purifying effect on the water.



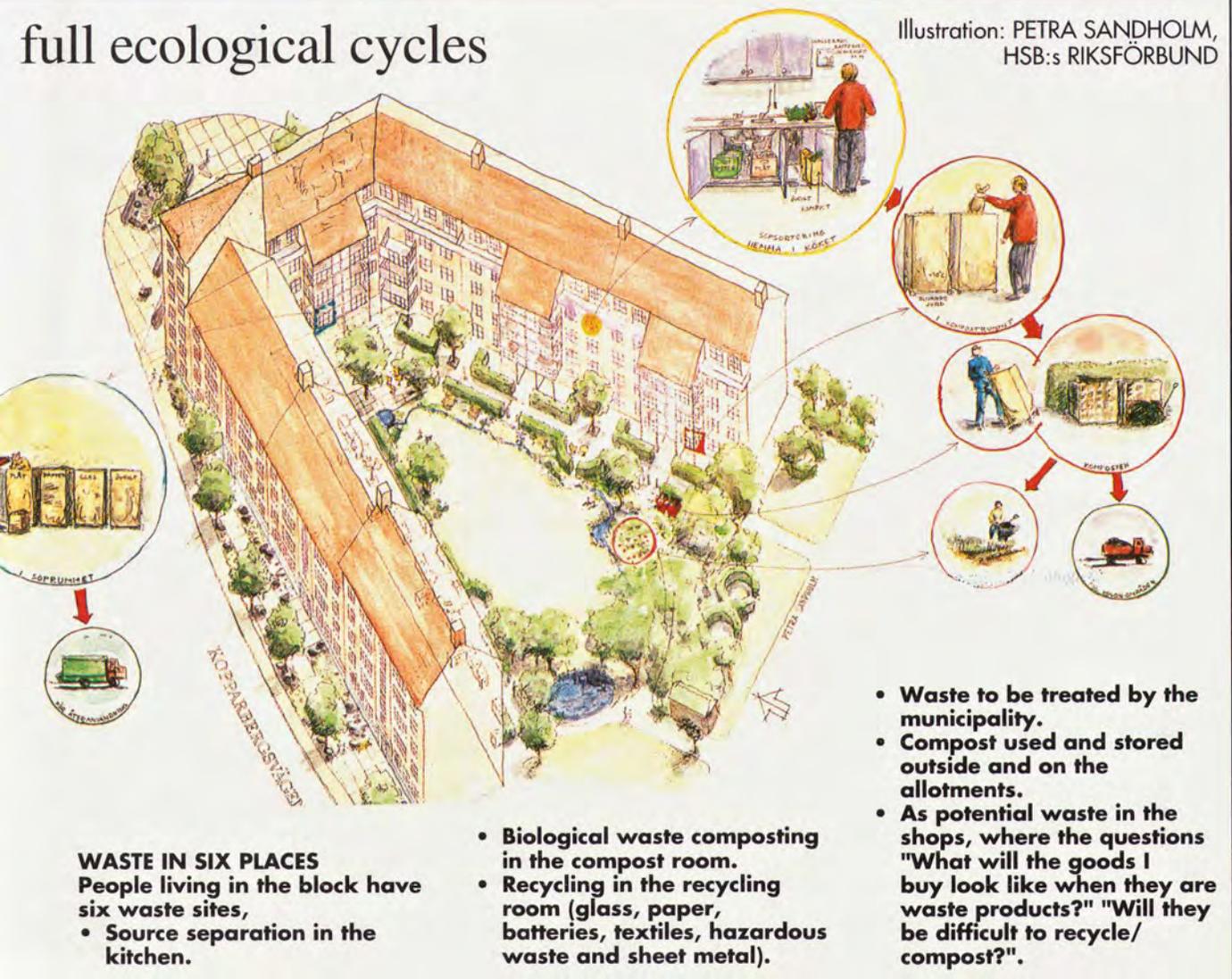
large-scale technical systems no individual can be expected to fully comprehend. If supply flows are integrated into the ecological cycle, and waste products returned, wherever possible, to the parts of the system from which they came, environmental problems can be reduced. If energy and staple goods are produced more locally, if technical systems are made more comprehensible, and if individuals can affect them, these *smaller-scale local ecological cycles* may be the ideal model for sustainable cities.

This chapter presents examples of municipal environment work on five aspects of the urban, technical infrastructure: green infrastructures, water and waste water supply systems, waste management, the energy supply, and traffic.

*URBAN SUPPLY
SYSTEMS REQUIRE
VISIBLE ECOCYCLES*

full ecological cycles

Illustration: PETRA SANDHOLM,
HSB:s RIKSFÖRBUND

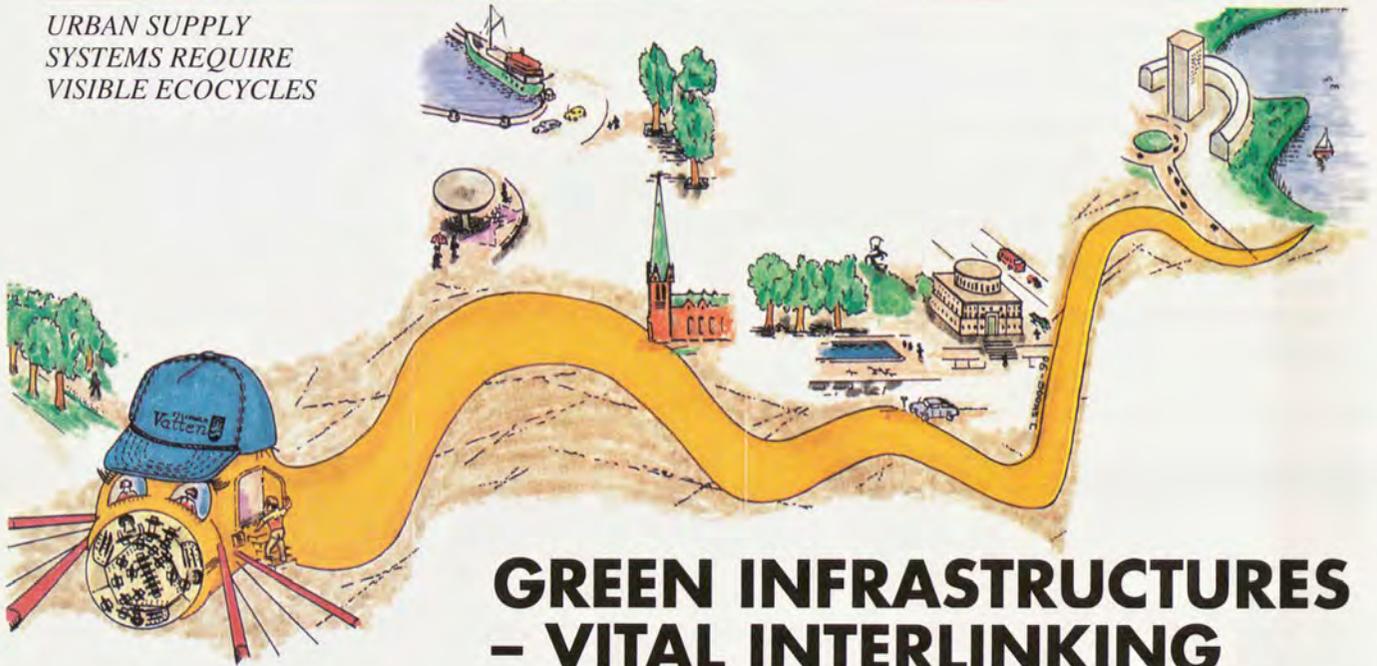


WASTE IN SIX PLACES
People living in the block have six waste sites,
 • Source separation in the kitchen.

- Biological waste composting in the compost room.
- Recycling in the recycling room (glass, paper, batteries, textiles, hazardous waste and sheet metal).

- Waste to be treated by the municipality.
- Compost used and stored outside and on the allotments.
- As potential waste in the shops, where the questions "What will the goods I buy look like when they are waste products?" "Will they be difficult to recycle/compost?"

URBAN SUPPLY
SYSTEMS REQUIRE
VISIBLE ECOCYCLES



GREEN INFRASTRUCTURES – VITAL INTERLINKING

To reduce the risk of flooding in times of heavy rain, Stockholm Water is constructing a storm sewer overflow basin known as the "ORMEN" project, with a very high capacity. This will make it possible to store storm sewer overflow water until the pipeline and treatment plants can handle it.

Source: Stockholm Water.

Many parts of Swedish cities are relatively sparsely structured and have a great deal of unbuilt-up space. Inner city residential areas only make up a fraction of Sweden's housing, and even such areas are dotted with parks and other open space. Swedish cities are often surrounded by woodlands with plenty of recreational areas. In other words, Swedish cities have a good physical point of departure for great ecological variation, a diversity of flora and fauna, dynamic exchange with the surrounding area, and the development of natural cycles.

The advantageous points of departure in terms of urban and physical planning described above should make it very possible to create a green infrastructure, taking advantage of the unbuilt-up areas to establish natural cycles in and among cities and between urban areas and their rural environments. Today, the necessary links for a sustainable, green infrastructure have not been established, and their absence means that cities and the surrounding areas are not intertwined, and the natural cycles are thus absent.

Developing a sustainable infrastructure is a task mainly in the hands of our urban planners, who have traditionally disputed whether the right solution is to have occasional green areas stretching from the countryside straight into the cities, or to have green belts at intervals encircling cities. Green stretches provide the best ecological contact between cities and the countryside, but perhaps the best overall solution is to have both stretches and belts, weaving a sustainable network of infrastructure.

No matter which urban planning tactic is used, interconnection of the green areas is vital. Clearly the green infrastructure and traffic will conflict, as green areas and roads must intersect. Often, the green infrastructure is

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Photo: JAN HÅKANSSON

A good urban environment requires excitement and variation. The open spaces must be well thought out, and the location of works of art and the flora and fauna can serve as cornerstones for detailed planning. "Paradise" by Niki Sant-Phalle and Jean Tinguely at Skeppsholmen in Stockholm.

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the loser. But just as when one link in the waste water system is missing the entire system breaks down, there only has to be one small disruption in the green corridor for the green infrastructure to fail to serve the animals, plants, water and people it is meant to transport.

The green infrastructure of our cities deserves more attention in our pre-school and school systems. Children and staff could be much more actively engaged with their local environments, and have a creative impact on them. The local nature provides a wealth of free educational material for children, and also gives them a basic understanding of natural cycles.

Well-planned vegetation and wooded park areas can improve the local air quality, and the micro-climate. We could do much more to improve our urban climates by better utilising vegetation to reduce the impact of the wind, balance temperature variation and hydrate the air. Planting wind barriers on the outskirts of cities is ineffective unless it is followed up with the necessary levels of urban wind protection.

Open water areas in urban environments are considered undesirable, and efforts have been made to drain them. We have filled the natural urban watercourses and wetlands with earth, and conducted natural running water out of our cities, at great expense.

Instead, water should be regarded as an asset, a positive element in urban environments. Water is a solution multiplier, with many beneficial effects. Vegetation and the soil can purify water, binding its pollutants and utilising its nutrients. We could conduct urban storm water for use in watering grass, bushes and trees instead of removing it through our sewer systems. We could allow our storm water to be filtered by the earth, retaining it in the soil, in ditches, in ponds and wetlands instead of eliminating it as quickly as possible. If we did this, the people, animals, and vegetation in our cities would live in a richer environment.

The green infrastructure of a city is an important, visible and pedagogical aspect of environmental education. This picture is from Stockholm's "ecopark", where children and adults may see 250 species of birds, unique deciduous forests, and many other plants and animals.



Photo: NADJA EKMAN

A group of pre-schoolers make their first hesitant contact with the cows at Aspö.



Photo: LENA CHRISTERSSON-MAGNUSSON

The Aspö city farm

City children of today know very little about where their food comes from, about the natural cycle between city and surroundings. The chain of events from planting a seed to putting dinner on the table has become too large-scale to be comprehensible, with enormous farms, and a centralised food processing industry including purchasing and transport systems and the retail trade. The connections have become blurred – between a cow and a carton of milk, a loaf of bread and a field of grain, a jar of applesauce and an orchard.

In the western Swedish town of Skövde, the municipal housing company has set up a city farm. Municipalities and associations could also start city farms to teach children where food comes from. A city farm is in the city or on its outskirts, and has cows, pigs, chickens, and small fields of grain and other crops. The children get to help look after the animals, but they are not to be cuddled and treated as pets. The animals live proper animal lives and are sent to the slaughterhouse.

The Aspö city farm is adjacent to three residential areas in which the Skövde municipal housing company has a total of 2,300 apartments. Day nursery and school classes are frequent visitors at the farm, and anyone who likes may go along on their free time and join in the work to be done. Tenants of Skövde's municipal housing company may rent low-cost allotment garden plots and join the farm pony club, where children may ride once a week for a nominal membership fee. The farm is run on

the lines of traditional agriculture, and the services of a farmer are hired. The farming generates a small profit, which makes the operating budget modest. The farm also has a recreational teacher on its staff, who leads the study tours and other activities.



Halmstad – green structures and nitrogen purification

The town of Halmstad is on the Laholm Gulf, a sometimes highly polluted stretch of the Swedish west coast.

Nitrogen leaching from the farmlands in the area has been detrimental to the sea. The Swedish government is running a massive project via the County Administrative Board and the municipalities, to do something about the nitrogen problem.

Most of this pollution is airborne, or comes from fertilisation of farm land, and a small part from waste treatment plants. The Riksdag adopted a decision to improve nitrogen purification, primarily at waste water treatment plants, which is more expensive than to improve nitrogen purification in farming. A combination of measures is the most cost-beneficial strategy.

One of the practical aspects of this work is that the Halmstad parks administration has made park land available for management and purification of storm water.

In return, Halmstad will

have lovely aqueous environments where plants and animals can thrive, and which the public can enjoy. The municipality is running various projects in which storm water is held in ponds and wetland before being conducted into the receiving waters.

A pond in the Vallås residential area has been used as a basin for short-term storage of storm water since the 1970s. Today the pond is completely integrated into the environment, and the people living there see it as a natural part of their neighbourhood. Swans and other birds nest there and there are plenty of frogs. To improve the nitrogen treatment and increase the ecological variation, a wetland area has been developed downstream of the pond. The people in the neighbourhood, including schoolchildren, helped the park staff to make the wetland, and it is becoming an area with a wealth of flora and fauna. The schools use the area to give

children first-hand experience of the natural environment.

The waste incineration plant in Halmstad is a serious polluter of storm water, when it runs off the hard surfaces where the RDF fuel (waste pellets) is stored. A wetland area has now been developed near the plant, where storm water will be purified before being conducted to the receiving waters. A similar storm water purifying wetland has been developed in eastern Halmstad in the vicinity of an industrial estate. The water from that area that now passes through the wetland previously ran right into a river.

A little lake, about 2.5 hectares in area, has been made near the Halmstad municipal waste water treatment plant. All the water from the plant will now be stored for "polishing" in the lake for 24 hours before running into the Laholm Gulf. A root zone area has been developed at another small municipal waste water treatment plant to fill the same function. The treated water passes through the area for further purification before running out into the surrounding rural areas.

In addition to their foresighted policies taking advantage of the green infrastructure, Halmstad has taken many other initiatives as well, such as a tree-planting plan which has won great political support because it is aesthetically and environmentally justified and will improve the air quality.

The parks administration has also worked hard to involve the schools in environmental work. They have written a "Catalogue of ideas for practical environmental work" giving schoolchildren twelve different activities to choose among, including planting deciduous trees in coniferous areas, putting up birdhouses, protecting sand dunes with pine branches, and planting grass and flower beds. The parks administration provides expert advice, but leaves the practical organisation to the schools.

Many Swedish cities have retained natural areas, such as parks and recreational areas, in the midst of built-up neighbourhoods. There are also often wooded areas on the outskirts of conurbations. These are valuable areas, and can be made even more so if their ecological diversity is increased. Although Halmstad is surrounded by farm land, the city has its parks and surrounding forests. The parks administration works very consciously to diversify the biology of these areas, and spends a great deal on their maintenance. Although it only costs about one-twentieth



The treatment plant in Halmstad at Västra Stranden serves 60,000 people, hospitals, and many industries. A total of 12.5 million cubic meters of waste water is conducted to the plant annually. At the plant the waste water is treated in several steps — mechanically, biologically and chemically. A further step for nitrogen purification is now being added.

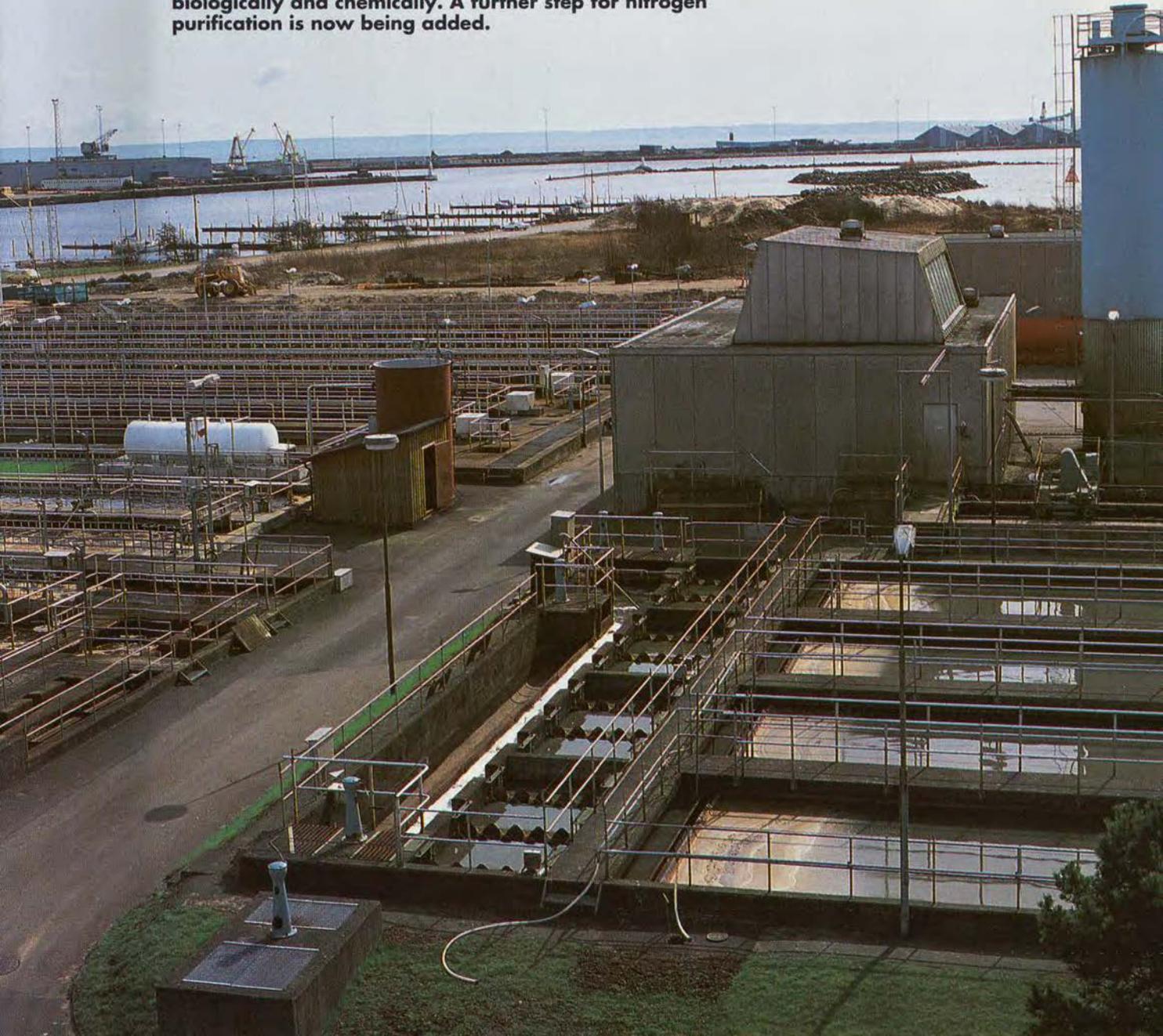




Photo: TORSTEN ROSENQVIST



Halmstad – green structures and nitrogen purification

of what it costs to maintain a park to keep these areas in order, it does cost substantially more than caring for traditional forests.

They concentrate on increasing the numbers of biotopes in the forest areas and on increasing the ecological variation of open landscapes. When new park land is being developed, newly-harvested hay from flowering meadows in the local nature preserves is brought in and used to cover the new areas where flowering meadows will be, as a means of naturally disseminating the local flora.

WATER AND SEWAGE – TWO WET CHALLENGES

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Sweden has a wealth of clean water. Contrary to many other nations, Swedish urban and rural areas have access to good drinking water. The only exception are the south-eastern parts of Sweden and the islands of Öland and Gotland, where annual precipitation levels are very low.

Pollution of ground water is an increasing problem, and difficult to overview. Our air is a sensitive system, and once it is polluted it is difficult to remedy. Both acidification and nitrogen pollution affect the ground water, and today we cannot know what the future consequences will be.

The main challenges for urban management of water and waste water are local management of more storm water, reduction of the heavy metal levels in waste water, and reduction of nitrogen leaching to the seas. Many municipalities have already initiated ambitious efforts to accomplish these things.

Urban storm water is conducted through a pipeline which cost billions of kronor to construct. It keeps city dwellers' lawns from being flooded after storms, and their feet from being soaked when they run from a parking lot into a building during a storm. The system will soon be ripe for renewal, which will mean investment of billions.

When acid rain falls, it is already rich in nitrogen, and it is further polluted when it runs off roofs, through parking lots, and along roads before it makes its way into the sewer system. The special storm water run-



Awareness of the cycles of water is important. Here schoolchildren from Örebro are doing field-works by means of the Ecology-bus – the rolling school of nature.

Photo: LEIF LARSSON

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**COSTS FOR REDUCTION OF
NITROGEN EMISSIONS**

	SEK/kg nitrogen
Recovery of wetlands	4-25
Waste water treatment plants	35-60
Manure handling	30-70
Planting catch crops	10-50
Nitrogen purification from flue gases	45-180
Vehicle exhaust purification	20-50

off pipelines conducts this untreated waste into stream, rivers and lakes, and pollutes them. When storm water is conducted via the ordinary waste water pipeline it adds an additional burden to the capacity of the waste treatment plants. When it rains heavily, untreated waste water also runs out into lakes, rivers and streams, as the capacity of the sewer system is insufficient.

Two measures must be implemented to reduce the problem of storm water management. Firstly, as much storm water as possible must be dealt with locally, through soil infiltration. Secondly, the time before storm water reaches the waste treatment plants must be prolonged as far as possible.

Because of the high heavy metal levels in waste water and, consequently, in waste sludge, many farmers hesitate to utilise the sludge today. Measures at source are the only way of reducing heavy metal levels. To date, most attention has been focused on discharges from major industries which, of course, accounted for most of the problem. A great deal has been done in this area. Now it is time to look at the contribution from small industries and households, and massive information campaigns will be required to encourage them to reduce their discharges. Efforts will also be made to reach the producers of cleansing agents and other domestic chemicals.

Most nitrogen leached into the sea comes from agriculture, but some comes from municipal waste water treatment plants. The Riksdag has stipulated that all coastal waste water treatment plants must reduce the total nitrogen content of their effluents by 50 per cent and, in sensitive areas, by

Mark/Älekulla – purification at source

The parish village of Älekulla in the municipality of Mark has roughly thirty households, and their waste water is treated at a primitive purification plant, a biological dam. The village could not expand without building a new purification plant, but the municipality found an alternative solution; at-source purification, and consequent reduction of the quantities of nutrients needing to be purified.

In the spring of 1989, the inhabitants were informed of the intentions of the local government, and provided free of charge with very low phosphate cleansers and detergents. The village shop also sold suitable products, and the phosphate levels in the domestic waste water decreased by more than 50 per cent. The people of Älekulla became very active in the project of reducing the damage to their watercourses, and by replacing high-phosphate detergents with equivalent low-phosphate products, they halved phosphate discharges from Älekulla.



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Photo: JAN COLLSIÖÖ/PRESSENS BILD

**What would Stockholm be
without its water?**

Stockholm's water – a unique environment

Stockholm – the capital of Sweden – has a unique environment by comparison with most other large cities. For example, people living in Stockholm can swim and fish for salmon in the water of Lake Mälaren, right in the middle of town. But the water of Stockholm is at constant threat, and safeguarding it is of vital importance. In the Plan for the Stockholm Environment, adopted by the city council in 1989, the aspect about water which is stressed is the need to increase the amount of protection given to drinking water and the lakes which supply it. The plan proposes a pilot project for local management of storm water, and the drawing up of a programme for ongoing renovation of the waste water network, as ways of gradually reducing the load on the pipeline and the municipal water purification plants.

Photo: BOSSE JOHANSSON



Although there has been a ban on the sale of mercury thermometers for the last year in Sweden, they still dominate household use. It is therefore important to spread information about how to dispose of them. During the spring of 1992, Stockholm Water carried out a campaign encouraging households to turn their mercury thermometers in at their local chemists. Every household also received a personal letter with information and the offer of a bonus upon return of a thermometer.

Stockholm Water Ltd., is a municipally-owned company which both supplies the people of Stockholm with drinking water and treats their waste water. The company has two water treatment plants and three sewage treatment plants. Since 1989 Stockholm Water has made every effort to reduce discharges of environmentally hazardous substances into the sewage system. The plants treat waste water from many sources: roughly one million inhabitants, innumerable small and medium-sized industries, a huge service sector, and the city's storm water. The waste water is subjected to high-degree purification with a special focus on suspended materials, oxygen-depleting substances, phosphorous and nitrogen. After treatment, the water is conducted out into the Stockholm archipelago and the Baltic Sea.

Beginning in the mid-1960s, and through to the end of the 1980s, Stockholm Water has worked primarily with trying to obtain less polluted waste water from industries, to minimise the input of hazardous pollutants into the sewer system. They have concentrated on heavy metals such as lead, cadmium and mercury, and on implementing measures at source.

The reasons for this are:

- No damage must be done to the sewer system; it must be kept in satisfactory working order.
- Treated waste water must be made harmless to the receiving waters.
- Purified sewage sludge can be made useful as a soil improvement material for agriculture. This makes it necessary to place high demands on the heavy level content of the sludge as well as its contents of certain other environmentally hazardous organic substances.
- Purification processes at sewage treatment plants should always function at optimum levels. The nitrogen purification process is particularly sensitive to disturbances.
- The work environment in the sewer system must not jeopardise the health of the personnel.

For example, the graphics industry and photo processing laboratories are no longer allowed to discharge used developer or fixing solution into the sewer system, but must separate it and treat it. This has forced the larger industries to acquire their own treatment facilities, primarily evaporation plants. There are also three waste

management companies in the region which collect waste from the graphics industry and treat it, using state-of-the-art technology.

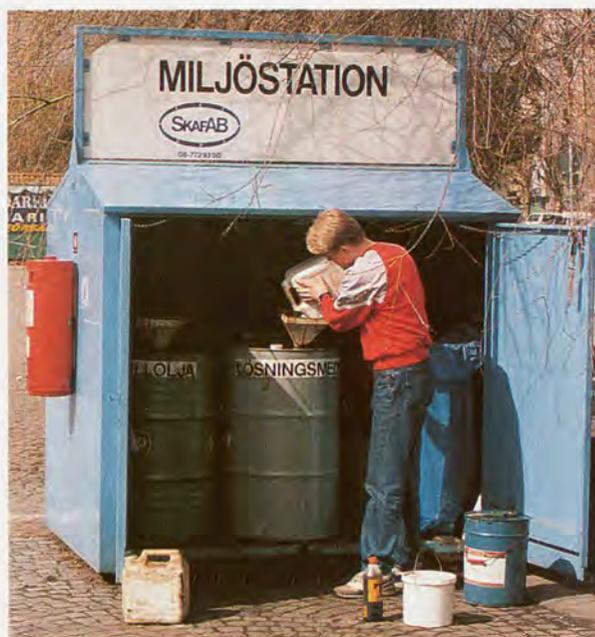
Most of the mercury discharged into the waste water comes from dental practices. Dentists have been required to have "amalgam separators" in their practices since the mid-1980s, with a view to reducing these discharges.

One of the main problems associated with discharges from the service sector is the use of more or less hazardous detergents and cleansers. Another is mercury from dental practices. Work to counteract these problems has been focused on information and direct contacts with major consumers. A folder entitled "Wash Wisely" was produced, describing suitable cleaning agents for various purposes.

The following example provides an illustration of how "Wash Wisely" worked in practice. Before the folder was circulated, one supplier of detergent to Stockholm day nurseries had cornered about 70 per cent of the market. These products were considered among the least suitable ones, and were therefore not listed in the folder. Stockholm Water contacted this distributor a couple of months after "Wash Wisely" was distributed. He was virtually unable to sell his products, and wondered what to do about it. This provoked discussions with a manufacturer, who proved instantly willing to change the contents of the dish washing soap.

Domestic waste water contains many substances with varying degrees of toxicity and in different amounts. Most emissions of environmentally hazardous chemicals come from dish washing and laundry soaps and cleaning agents, but other problem areas include used photo chemicals, paint residues, solvents, insecticides, and mercury from broken thermometers. For this reason, the city has opened a number of environment centres, and run various campaigns aimed at households.

Storm water is a major source of pollution in Stockholm. It carries large quantities of hazardous substances into the waste water network. Automobile traffic contributes to pollution both in terms of exhaust, wear and tear on asphalt roads, and studded tires. Nearly half of the Stockholm waste water network is of the combination type, meaning that storm water is collected in the same pipeline as other waste water and conducted to a treatment plant for purification. The current plan regulating the expansion of the Stockholm waste water network indicates that most of the combination network will be retained, and supplemented with overflow basins. This means that large quantities of pollutants will continue to flow through the treatment plants via storm water. The



Readily accessible environmental stations all over the city — located, for example, at gas stations, are a prerequisite for consumers really bringing in their environmentally-hazardous waste.

Photo: BOSSE JOHANSSON

only way of reducing these quantities is to implement measures, mainly in relation to automotive traffic.

Stockholm Water has not yet made much progress in this area, but a one-year study of the impact of vehicle traffic on storm water has been initiated. Measurements will be made of the contribution from vehicle traffic of dioxins, PAH compounds, PCB compounds, various metals, etc. Possible measures may include a ban on the use of studded tires in central Stockholm, reduced uses of leaded petrol, and separate conduction of storm water from the most highly-trafficked streets.

Stockholm Water has also taken the initiative in regional collaboration amongst the municipalities around Stockholm. A working group is studying the potential for "measures at source" and has already proposed a review of the construction material sector, with new environmental requirements. Materials which may give rise to environmental problems are to be avoided, and when there is a choice, the most environmentally sound material is always to be used. It has been proposed that the granting of building permits or loans for new buildings or building renovation be used as an instrument in this respect.

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Rooting zone treatment of overflow water is a state-of-the-art biological technology. Research indicates that the technique works in the winter, too, although the purification effects are slightly reduced.

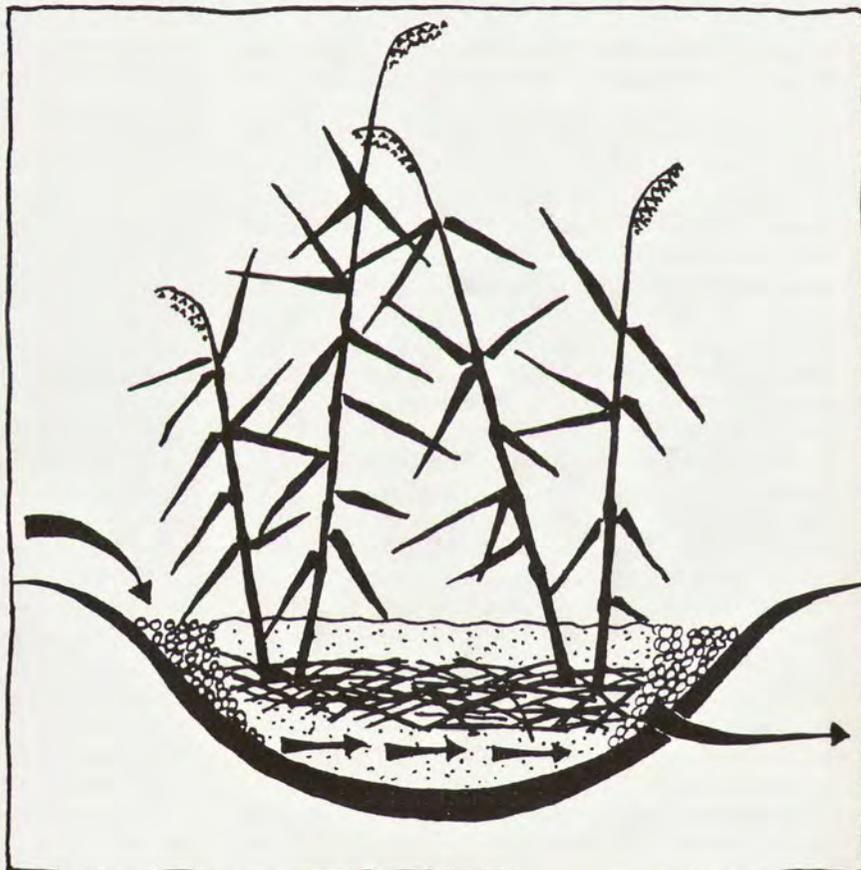
70 per cent. This is quite an expensive undertaking. In some municipalities treatment plans only account for a few per cent of nitrogen leaching to the sea, and in these municipalities it might be more cost-beneficial to invest corresponding amounts in the natural water systems instead. However, in sensitive areas the need to reduce nitrogen leaching is so great that it is necessary to invest both in the treatment plants and in the natural systems.

Nitrogen purification systems for municipal waste water treatment plants may be either conventional or biological. Conventional technology is expensive, and means "concrete-and-pipe" solutions. Biological technology, which uses rooting zone plants, biological filtration, etc., is extremely space-consuming and also means installing some pipe and pump systems, which often makes it just as expensive as conventional technology.

Measures which can be taken in the natural water systems are mainly "passive" ones, which require no technical installations or monitoring of operation and maintenance. Reinstating wetland areas, establishment of coastal beach zones, changing the drainage system of ditches and streams, establishing non-cultivation zones with natural vegetation along watercourses, are examples of measures for the natural water system.



Photo: BENGT PERSSON



Source: DAGGMASKENS DILEMMA

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Photo: BOSSE JOHANSSON

In Sweden, a massive expansion of modern waste water treatment plants took place, primarily during the 1960s. This resulted directly in the lakes and watercourses and the sea becoming less polluted. The water could once again be used for swimming, and fish species which had been eradicated returned. But we were overly optimistic about the purification capacity of the technology — and for this reason contemporary environmental work is being focused on purification at source. Catching pollutants before they reach the water should be one of our main strategies.

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WASTE – INCENTIVES TO CHANGE

Up until the 1980s, quantities of domestic waste increased steadily. The amount of household waste collected annually by municipal sanitation authorities increased from less than 15–20 kg per person in 1950 to over 300 kg per person in 1980.

Most waste management in Sweden has taken the form of landfill deposits and incineration. Today, 55 per cent of all household waste is incinerated in the 24 Swedish incineration plants. Sweden's 400 landfills mainly receive industrial waste, ash and slag from incineration processes, sludge from waste water treatment plants, and most of the remaining household waste.

Waste management today does not enable individuals to see the consequences of their behaviour, or the results of changing it. We need a climate with incentives to change. Local management of as much waste as possible and demanding comprehensive source separation will make it possible for people to see the effects of their actions.

Waste landfill deposit is a poor way of managing resources with a negative environmental impact, as it spreads pollutants to the soil, water and atmosphere. It must gradually be replaced. Today some landfill deposit is inevitable, but it should be minimised.

Sludge from sewage treatment plants could be a resource for farmers, was it not for its decontamination.



Photo: BENGT PERSSON

Borlänge – energy and waste

In the municipality of Borlänge, in the province of Dalacarla, a municipally-owned limited company (Borlänge Energy, Ltd.) has been given responsibility for both supplying the municipality with electricity and district heat, and managing its waste. This has had many positive synergetic effects, including intensive utilisation of waste for municipal energy production.

The Borlänge district heating network gets 65 per cent of its energy from three heat pumps connected to the waste water system of the local paper mill, Kvarnsveden. Roughly two-thirds of the households in Borlänge are connected to this network, as well as some other premises and places of work. A large part of the remaining energy demand is generated through combustion of household waste. In a longer-term perspective, however, combustion of household waste is not a sustainable solution, but must be seen more as a temporary measure. RDF fuel is also produced from household waste at a separation and composting plant built in 1980. This fuel is stored during the summer months and used during the winter. A huge roof will now be built over the RDF depot to keep the fuel dry during storage, so as to increase its energy exchange value and reduce pollution.



At the Borlänge district heating plant, some household waste is used as fuel, but this is not a sustainable solution, and so Borlänge has opened a central composting plant. This means that inhabitants can purchase not only electricity but also topsoil from their municipal energy authority.

At the separation plant, metals and compostable waste are removed, and the latter is then centrally composted and the product has been sold as top soil for gardening. The heavy metal content has posed a problem, but has now been reduced from an initial 2,000 ppm to 150-200 ppm today. In an ongoing project for more effective source separation at 2,000 households, values as low as 25-40 ppm in finished compost have been achieved. This indicates that substantially lower pollution levels can be attained through source separation than central sorting.

Borlänge has also distributed large amounts of information to the general public. All school classes from fourth grade through upper secondary school were visited by a representative of the energy authorities, and informed about waste, waste management, shopping environmentally-wisely, and environmental impact. The energy authorities have one person working full time with school information and integration of waste and environmental issues in education.

The separation and composting plant had an open house to show what happens with waste products after an individual throws them away. The local cable TV network broadcast information on waste for two hours a week for six months. Flyers about battery disposal were distributed to household, environmental groups, authorities and political organisations. Representatives of the energy authorities visit industries and construction sites with a view to improving separation and recycling techniques.

Both domestic and industrial materials recycling have increased in recent years, thanks to increased information and better equipment for source separation. Recycling increased by 37 per cent between 1986 and 1991.



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We must pursue efforts to recycle paper, glass and plastic, although such recycling is not yet very economically rewarding. Source separation and recycling must continue while long-term sustainable solutions to the waste management problem are being developed.

Central sorting of waste for compost plants does not result in good enough quality compost. Local composting of household and garden waste reduces many waste management problems, but require attitude changes as well as changes in municipal regulations if they are to be gain broad acceptance.

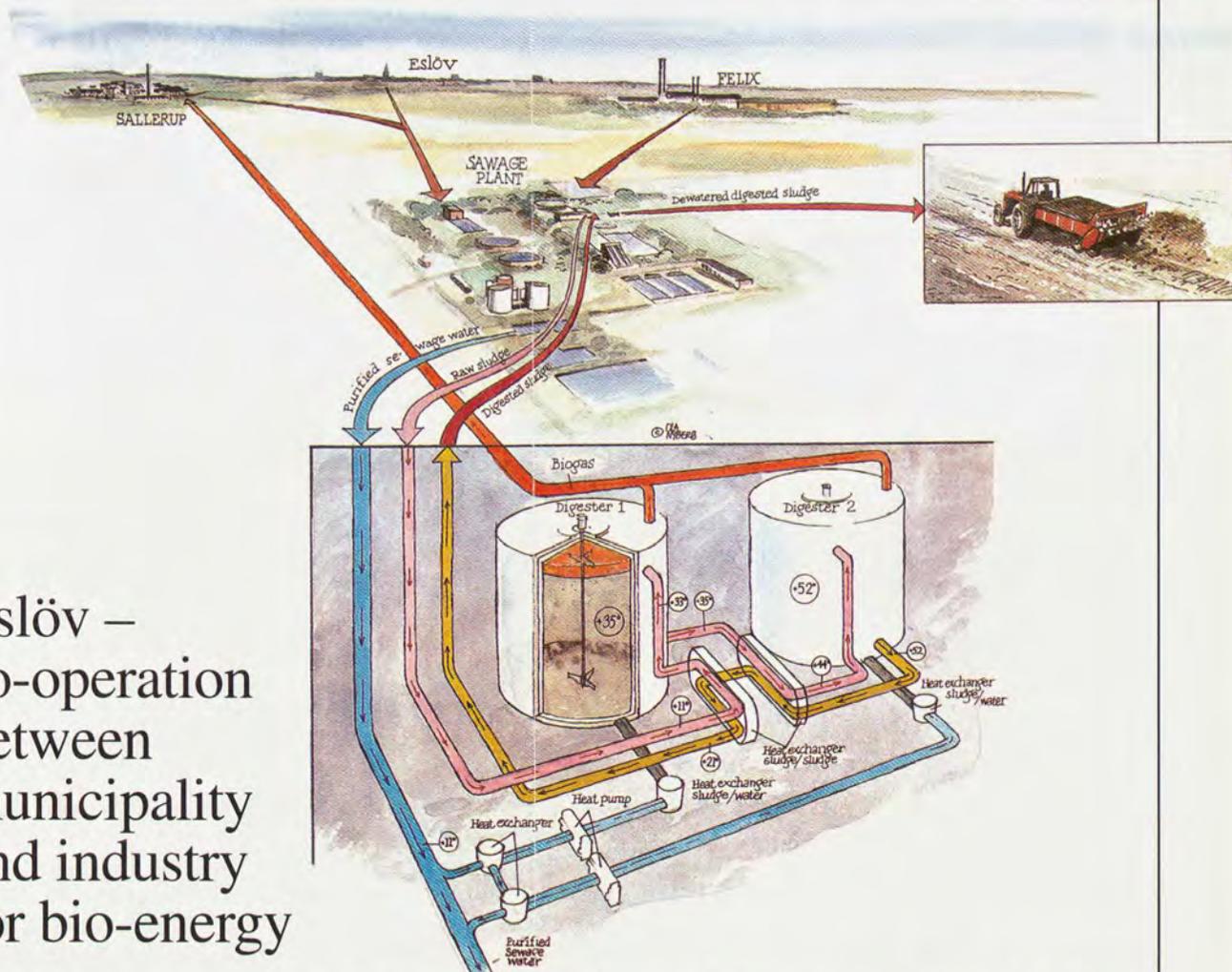
Transport of waste is extensive today and consumes enormous amounts of energy, is costly and has negative environmental consequences. Waste is space-consuming, and has to be collected frequently for this reason as well as for sanitary reasons. Landfills and, even moreso incineration plants, are centralised. Waste for incineration sometimes has to be transported more than 150 km from where it is collected. Recycling stations are few and far between, so recycled paper, glass and plastic end up being transported all over Sweden.

The sludge from sewage treatment plants must be decontaminated so it can be used as agricultural fertiliser. Today, pollution levels in the sludge from some plants are so high that the farmers' organisations recommend that their members not accept it. Increased source separation and management of hazardous domestic waste, increased awareness of the dangers associated with using various chemicals, cleansing agents, etc., can improve the quality of sludge and make it a product farmers will want to purchase. Implementation of measures at industries which generate large amounts of pollutants, etc. will also be helpful in this respect.

Transport of waste is extensive, costly and energy consuming.



Photo: BOSSE JOHANSSON



Eslöv – co-operation between municipality and industry for bio-energy

Bio-gas plants are very investment-intensive. To be profitable, there must be enormous depots or sedimentation chambers with large amounts of material for sedimentation. In many situations, it is difficult to make biogas extraction from household waste in sedimentation chambers a paying venture. The potential for economic feasibility increases in co-operation with major industrial or agricultural producers of biological waste, or farmers cultivating bio-energy crops for sedimentation. The municipality of Eslöv has had a sedimentation chamber for waste water constructed. They use it in collaboration with a food processing industry, Felix, which produce very large amounts of vegetable waste and other food waste. Municipal waste water accounts for 15 per cent of the sedimentation material, and Felix

for 85 per cent. Both fractions contain a great deal of water. The extracted bio-gas is conducted to a heating centre 1.5 km from the waste water treatment plant, service 450 one-family houses. The profit generated from the sale of the gas covers the waste treatment costs. The sedimentation residue is spread on the fields.

Previously the waste water treatment plant produced 20,000 tonnes of sludge annually. The sedimentation chamber has reduced this quantity to 6,000 tonnes annually. The sedimentation sludge has very low levels of heavy metals and other pollutants, and can therefore be used as a plant nutrient and soil improvement agent in agriculture. The municipality is now supplementing the plant with a domestic waste reactor. A pilot project involving 112 households has been successfully initiated.

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ENERGY – REFOCUSING ON SOLAR, WIND AND BIOFUELS

The sun is one of the sources of life — the most important of them all. The rays of the sun wake vegetation to life, trigger oxygen production. The sun is a basic prerequisite for life on earth. Plants store solar energy, which is then released to the benefit of mankind.

When the use of energy is dominated by fossil fuels, the balance of nature is disturbed. The carbon dioxide in the atmosphere increases, the temperature rises, the climate changes. This is what makes our contemporary use of fossil fuels a threat to the future of humanity.

To establish sustainable development, we must convert our use of energy to renewable and environmentally adapted sources. We must also make more efficient use of energy and develop energy supply systems that minimise our vulnerability.

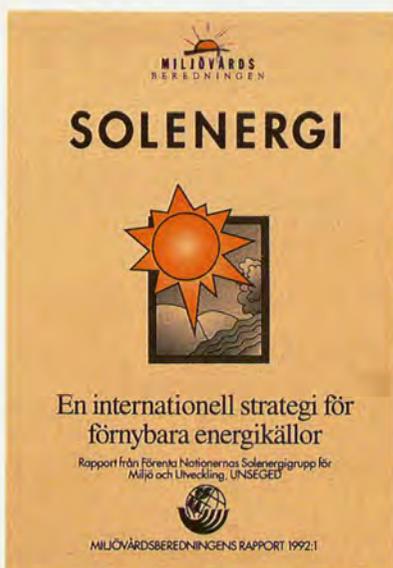
A system for renewable sources of energy will, by necessity, include technologies using many kinds of energy. This will have to be a decentralised system, with components on different scales, adapted to meet local and regional need. The energy flowing into the system will vary locally and over time. All this means that the supply technologies used in a renewable energy system and the end user technologies applied to satisfy energy service demands will have to be well-integrated. Such technologies are already available today.

The Swedish climate is a cold one, meaning that we need a great deal of excess energy to heat our homes and workplaces. We demand a high level of comfort: no matter how cold it is outside most of us want the indoor temperature to be at least +20°C indoors. Sweden also has a large proportion of built space per inhabitant: 93 m², including housing, offices and other facilities, but excluding industrial space.

Despite Sweden's cold climate, there is plenty of solar radiation during the summer months (just as much as in North Africa), but the heat needs to be stored for the winter half of the year. Technology has been developed to meet this need.

A great deal of work has been done to improve the insulation of buildings, and new buildings constructed according to the present norms and standards, are very energy-efficient.

During the 1980s, a great deal of work has been done in the construction sector to develop methods and technologies for energy efficient buildings. This work was successful, and it was concluded that residential buildings constructed in the 1990s would not need to purchase more than 100 to 120 kWh of energy per square meter and year. However, these technological solutions contained a fundamental error: The reduction in total energy consumption took place at the expense of increased consumption of electricity, most of which was used to run ventilation systems.



Solar Energy. A Report of the United Nations Solar Energy Group for Environment and Development (UNSEGED), November 1991.

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SYSTEMS REQUIRE
VISIBLE ECOCYCLES*



Despite its cold climate, Sweden has developed solar collector technology for both large and small scale applications. The photo below shows a field of solar collectors in Nykvarn in Södertälje. The picture to the left shows an energy-efficient building in Stockholm. It is an interesting illustration of the potential for building new, energy-efficient buildings right in the middle of densely constructed inner city areas.



Photo: BOSSE JOHANSSON

*URBAN SUPPLY
SYSTEMS REQUIRE
VISIBLE ECOCYCLES*

Photo: BENGT PERSSON



A factor that has exacerbated a move towards lower energy consumption in new buildings, is the increasing numbers of health problems attributable to poor indoor climates. A few years ago, a Government Commission reported that allergies are on the increase in Sweden, and that this is related to the fact of our poor indoor environments. The Commission concluded that the efforts to conserve energy in buildings had been overly ambitious, and that the problems which had arisen would have to be solved by expanding ventilation systems, which would require using more electricity. However, there are many indications that this argument is erroneous. The poor indoor climate in many buildings can mainly be attributed to a combination of unsatisfactory building materials and careless construction.

Sweden has long had excellent availability of electricity, and very low electricity prices by international standards. Half of the electricity supply is generated from hydropower and the other from nuclear power. Sweden, with its twelve nuclear power plants, has the most nuclear power per inhabitant of any country in the world, and total annual electricity production of 70 TWh. However, nuclear power is not a sustainable energy source. Therefore the Parliament, after a referendum, has decided that all nuclear power stations should be decommissioned latest by year 2010.

The conversion of urban building towards more energy effective structures is a slow process. Buildings are built to have very long lifetimes – hundreds of years. For this reason it is important to take the opportunity, every time a building is to be renovated or extended, to apply state of the art technology and the most energy-efficient solutions available.

The Stockholm City Real Estate Department calculates, for example, that in the year 2020 less than a quarter of the buildings in Stockholm will be "new buildings" (i.e. built no later than 1992), just over a quarter will be newly renovated, while the remaining half will at best have been renovated at some point and have had their equipment and appliances (boilers, refrigerators, etc.) replaced.

Swedish cities have reduced their dependence on imported fossil fuels, but their energy supplies are now more dependent on nuclear power. Promising results indicate that it is possible to reduce dependency on both fossil fuels and uranium, by more efficient energy use, and increased use of solar and wind power and biofuels. The technology is available, but is only used to a limited extent today owing to the fact that the price of electricity is too low.

*URBAN SUPPLY
SYSTEMS REQUIRE
VISIBLE ECOCYCLES*

Sweden's dependence on imports of oil has been substantially reduced through energy conservation and replacing oil with electricity from hydropower and nuclear power. But, because nuclear power is not a sustainable solution, the Swedish energy system is being refocused on solar and bio-fuels.

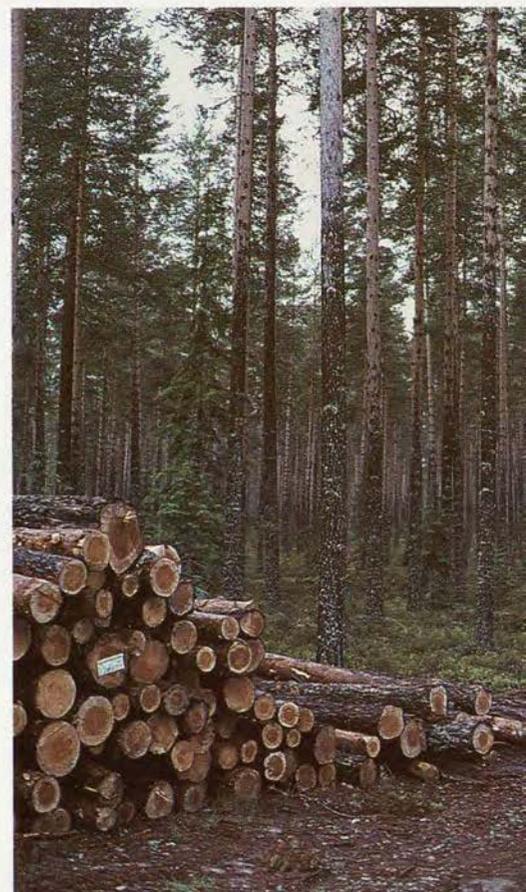
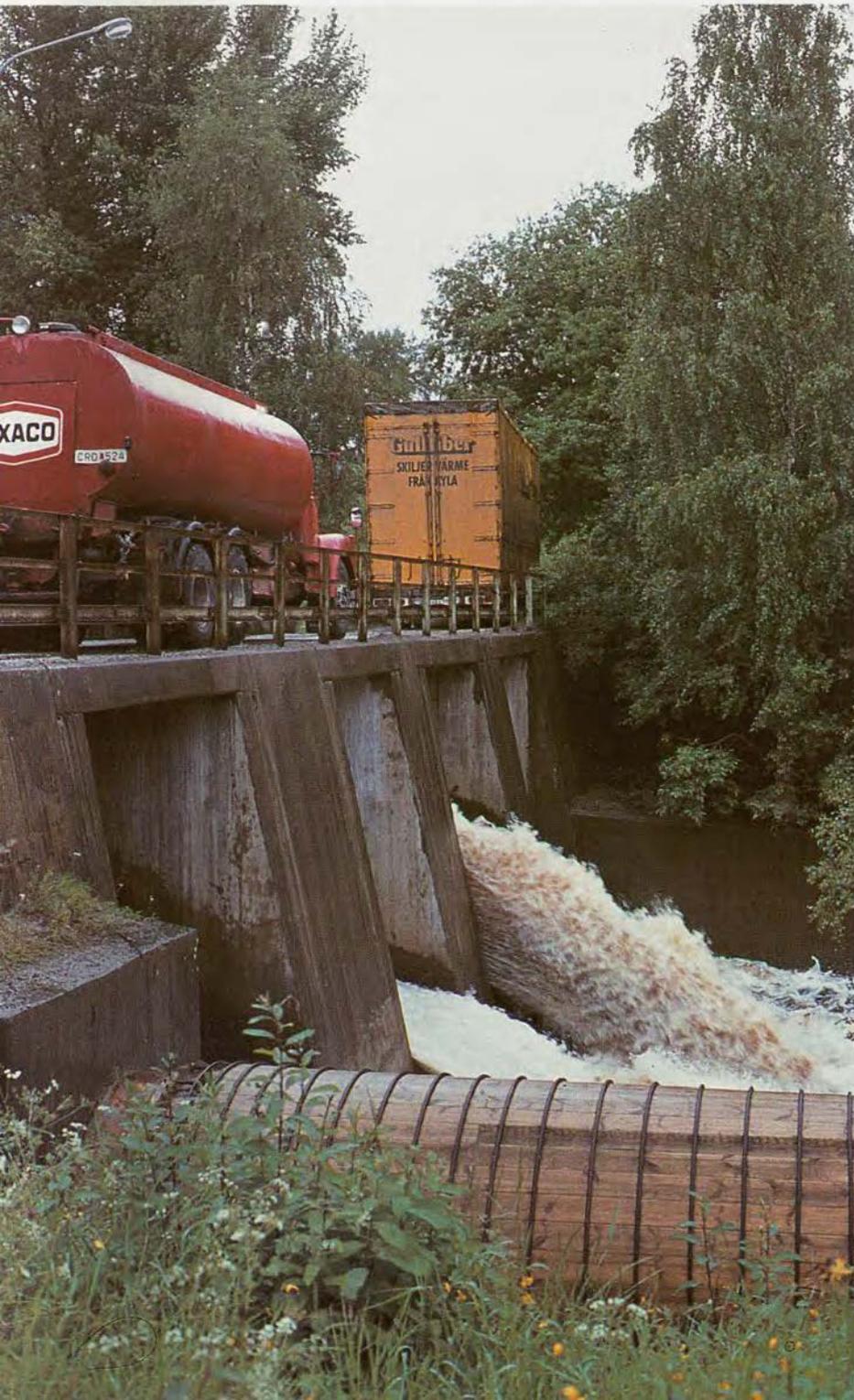


Photo: TOMMY MÅNSSON

Energy consultancy an important aspect of energy policy in Falkenberg

More and more of the energy used in the town of Falkenberg comes from the sun, the wind, and wood chips. And the people of Falkenberg also have access to free advisory services about how they could use less energy.

There are many visible signs of how Falkenberg has invested in renewable sources of energy. Along the main road coming from the north is one of Sweden's largest fields of solar collectors, and there is a wind power plant in the harbour. Close to the town centre you can see truckloads of wood chips being delivered to the district heating plant.

Falkenberg is a coastal town about 100 km south of Göteborg with 17,000 inhabitants in the town itself and 37,000 in the greater Falkenberg area.



The energy advisory services office in the town centre is not nearly as conspicuous as the solar collector field or the wind power plant. Anyone at all is welcome in, to consult with the town energy advisor. Most visitors come wanting help in choosing the best heating alternative: how much is a heat pump or a natural gas boiler? Can I fuel my boiler with wood?

The choice of technical solution is important, but the advisory service staff also stresses that changing energy consumption habits and maintaining the equipment you have can be even more important ways of reducing energy consumption. They speak at schools and elsewhere, and

encourage people to work out, for example, how much a long, hot shower costs in energy and in money.

You can also use the advisory service to find out about insulating your home, extra glazing for your windows, or sealing your doors and windows better.

The municipality of Falkenberg is showing the way to effective energy use by setting a good example. The municipal housing company has reduced the energy consumption in a block of 150 flats by 62 per cent over a ten year period. Their success is attributable to a combination of implementing gradual technical improvements, better maintenance routines, and an information campaign to the tenants. Experience has proven that if a building has a skilled, committed caretaker, it will be much easier to keep energy consumption down. Caretaker training has therefore become one of the many areas in which the advisory service works.

The energy consultant in Falkenberg has found there to be a connection between municipal efforts and individuals' interest in energy issues. A few years ago the municipality installed solar cells at the public swimming centre to heat the shower water, and many homeowners then wanted to install solar heat at home.

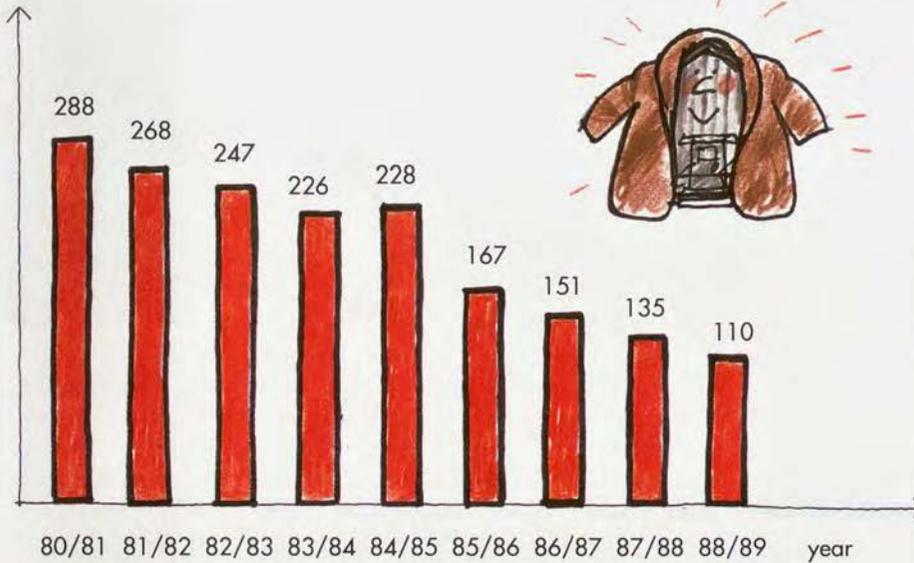
Falkenberg has been consistent and quite successful in promoting environmentally-profiled energy policies since the mid-70s. This has resulted, for instance, in a two-thirds reduction of oil consumption (excluding the transport sector).

In 1978, the municipality itself used 3,000 m³ of oil to heat schools, retirement homes, etc. In 1991 this consumption was down to 700 m³, despite an increase in the total heated area. They have managed to do away with 1000 cubic meters of oil, to replace another 900 m³ with wood chips and a further 400 m³ still with fossil gas solar energy and heat pumps.

The municipality has an important role to play in commissioning technologies for using renewable energy. For this reason, a few years ago the municipal energy authorities purchased a wind power plant developed by a local firm. Two more wind power plants have recently been ordered from the same firm, and in the municipality there are three more wind power plants spinning under other ownership. Falkenberg is a windy town, and it is possible to build many more.

The energy consumption was reduced by 62 per cent over a ten-year period in a block with 150 apartments in Falkenberg. Measurements, analyses, and attention to details gave good cost-beneficial results.

Purchased energy
kWh/ m² apartment-area per year



1980/81 New weather sealing for windows, thermostat-regulated apartment vents, more efficient boiler maintenance, posters on energy savings.

1981/82 The same measures implemented in all apartments.

1982/83 Drying rooms renovated, hot water temperature reduced from 65°C to 55 °C.

1983/84 Checking and replacing thermostat vents, run-off drains installed in bathtubs and sinks, information to tenants.

1984/85 Adjustment of regulatory vents for additional heat.

1985/86 Renovation work begun — insulation of attic, triple glazed windows, water conservation measures, outdoor air heat pumps begin operation, boiler room renovated, computerised heat control equipment.

1986/87 Renovation completed, adjustment of heating equipment.

Photo: MARTIN NAUCLÉR



The solar collector field, with a solar cell area covering 5,500 m², supplies heat to the district heating network during the summer months. Solar heat satisfies 10 per cent of the annual demands of the district heating system, with the remainder of the excess heat supplied by the wood chip-fuelled boiler.

Despite the cold Swedish climate, there is just as much

solar radiation during the summer months in Falkenberg as in Northern Africa, because the days are so long close to the north pole.

Around midsummer Sweden does not need much heat, except for hot tap water, but the good thing about solar heat is that it can be stored from summer until winter.

TRAFFIC - TOWARDS NEW MODES AND NEW FUELS

Twenty-five percent of all traffic in Sweden takes place on the less than 2 per cent of the Swedish road network in the three large metropolitan areas (Stockholm, Göteborg and Malmö). This concentration also means that these three areas have the best point of departure for an extensive public transport system, not least of the rail-bound type. Although the size of the rail-bound public transport network in Sweden is relatively small, it accounts for a relatively large proportion of Sweden's public transport, particularly in the Stockholm region. The ratio of car ownership per capita is also lower in the metropolitan areas than elsewhere in Sweden.

In recent years, passenger car traffic has, however, increased more rapidly than the population. This is partly because the transport distances have increased as distances between residential areas and places of work have grown longer with increasing urbanisation, and also because people choose to use their cars when travelling around the suburbs more than in the centre of towns. In Stockholm, between 1980 and 1987, car travelling increased by 17 per cent, while the number of people travelling by public transport dropped by 7-8 per cent during the same period. In Göteborg car travel has increased by 3-4 per cent annually over the last few years, while the number of people travelling by public transport decreased by 9 per cent between 1985 and 89. In Malmö, car traffic has increased by a few per cent per year, and between 1985 and 87 the number of people travelling by

TRAVEL HABITS IN SOME CITIES 1980

City	Degree of land utilisation (Housing and places of work per hectare)	Choice of transport type for travelling to work		
		Private automobile	Public transport	Foot and bicycle
Phoenix	13	93	3	3
Perth	15	84	12	4
Washington	21	81	14	5
Sydney	25	65	30	5
Toronto	59	63	31	6
Hamburg	66	44	42	15
Amsterdam	74	58	14	28
Stockholm	85	34	46	20
Munich	91	38	42	20
Vienna	111	40	45	15
Tokyo	171	16	59	25
Hong Kong	403	3	62	35

Source: World Watch Paper 98.



Photo: BOSSE JOHANSSON

public transport in Malmö dropped by 12 per cent. Unless the physical and economic situations change, this trend is expected to continue.

In an international perspective, a relatively large proportion of the travelling done in Stockholm is done using public transport. The corresponding proportions for Göteborg and Malmö are substantially lower. Nearly one-third of the transports carried out in many cities are short ones, done by bicycle or on foot. There is also a great deal of distribution traffic, carried out by lorry. Planning of residential areas, services, places of work, public transportation and depots are all important factors that will affect future developments in transportation work.

In large cities, automobile traffic gives rise to substantial disturbances including increased levels of air pollutants that damage human health, and noise. Traffic is the foremost source of these disturbances. According to Swedish studies, urban air pollution causes between 300 and 2,000 new cases of cancer annually. Traffic accounts for roughly 70% of the emissions of carcinogenic substances, and substances that may affect the genes of people living in urban areas, the main problem being hydrocarbon emissions.

Air pollution from traffic and emissions from other sources may affect

human health both directly and by contributing to allergies and other types of over-sensitivity. Such health problems have increased in recent years.

Noise from various sources may disturb people's ability to work, sleep and relax, as well as affecting the human cardiovascular system. Calculations indicate that one to three million people per day experience disturbance from road traffic noise in Sweden. Traffic is by far the main contributor to urban noise disturbance.

In city centres and other urban areas, vehicle exhaust fumes account for roughly 60% of the emissions of oxides of nitrogen and hydrocarbons.

The transport infrastructure uses land and, in cities, where land is most valuable, the land required for the traffic system poses large problems. For example, calculations for Stockholm indicate that traffic (in the broad sense) uses nearly half the urban land area. Generally speaking, road traffic requires more land than railway traffic. Roads and railways cut through the landscape and impact on large areas. The degree of disturbance they cause will depend on the nature of the landscape. Roads and railways also give rise to "barrier effects", in that they are difficult to cross.

Urban motorists in Sweden express ambivalence about cars and the environment. Human ecologist Emin Tengström studied motoring as a social phenomenon, and found that people tend to "regard cars as an everyday necessity, but feel concern about what effects driving is actually having". In Göteborg, travel by car increase by 5 per cent annually throughout the 1980s. Tengström sees no conflict between this fact and motorists' ambivalence. But if the burden motoring places on the environment becomes clearer, and if the ambivalence is explicitly expressed, this may generate sufficient mental energy to trigger individual initiatives and collective political action.

There is a clear relationship between any city's structure and its traffic patterns. The boom in housing construction during the 70s and 80s meant that people were spread out over vast areas, and it was difficult for public transport to keep pace, and offer all neighbourhoods satisfactory proximity to public transport with good headways. On the other hand, more densely built-up cities makes it more difficult to integrate all aspects of life into local ecological cycles, which are a prerequisite for sustainable cities.

A COMPARISON OF METROPOLITAN REGIONS

	<i>Stockholm region</i>	<i>Göteborg region</i>	<i>Malmö region</i>	<i>City of Stockholm</i>	<i>City of Göteborg</i>	<i>City of Malmö</i>
Population as of 31 December 1987	1,606,000	686,000	463,00	667,000	432,000	231,000
No. cars per capita as of 31 December 1987	351	384	380	340	364	354
No. car journeys to and from city centres per day	-	-	-	590,000	460,000	250,000
No. of the above journeys on through roads	-	-	-	150,000	70,000	60,000
No. journeys by public transport in millions /year 1987	498	122	60	--	88	38
No. journeys by public transport per inhabitant/year	310	180	130	--	205	165
Percentage of public transport	42%	25%	approx. 10%	53%	32%	24%

Source: The metropolitan traffic committee.

Ethanol buses in Stockholm

Since 1990, SL (the Stockholm Local Mass Transport Company) has had thirty-two ethanol-fuelled buses serving the city centre. The ethanol is produced from by-products from a sulphate pulp mill in Domsjö, in northern Sweden, so the raw material is wood. Ethanol can also be produced through fermentation of various agricultural products. Ethanol buses generate, for instance, far fewer emissions of nitrous oxides and particulates than diesel buses. There are considered to be no carbon dioxide emissions at all, as the raw material is renewable. SL are very pleased with their experience from using the ethanol buses, and the predicted risk of increased wear and tear on the engine have proven unfounded. SL now wishes to introduce only ethanol-fuelled city centre buses (300 buses) by 1998, but it is more expensive to run buses on ethanol than on diesel fuel, and so the future of ethanol will ultimately be a political issue.

In 1990, the Stockholm municipal council adopted a decision stating that: "planning is to be concentrated on doing away with diesel-fuelled vehicles within five years and petrol-fuelled vehicles within fifteen to twenty years." But Stockholm is far from being capable of fulfilling that objective today.

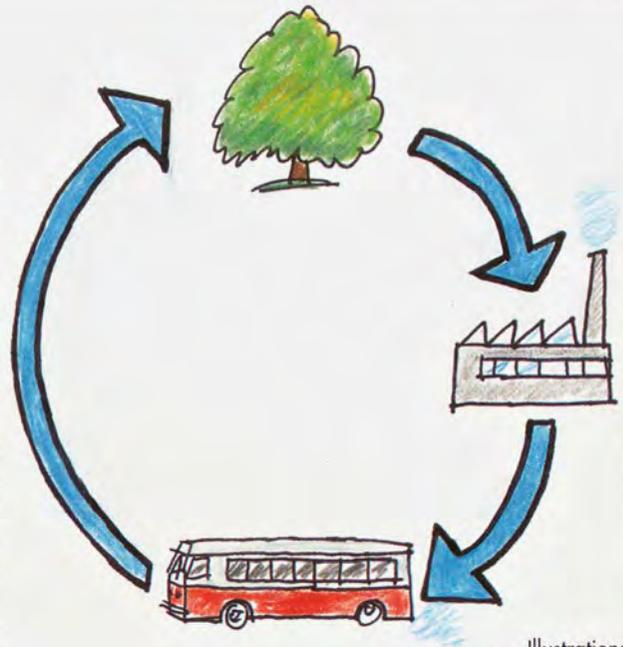


Illustration:
BIRGIT ELIASSON



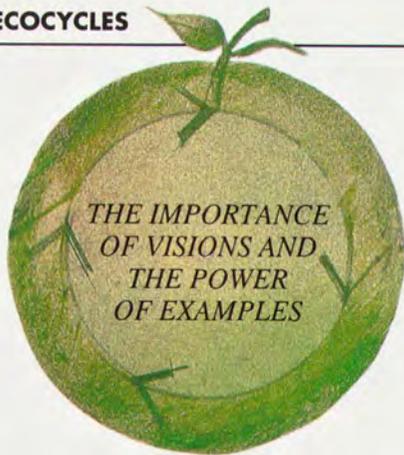
Photo: BOSSE JOHANSSON



THE IMPORTANCE OF VISIONS AND THE POWER OF EXAMPLES



Local work to achieve change requires the active participation of everyone in society, working together towards common environmental goals. This requires visions and creative thinking



The municipal organisation of Sweden has its own habits and inertia. To create sustainable cities, attitudes and decision-making processes will have to be changed. Today, municipal planning focuses on decision-making. This focus must shift and become a process-orientation if municipalities are to develop solution multipliers. Basic change will also have to be based on inter-administration co-operation and extension of competence boundaries.

There are three main challenges that must be faced for creative thinking and change to take place in the sphere of Swedish municipal authorities:

- Planning by Swedish municipalities is carried out in an extremely sectoral way. For example, one municipal authority is responsible for physical planning, and others for issues relating to the infrastructure, water, waste, traffic, and energy. These issues must begin to be seen holistically, and the various experts must help one another to identify and implement measures.
- Municipal solutions for maintaining the technical infrastructure for waste water, traffic, sanitation, etc. tend to be general high-tech ones. For example, all municipalities and all inhabitants are tied to the same type of solid waste and waste water management systems. In other words, municipalities collect the rubbish from a city apartment block in the same way as from a rural farm, and according to the same principles

in Stockholm as in villages. Technological solutions for maintaining the infrastructure must be adapted to local conditions, and local solutions developed to utilise potential for co-ordination.

- The actors in municipal decision-making and implementation processes are professional. Decisions are made according to a highly-structured process, by municipal administrations and committees. Sub-optimisation of decisions in individual administrations makes it difficult to have an overview of the general situation. Because the actors are professional, they are part of a tradition of facts and reporting in which inertia figures as a constant, rather than change and creativity. The structure will have to be changed to activate the actors, and work organisation adapted to the real prerequisites of the matters at hand.



This chapter describes experience from five municipalities – Ystad, Örebro, Göteborg, Timrå and Övertorneå. These municipalities vary in size and commercial structure, and each one has its own special environmental problems. Each municipality has also chosen its own special way to attack the environmental problems.



Photo: OLA SJÖSTEN

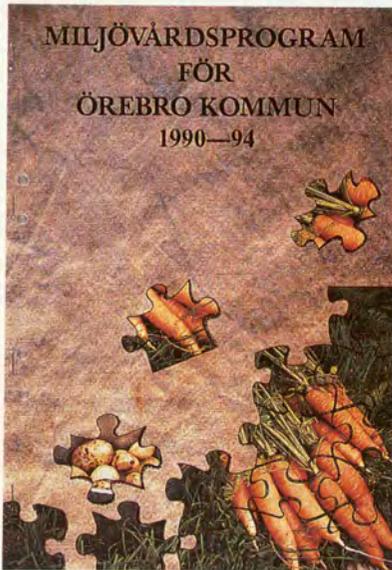
Ystad – city and countryside in co-operation

Ystad municipality has decided to strive towards the development of ecological cycles between city and countryside, and to make Ystad into an eco-municipality by the year 2000. Ystad is cooperating with The Centre for the Urban Environment at the Swedish Agricultural University on a project known as "City and countryside in co-operation". The project has five subareas – water, flora and fauna, waste, local production of food processing and local production of bio-energy. Change in the municipal organisation has been identified as a major prerequisite for implementing broad municipal change in the direction of ecological cycles and greater sustainability. Municipal officials and external researchers work together in the sub-projects.

That work will, in itself, lead to changed attitudes and ways of thinking. The aim of the subprojects is to develop strategies for work in Ystad in each respective area: both in accordance with a three-year plan, and also until the year 2000. When the sub-projects are completed, there will be a run-in phase for integration of the new strategies and attitudes amongst other municipal officials and politicians. Via the mass media, associations and organisations, schools, pre-schools, educational societies, etc., the general public will be involved in attitude change. Concrete pilot projects will be initiated by each sub-group within a year, and provide object lessons to the press and the public as well as municipal officials and politicians.

THE IMPORTANCE
OF VISIONS
AND THE POWER
OF EXAMPLES

ÖREBRO – WIDE-RANGING ENVIRONMENTAL WORK



Environmental work at municipal level in Sweden has mainly comprised efforts to keep pollution under control. For example, municipalities have measured emission levels and compared them with limit values. If the readings were in excess of the limit values, the municipalities intervened and demanded remedial action. In other words, municipalities have tried to ensure that pollution was kept within the permitted limits (often in relation to centrally-established norms). Today, Örebro is striving to implement preventive measures to reduce the environmental load, and, in a way to go further than the centrally-established minimum norms require.

The city of Örebro, with a population of approximately 120,000 and a trade sector dominated by service and commerce, activated its environmental work in the early 1980s. In 1981 they drew up the first draft of a municipal environmental protection programme, the final form of which was adopted by the local government two years later. In 1989, Örebro appointed an environmental delegation, a special organisation with representatives from all the central municipal boards, and directly responsible to the municipal council. Its purpose was to co-ordinate environmental work, find new ways to go about it, and experiment with unconventional methods. In 1991, the environmental delegation was superseded by a standing committee on the environment. The Örebro municipal environmental programme for 1990-94 states that society must be structured on basic ecological principles. In the foreword to the programme, the objectives of environmental work in the municipality are described as follows:

"Our aim is to structure social developments around a basic ecological view, including ensuring that resource consumption and pollution must not exceed what nature can withstand. However, successful environmental policy requires more fundamental reassessment of many aspects of society. The aim of development work and social planning must be to improve economisation of resources. We can only achieve long-term acceptable development by reducing our consumption of natural resources.

We must adopt political decisions for limit values laid down by law, environmental surcharges, and specification of legal liability – to mention a few examples. We must make political decisions to obtain public transport solutions for our traffic systems, and collective solutions to the problems associated with energy systems, water, effluent and waste management. Public agencies and Boards of Directors, associations and industries must all contribute to energy conservation, procurement



Photo: BOSSE JOHANSSON



At a day nursery in central Örebro, children learn to bring ecocycles full course. After every meal, they clear the table, separate compostables into buckets, and carry them to the warm compost pile. The rich composted soil is used to fertilise the children's vegetable garden.

*THE IMPORTANCE
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**Blekt eller oblekt.
Du känner ingen skillnad
- men det gör naturen!**

**Naturen sväljer
inte all.**

Mother nature cannot swallow whatever we feed her. You won't feel the difference if you use bleached or unbleached products — but she will!

of environment friendly goods, environmentally sound manufacturing processes and products.

It is a major political task to provide the prerequisites, through information campaigns and the creation of public opinion, for adopting sufficiently effective laws and other ordinances. When conflicts arise between the interests of profit and the long-term, comprehensive interests of society in safeguarding the environment, the latter must be given precedence, via the organised, democratic forces in society. When conflicts arise between short-term employment factors and environmental considerations, precedence must be given to what nature can withstand. Otherwise, in the long run, employment will also be threatened."

ACTIVE PROMOTION

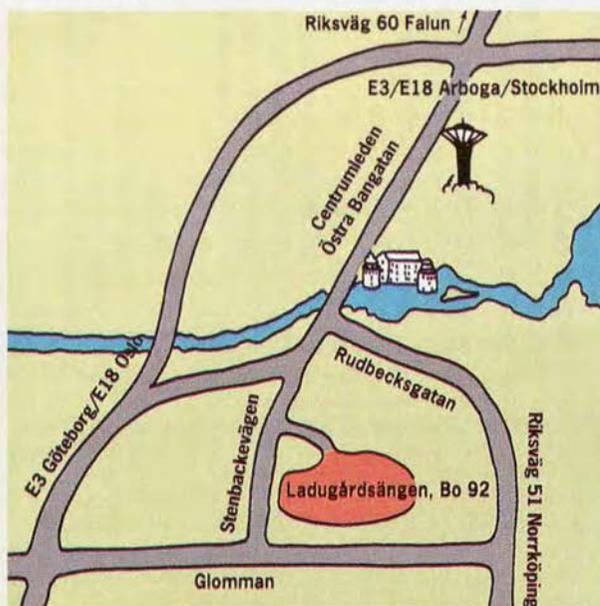
This was the environmental protection programme adopted by the municipality. But what did they do then? Their work has progressed at several levels. The local government has not only played its part as a public authority, but has also been active in promoting, demanding and innovating. Establishment of the environmental delegation was a clear signal from the local government to all its agencies that environmental work was being given high priority. How is it possible to get around the inertia often experienced when local government agencies are to attack new problem areas? The solution used in Örebro was to initiate co-operation beyond the usual territorial bounds.

In the past, municipal work had been extremely linear. Each section has dealt with its own issues, and stayed out of those of others. Many obstacles have been abolished by experimenting with new working methods. One example is the "Give the Environment a Chance" campaign, carried out by the City Management Board. The campaign promoted a new life style to reduce the environmental load. The daily newspapers ran advertisements with headings including: "Keeping your home clean can be dirty work – for nature" (on domestic chemicals), "If you take your car when you don't need it, you're taking yourself for a ride" and "Bleached or unbleached? You won't feel the difference, but Mother Nature will" (on different kinds of toilet paper). The purpose of the campaign was to help raise awareness among people living in Örebro of how their own lifestyles impact on the environment, and it was concluded with a festival for the environment in the town square, including a waste source separation competition between school children and politicians. A study made by Statistics Sweden indicated that many people changed their purchasing habits after the campaign.

Physical planning usually means working on the basis of given guidelines. There must be one pipe system for drinking water, one for waste water and one for storm water. There must be pipelines for energy and district heating. Roads are to have specified dimensions, and there are to be a certain number of parking spaces per square meter of dwelling space. There are even norms for the distance from buildings to bus stops. When



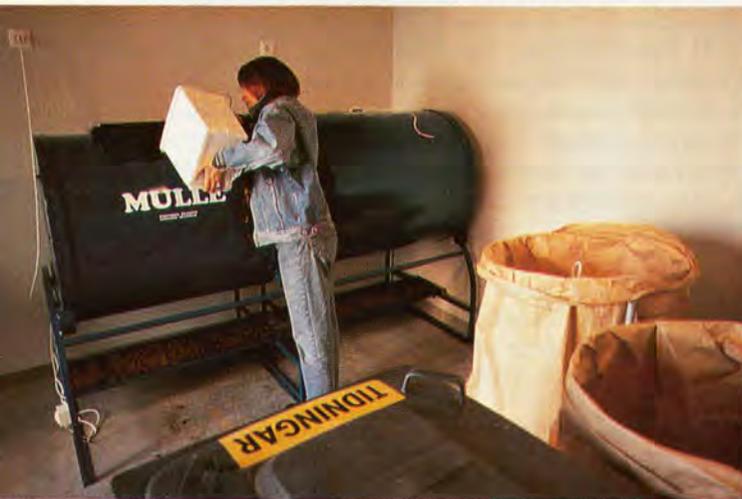
Ladugårdsängen, a new area in Örebro



Ladugårdsängen, an area planned on the basis of ecological principles, will be complete by the summer of 1992 when Örebro is hosting a trade fair known as Housing '92. The neighbourhood will consist of some 850 apartments in large and small apartment buildings built for over twenty housing associations – private, public, and condominium. The philosophy of the cycles of nature will be expressed at various levels, from the municipal master plan through technical design and appearance on site, to the lifestyles of the people living in the different buildings.

The following principles have guided the work of the municipality:

- The area was chosen because it is in easy reach of the town centre, about 1 km by bicycle.
- The area will have both residential neighbourhoods and places of work. Probably about 500 people will work there.
- Rain water will be collected. Ladugårdsängen will use soil infiltration and conduction to ponds for local storm



► Ladugårdsängen, a new area in Örebro

water (rain water) management. This will make the storm water an asset to the area, instead of a load on the receiving waters. The soil will be the catchment site for phosphorous, metals and other substances normally transported to rivers and the sea with a detrimental impact on their quality.

- Reducing the number of parking spaces in residential neighbourhoods makes them somewhat more people-oriented. Making new parking areas along the edges of the main roads and utilising existing parking spaces more rationally has made it possible to reduce parking to 70 per cent of the normal parking standard. Where there used to be cars there are now garden allotments, which makes the environment pleasanter and increases the real estate value of the property.
- Waste separation. Rubbish trucks will come to Ladugårdsängen less and less frequently over time. The inhabitants will reduce the quantities of waste they produce and manage their own waste as far as possible. The waste management plans for the area provides for a variety of solutions, extensive source separation and composting. There are plans to provide the people living in the publicly-owned collective apartment house with a worm composting system. The condominium buildings have been built with thermal composting facilities, and special compost rooms alongside every street entrance. The privately-owned buildings will have a suction system for waste separation.
- Differentiated streets with traffic separation will increase safety and improve the environment.
- The proximity of recreational facilities (a golf course, sports hall, swimming centre) and excellent parks (the Sörby woods) will make it possible for the inhabitants of the area to do sports and be out of doors without needing a car.

There was also a proposal during the early planning stages for local waste water treatment. A system of separate waste water systems was initially discussed, to make it possible to conduct toilet waste water to a bio-gas plant and extract energy to obtain rich, usable sludge. However, these plans were abandoned owing to the high cost and some scepticism about the untested technology. A small number of the apartments will now be testing a new kind of water-economising toilet with considerably lower water consumption than a normal toilet – 0.8 litres contra the normal figure of 6 litres per flush.



At Ladugårdsängen, Örebro, new ways of building and housing are tested. It is a mix between traditional building style and modern architecture.

Photo: BOSSE JOHANSSON



*THE IMPORTANCE
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the newest area in Örebro, known as Ladugårdsängen, was going to be planned, traditional thinking was reversed, and new questions asked, including: “Do we really have to follow all the specified planning guidelines?” “Do we have to plan for cars?” “Do we have to have waste collection vehicles?”, etc. Planning work for Ladugårdsängen began on the basis of such perspectives, and although many of the ideas generated were not ultimately used right there, a whole new way of thinking about physical planning came into being.

What happened can be described as the meeting of old and new ways of thinking: planning in the 1970s could be described as predominantly waste water planning. The capacity of the water and waste water network and population size in relation to services required determined the results of planning. A new area had to have enough people in it to justify construction of primary schools and shops. Today, methodical planning on the basis of ecological factors has begun to dominate. One example of what this means in practice is that all detailed planning in the future is to include environmental impact assessments.

RESOURCE MINIMISATION

But Ladugårdsängen is only one small, new part of Örebro. The rest of the environmental work done there must be based on existing environments, including a densely-populated part of the city with mostly stone buildings, and other areas which have been built up throughout this century. The municipality emphasises words like resource minimisation, re-use, energy conservation, energy production with renewable sources of energy (solar power, wind power, and hydropower), in stating its main objectives for environmental work. Cautious use of chemicals and consideration of what nature and living organisms can withstand are other ways in which this basic ecological view is expressed. When it comes to actual goals, the municipality has set a zero-emission limit for some toxic substances and others which only biodegrade very slowly (i.e. no emissions at all). For other substances, the goal is to keep pollution increases low in relation to natural background levels. For polluting substances which occur in nature, the goal is to bring every pollutant down to a level safely below the lowest level at which tangible negative effects are known to occur. Another fundamental approach has been to attack environmental problems at source. This means:

- Reducing emissions of acidifying substances rather than treating watercourses with powdered limestone.
- Limiting noise disturbance rather than muffling it.
- Economising with raw materials and promoting recycling.

As an aid in this work, and to raise awareness of the significance of environmental issues, a decision was adopted to introduce environmental impact assessments in municipal work beginning in 1991.



Photo: BOSSE JOHANSSON

Bicycles - the ultimate environmental alternative

Electric cars and public transport are being promoted as environment friendly alternatives today, but some people go by bike!

In Örebro, you cannot miss the many bikers when you look around the city of 120,000. By Swedish standards, Örebro is an average size city, and the city has consciously routed separate bike paths from all the outlying areas into the city centre. Once they get in, they can continue on undisturbed bike paths along the main roads, but have to get on with the other kinds of traffic elsewhere.

Between 1976 and 1990 the number of people cycling to work increased from 25 to 42 per cent, and the number of people driving to work decreased from 53 to 43 per cent. If men were to alter their travel habits to be more like women's, the percentage of bikers would further increase. Visitors can join the ranks of the bikers by renting a yellow city bike for fifteen kronor a day.

Biking is a very good transport alternative. From the point of view of resource conservation it is only surpassed by walking. One disadvantage of biking is that the risk of accidents is rather high. Swedes are wearing more and more bike helmets, as protection against head injuries, which are often quite serious. It would be possible to build with the risk of collisions almost entirely out of existence, at very little expense in comparison with the total amounts of money being spent on our infrastructure.

Örebro is a small enough city that it is basically possible to bike everywhere. In large cities (which in Sweden include Malmö, Stockholm, and Göteborg) it should be possible to expand biking both over shorter distances (for example around the city centre, or from the outskirts into the city) and in combination with public transport. But bike traffic tends to be forgotten when transport routes are planned.

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In some problematic situations, for example in relation to pesticide residues in water, various local agencies have collaborated to find solutions. In that project, the environmental delegation worked with the environment and occupational health administration, the town planning office, the labour market office, the County Administrative Board's department of trade and industry, and representatives of agriculture.

In 1990, the environmental delegation initiated a project in collaboration with affected farmers and the municipality, for the establishment of non-cultivated buffer zones with natural vegetation along watercourses. Buffer zones prevent water pollution from soil particulates and precipitation. The municipality has drawn up detailed measures to be implemented for every section of its environmental protection programme, specified what local government bodies are responsible for implementing them and ranked the



Use of green stretches has been the planning instrument in Örebro for getting corridors between the city and its surrounding.

Jointly-owned cars mean less car travel

The VivallaBil car co-op has been working in Örebro for ten years. People who once owned their own cars travel dramatically less by car after joining the co-op.

The VivallaBil car co-op was founded in 1982 in the Vivalla area of Örebro. The original idea was to give people access to a car without having to own one, so that people of lesser means could also go the kind of places you need a car to reach. The authorities originally subsidised the project, but the co-op has now been completely self-sufficient for years.

Twenty-five households are members of the VivallaBil car co-op. The co-op rents a few extra cars in the summer, when demand is higher. During the daytime, when the members seldom drive, the co-op rents its cars to the municipality.

Ten years of experience indicate that car co-ops can lead to an overall reduction in car travel. If the idea spread widely, it could contribute substantially to reducing the environmental load of motoring.

The co-op's cars are all quite new and high standard, and they are economical to drive. Because they are utilised effectively, they also cost less than privately-owned cars in terms of the environment. Although the co-op's cars are not expensive to operate, co-op members still drive considerably less than "ordinary" motorists. Members who sold their own cars to join the co-op drive less than half as much as they did before.

Why is this? In addition to co-operatively owned cars being somewhat more difficult to "get at" they have to be booked and the key has to be picked up – the individual driver feels the expense of his or her car use much more clearly, because you only pay when you use it. It costs between 185 and 220 kronor per day to hire a car, and it has to be returned with a full tank of gas. If you own your car, you are not nearly as distinctly aware of how much it costs every time you use it. The cost of the petrol is actually only a fraction of every trip. Three-quarters of the cost is paid at other times than when you are doing the actual driving, and include interest on loans, taxes, inspection fees, insurance, maintenance, accessories, repairs, garage rent, tires, etc.

If you own a car, you have these fixed expenses, but once you have paid them the marginal cost per kilometre is quite low. In this way, automobile ownership encourages more car travel.

Efforts have been made to start car co-ops elsewhere

in Sweden, but in most cases it has been extremely difficult to find enough people who were interested in getting a co-op off the ground. This disinterest stands in sharp contrast to the stability of VivalaBil and the loyalty of its members over the years. Although many members have moved to other parts of Örebro, they have remained in the co-op. Car co-ops appear to face a pedagogical problem. It seems difficult to make non-members aware of the benefits the members who have tried the system feel it has.

Joint, as opposed to individual, car ownership means having to plan your driving in advance. A co-operative car

Photo: CHRISTER PÖHNER



Sharing a car has multiple benefits.

owner has to sacrifice the spontaneous joy rides a private car owner can make. This difference may be one of the main explanations for the sparse interest in car co-ops, but it is also one of the reasons co-operative car ownership can reduce the environmental load in comparison with private ownership.

It has been proposed that part of municipal traffic policy should be to contribute to the establishment of car co-ops. A general transition from private car ownership to collective ownership could reduce road traffic and consequently also reduce the need for expensive road construction projects. Moreover, more people would travel by public transport. Car co-ops could be encouraged through incentives such as free parking, help with bookings, etc.

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projects in order of priority by determining the date by which each measure is to be implemented.

Follow up is another important aspect of municipal environmental work. The municipal council has highlighted the significance of environmental issues for the welfare of the population and the future of the municipality by closely monitoring the environmental work carried out by the local administrations. In dialogue with all the bodies involved, the environmental delegation has performed evaluations, and prepared written assessments of the work of each administration. The evaluations were made public in the local press, and were also published in the municipality's personnel newsletter. The environmental delegation stated that this was very important in keeping up the interest of all parties involved.

Örebro has proven to be a pioneer municipality in environmental protection work in other ways besides these organisational changes and new working methods. They have found new technologies and methods for solving old problems. The district heating system built up by the municipality – including a combined heat and power plant, CHP, based on solid fuel (wood chips, lumber from demolished buildings, etc.) is considered very environmentally sound. Its combustion processes are effective and controlled, and its sophisticated technology makes it possible to substantially reduce the levels of most types of emissions.

As an example of the ambitions of the municipality, the energy plan and environmental protection programme propose measures to:

- Reduce environmental impact
- Reduce energy consumption
- Increase the use of renewable sources of energy
- Increase the proportion of wood fuels used at the CHP plant

Extremely high goals have been stated for the CHP plant, including the use of at least 50 per cent wood fuel in the new solid fuel boiler until 1994. This will mean lower emissions of sulphur and mercury than combustion of peat or coal, and no increase of the carbon dioxide level in the atmosphere.

A new energy plan will be drawn up in 1992. One of the goals will be to take concrete measures to encourage the use of renewable types of energy.

The goal of the municipality with regard to domestic and industrial waste is to plan with a view to reducing waste quantities, its disruptive effects on human health and the environment, and optimum utilisation of management resources. In order to achieve this, waste is to be regarded as a resource, and the municipality has been instructed to aim for maximum recycling through source separation. One objective is to reduce the total waste fraction deposited by 50 per cent between 1990 and 1994.

Many measures will be implemented with regard to waste. The environmental protection programme details seventeen measures, twelve of which are ranked as high priority. These include measures to reduce or phase out entirely municipal organisations' use of disposable materials, recurring neighbourhood campaigns for special disposal of hazardous waste, and a study of the possibility of differentiating waste collection



The consumer handbook "Environment Friendly Shopping", produced by the Swedish Nature Conservation Society, has been used in Örebro as well as in number of other Swedish municipalities in their campaigns.

tariffs to stimulate households and industries to separate their waste. A comprehensive waste management plan has been adopted, and the local sanitation department has run a successful campaign to stimulate waste separation.

Örebro municipality and the local tradesmen are running a joint campaign called "the Black List" to stimulate environmentally sound shopping, focusing on household use of chemicals and their environmental load. The campaign is part of an agreement with the retail trade in an effort to limit the proportion of environmentally hazardous products in the product range of the grocery, automotive, paint and construction sector. The campaign has received a great deal of attention, and was copied by other Swedish municipalities.

This campaign, in conjunction with the "Environment Friendly Shopping" campaign run by the Swedish Nature Conservation Society have made the people of Örebro municipality more aware of their environmental impact, and of how a consumer's product choice can affect the environment. Relatively large environmental benefits have accrued from this collaboration with the retail trade. In one year, the number of environmentally harmful products sold was reduced by 75 per cent because manufacturers changed the chemical contents of their products. Some suppliers have also stopped importing products containing hazardous substances.

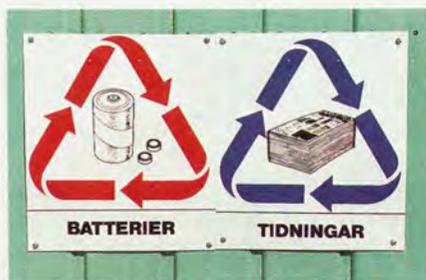
Other examples of ongoing practical environment work in Örebro include efforts to improve water quality in the Svartå River, the water supply source of Örebro. Those efforts include the introduction of "buffer zones", areas adjacent to watercourses where land utilisation is limited. This is achieved in negotiation with farmers and land owners in which they are encouraged to safeguard the water from nutrient leaching (primarily of nitrogen and phosphorous) and pesticide leaching.

The establishment of the Örebro Environmental Protection Centre in 1985 was another initiative. The centre works with organic gardening and experiments with alternative forms of cultivation and composting. The centre runs tours for school and pre-school children, teaching them about ecological relationships and the laws of nature. And a private initiative known as "the ecology bus" makes it possible for the school children of Örebro to learn about the cycles of nature on site.

Since 1985, the municipality has also consulted regularly with all the environmental and nature conservation associations via the nature conservation council, on which members from the various interest organisations serve. The council discusses various plans and proposals for improving the conditions for the flora and fauna of the region, and its biological diversity.

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Waste is separated into four main fractions — batteries, newspapers, transparent glass and tinted glass.



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THE GÖTEBORG ENVIRONMENT PROJECT – A CATALYST

In 1987 the Swedish government appointed a special delegation: “The Göteborg Environment Project”. The purpose of the delegation was to produce a plan for substantial improvements in the Göteborg environment over a ten-year period. Traditionally, environmental protection measures have only been implemented when required by law or under threat of new legislation. The Göteborg Environment Project chose a different strategy for its work:

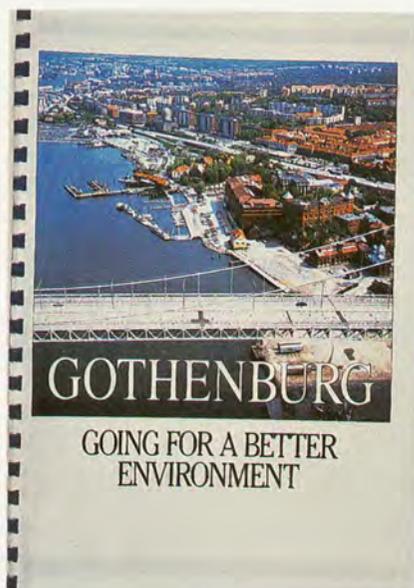
“Let us end this stalemate! If the authorities and the environmental organisations continue to regard industry as the enemy we cannot make any progress. Let us cease to see only the problems, and strive instead to co-operate where we can. We have a problem – let us solve it together!”

The Göteborg Environment Project defined the three main problem areas as traffic, emissions of hydrocarbons from petroleum handling and refineries, and chemicals in society.

Today, production processes and products, rather than industrial emissions are the main problem. It has been estimated that in the manufacturing industry, the quantities of environmentally harmful substances associated with products are one hundred-fold in comparison with those associated with emissions. Increasingly sophisticated purification technologies can no longer solve the environmental problems caused by chemicals. The problems must be dealt with at source, by applying a philosophy of ecological cycles, on the basis of utilisation of resources and re-use.

The Göteborg Environment Project has had a catalytic effect on environment work in Göteborg. Co-operation has been initiated with Volvo (the largest automobile manufacturer in Sweden, with its head office in Göteborg) and other companies, and there has been consultation about a number of hazardous substances. A joint action programme for avoiding these substances or replacing them with less hazardous ones has been drawn up. This working model, using direct contact with industry, proved successful. For example, the largest Swedish textile detergent producer now makes an all new, environmentally sound detergent, and Volvo has adopted an intention of eliminating cadmium, mercury, asbestos and chromium entirely from their manufacturing processes and products.

One of the largest shipping companies serving the port of Göteborg, is Stena Line, with both ferry and international freight traffic. Stena Line's vessels have more than twenty arrivals to and departures from Göteborg



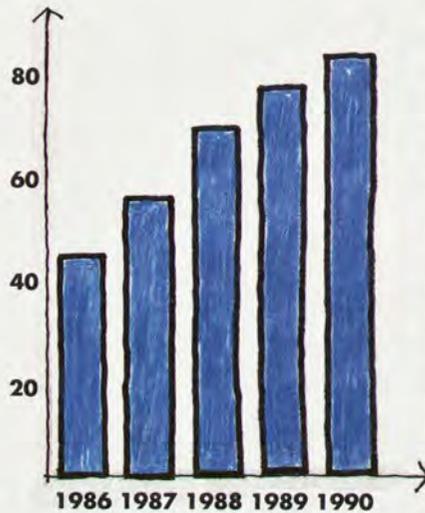


With its large port, refineries and industries, Göteborg is a city facing many environmental challenges.

Photo: PETER ÅHRÉN

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tons/year



The collection of used batteries has been successful.

daily, year round, and transport more than five million passengers to and from Denmark and Germany annually.

Stena Line has now drawn up an environmental programme, including a project for developing new technologies to purify diesel exhaust fumes. Stena Line has used low-sulphur oil since 1989, thus effecting an annual reduction in sulphur dioxide emissions of 600 tonnes. They no longer use their diesel engines to generate electricity in port, but have quayside installations instead.

Their waste water, solid waste and excess oil are disposed of in closed processes. They have reviewed their use of chemical products on board, and reduced the number of chemical products used from 156 to 10. The environment is taken into account in relation to their entire product range, from the carrier bags in the duty free shop to the paper napkins in the restaurants.

CONSUMER POWER

Municipal environmental work has also been re-focused. More attention is being paid to problems associated with products and product consumption. This marks a new phase in environmental work - attacking the problem at source instead of treating process emissions. In the past, products have been seen mostly linearly, moving from raw material to product to waste. Today we must see the product in its cycle, so that products whose lifetime is finished may serve as raw materials for new production processes

Göteborg has run several major environmental information campaigns aimed at the general public. The first one, "Practice what you preach" was about the effects of chemicals on the environment, and what each person can do to reduce resource waste and the spread of toxic substances. The advice was straightforward – buy deposit bottles instead of non-returnable ones, buy unbleached toilet paper, etc. This advice was meant to be easy for everyone to follow without major sacrifices. An ongoing, intensive campaign is being run to promote source separation and separate collection of glass, paper, batteries, and hazardous waste. Göteborg also has a small fleet of "environment trucks" which circulate among residential areas according to a timetable. People may bring their hazardous waste to their local truck, including everything from old paint tins to fluorescent light bulbs and chemicals.

In 1990, all Göteborg households were issued an environmental directory by the municipality. Most people in Göteborg are environmentally aware and willing to be environmentally sound, but they don't always knowhow. The directory is full of advice on how to clean without abrasive chemicals using traditional methods, etc. It also lists many detergents and cleaning agents which are good environmental choices. The environmental directory aroused a storm of criticism, from the chemicals industry and other, but it contributed to environmental awareness in the general public.

Göteborg municipality has now instituted two projects with a view to measures at source, "Chemicals cleanup" and "Environmental awareness in procurement". Experience from Sweden and elsewhere indicate that

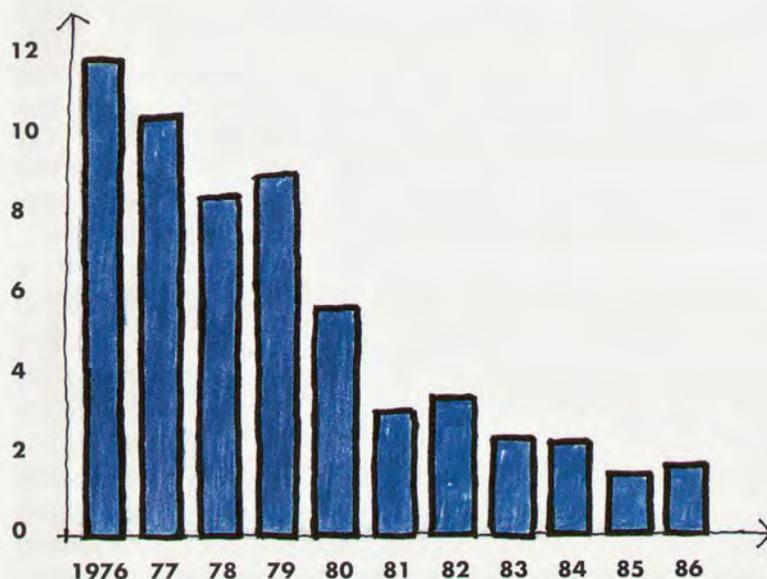
consumers have a great deal of power over manufacturers. The Chemicals cleanup campaign is based on a cyclic way of thinking. Its main aim is to substantially reduce the use of environmentally hazardous chemicals in Göteborg.

The Chemical Products Act stipulates that the importer, manufacturer or user of a chemical product is also responsible for seeing to it that the product is not harmful to mankind or the environment. The task of the authorities is to ensure that companies bear this responsibility for their products. In reality, the Act is not enforced. Many companies use hazardous chemicals, and there are many such chemicals on the shop shelves as well.

The Act also contains an "exchange regulation". This means that of two equivalent products, the least environmentally harmful one is to be used.

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mg/kg TS



The cadmium content of the waste sludge from the region's waste water treatment plant.

The exchange regulation is applied to accelerate the phasing out of environmentally hazardous chemicals used in Göteborg.

The Chemicals Cleanup campaign works at many levels and with many methods. Information to households is one way of reducing the use of some chemicals. This project continues in the same spirit as the Practice what you Preach campaign and the environment directory. But an even more important aspect of the campaign is its co-operation with the manufacturers, industry and commerce, and the major consumers.

One of the concrete project initiated is in relation to car washing detergents. In Göteborg, 300,000 litres of concentrated car washing liquid containing aromatic substances, solvents, tensides and complexing agents are used annually. This annual consumption gives emissions of 100 tonnes of turpentine to the air.

The Chemicals Cleanup campaign has drawn up a technical specification

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for an environmentally sound car washing detergent. Briefly, it would have to contain only non- environmentally hazardous chemicals, and thus to satisfy certain standards with regard to toxicity, bio-degradability, and bio-accumulation. It would not be allowed to contain more than five per cent tensides. Several manufacturers have produced new car washing detergents using paraffin or rape oil-based micro-emulsions as their active component instead of turpentine. The Chemicals Cleanup campaign has begun collaboration with car washing firms, most of which have agreed to test the new, environmentally-approved car washing detergents. Municipal staff will measure emission from these car washes and check their washing results.

The Chemicals Cleanup campaign has attacked the problem of air pollution from diesel powered vehicles in a similar way. Today diesel fuelled vehicles pose the greatest pollution problem in relation to Göteborg's road traffic. The Swedish authorities have classified diesel fuels into three environmental categories. As diesel fuel is a chemical product, its use is subject to the substitution principle in the Chemical Products Act. In other words, The Chemicals Cleanup campaign says that everyone using diesel fuel must be sure to use the least environmentally-harmful type. The Chemicals Cleanup campaign urges both municipal authorities and private companies to comply, and it has been successful. More and more people are using the most environmentally sound type of diesel fuel today.

THE MUNICIPALITY AS A CONSUMER

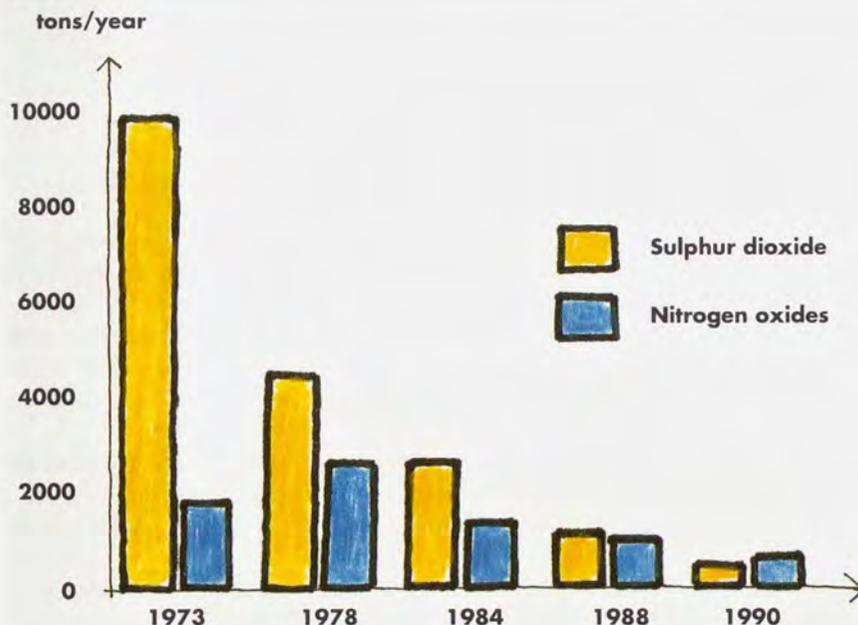
We should all practice what we preach. Göteborg municipality is a major consumer of different products, with total annual procurements of SEK 1–2 billion. The municipality made a number of decisions on the basis of environmental considerations in the 1970s and 80s. For example:

- Only low-sulphur oil may be used in energy production.
- All petrol-fuelled vehicles purchased are to be equipped with catalytic converters (before this was required by law in Sweden in 1989) and be non- metallic.
- Municipal vehicles are to be run on unleaded petrol or light diesel fuel.

In 1990, the Göteborg local government adopted an action programme for environment friendly procurement, making Göteborg the first municipality in Sweden to place special emphasis on the environment in all its procurement. The importance of consumers in the environmental process must not be underestimated, and Göteborg is such a major consumer that municipal procurement policy can affect producers, encouraging them to develop more environment friendly products. The municipality took a comprehensive approach, stating that the environmental impact of a product must be taken into consideration from cradle (raw material) to grave (waste). This means that:

- During a product's manufacture and lifetime, it shall give rise to as little environmental damage as possible, from manufacture through consumption to final disposal,

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Emissions of sulphur and nitrogen oxides from Gothenburg Energy Ltd's installations have been considerably reduced.

- Products must not be harmful to the consumer/user (from an occupational health and safety viewpoint),
- When it becomes waste, a product shall be biodegradable or reusable,
- Product manufacture and use are to be based on economical use of raw material and energy resources.

The purpose of the municipal action plan is to encourage producers and suppliers to think creatively and to build up their own expertise and their abilities to choose the least environmentally harmful goods. In order to obtain more factual information on which to base procurement decisions, the municipality now demands that every supplier produce an environmental label for its products, stating whether the product contains certain hazardous chemicals, what kind of packaging material is used, how it is distributed, etc.

The municipality of Göteborg has also adopted various sub- decisions not to purchase products containing hazardous chemicals. These include products containing freons or requiring the use of freons to manufacture, products containing the very common solvent 1-1-1 trichlorethane, found in many items, and which has a degrading effect on the ozone layer. The municipality has also adopted a decision not to purchase furniture or construction material made from wood from the tropical rain forests unless it can be proven that the material comes from a sustainable forestry industry.

The new environmental awareness has gained a foothold in industry, at car washes, amongst lorry drivers and general consumers. The result has been that each of the city dwellers bear a responsibility for improving the environment, and everyone has begun to participate in the work to achieve sustainable development.

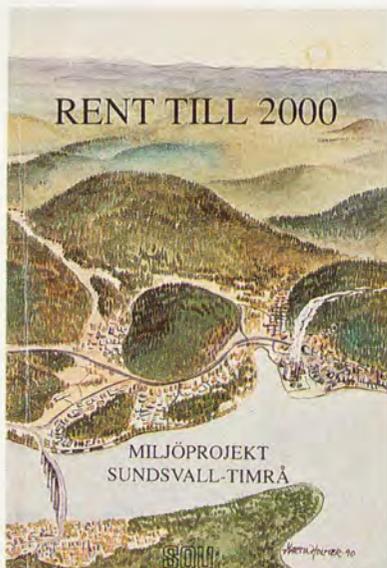
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TIMRÅ - CLEANING UP FROM OLD POLLUTION

Timrå is a municipality on the Baltic coast of northern Sweden, with roughly 19,000 inhabitants. Today, Timrå is part of one of the most industrialised regions in Sweden. The region was early to be industrialised, because it was rich in forest land and rivers for timber floating, and because the harbour conditions on the coast were advantageous. There were sawmills along the small inland watercourses in the region as early as during the sixteenth century.

The last four generations of inhabitants in the region have really claimed the coastal region for industrial development, and pollution is worse today in the Timrå region than almost anywhere else in Sweden. In order to deal with the serious environmental problems in Timrå and the adjacent municipality of Sundsvall, in 1989 the Swedish government appointed a delegation – “The Sundsvall-Timrå Environment Project” – to review the environmental situation in the region and propose measures for improving the environment in these neighbouring municipalities considerably within ten years. The members of the delegation were local politicians, representatives of industry, and appointed experts.

One aspect of the work of the delegation was to survey the risks associated with old industrial areas where environmentally hazardous operations are or have been carried out. Many of these sites also contain old landfills with environmentally hazardous waste. The delegation made a risk assessment of every industry they inventoried, with a view to identifying and evaluating the remaining environmental and health risks. The risk assessments are based on on-site inventories, knowledge of industrial processes, the hazardous properties of various substances, historical documentation, etc.



Clean by the year 2000.

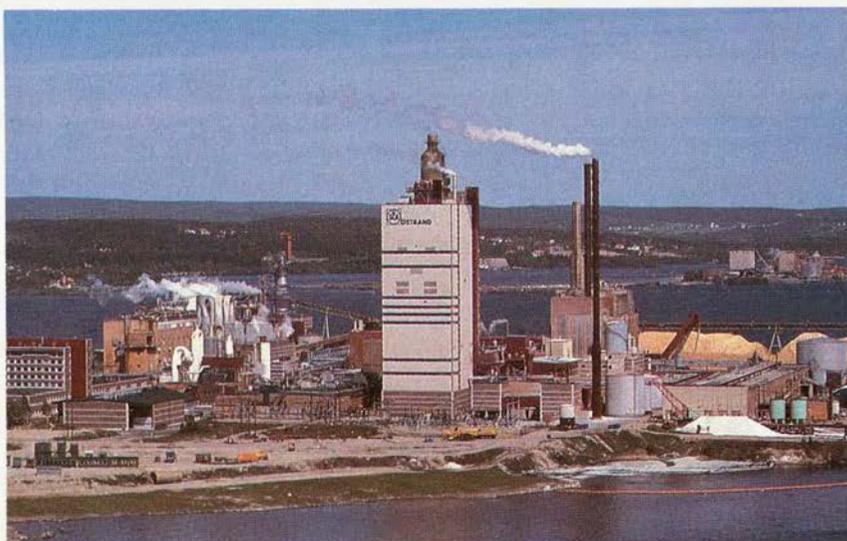
A SYSTEM FOR ASSESSING ENVIRONMENTAL RISKS.

Class	Risk level	Recommendations
1	very high	Study and analyse the risks in detail. Retrospective or protective measures probably heeded irrespective of future land use.
2	high	Study the area thoroughly. Measures may particularly be necessary when land utilisation changes
3	medium	Study and assess the risks. Extensive measures probably not required.
4	low	On the basis of current knowledge, only a simple study is needed, and no protective measures.



The Timrå - Sundsvall region has had many industries and the factory buildings have been demolished.

Photo: SUNDSVALLS TIDNING



The new pulp mill Östrand and the Wifsta varv paper industry.

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Photo: SUNDSVALLS TIDNING



There are physical risks as rotting quays, leftover pilings, decaying buildings and miscellaneous rubbish in many of the closed industrial sites.

The following risks were appraised:

- Chemical risks such as corrosion and fire damage, toxication, cancer, genetic impact, foetal damage, etc.
- Geological/geotechnical risks such as subsidence, erosion, and landslides
- Other physical risks such as the risk of accident owing to abandoned and disused, buildings, quays, equipment, and waste in the areas.

The results of the inventory indicate that there are physical risks such as rotting quays, leftover pilings, decaying buildings and miscellaneous rubbish in all the areas. Such risks are relatively easy to eliminate. The chemical risks are considerably more difficult to assess and to manage. The areas that were classified as highest risk were those with pulp and paper, and chemical and mechanical engineering industries. Different types of "retrospective treatment" are needed to clean up the areas that have been subjected to most damage. "Retrospective treatment" is a collective term for all measures implemented to limit or eliminate the traces of a previous type of land utilisation, with the effects of the remaining environmental disturbances for man and the environment in mind. "Retrospective treatment" must not, in turn, give rise to new environmental problems. Often the most suitable treatment is to leave the pollutants on site, but encapsulate them to limit their spread. Another type of treatment is to decide what type of land utilisation the area is suited to in other respects and implement the necessary measures for that use. In such cases encapsulation is usually insufficient, as shafting, piling and filling are often required. Some of this type of retrospective treatment work must be considered exploitation expenses. Other methods which may be useful include:

- Limiting land use, for example by prohibiting shafting and construction.
- Cutting off the damage by covering it over or encapsulating it, so as to halt leaching of environmentally hazardous substances.
- Decontamination or detoxification to remove harmful pollutants.

LESSONS TO BE LEARNED

How can future problems be avoided? The best way of solving a problem, of course, is to ensure that it never occurs. This appears to be a truism, but what it really means is being sure that, from cradle to grave, products and the processes by which they are produced are as little disruptive to the environment as possible. If we handle less heavy metals, solvents, etc., they will cause less disruption to the environment, and less retroactive treatment will be needed to deal with their effects. The story of the Timrå-Sundsvall region is very illuminating, and emphasises that nothing goes on forever. If, in the 1950s, someone had looked at the three huge pulp plants in the area where the Ljungan River runs out into the Baltic Sea, and claimed that twenty years later those activities would be at a standstill, he would probably not have been believed.

One of the main problems associated with risk assessment has been that it is very difficult to get accurate information about discontinued operations. If, retrospectively, we know where hazardous substances have been

in use, it is possible to limit the areas that have to be assessed. It has also been shown that it is necessary to have documentation of pipelines, sedimentation basins, etc. in order to make accurate retrospective assessments of the environmental risks.

In December 1990, the delegation presented its findings in "Clean by 2000", a joint environmental programme for the two municipalities. It contains proposals to raise ambitions and standards for environmental work as well as providing a comprehensive overview of the status of the environment. The delegation determined that work should be focused on the following areas:

- Cleaning up old pollution, including industrial waste on the Baltic sea bed outside Sundsvall and along the coastline, as well as high levels of toxic mercury and caesium in fresh water fish.
- Reducing vehicle exhaust and noise from traffic.
- Reducing waste quantities and emissions to air and water from the major process industries and municipal waste water treatment plants.
- Safeguarding the forest and agricultural landscapes and their flora and fauna.
- Increasing knowledge and awareness of environmental issues.

The delegation stated that the main responsibility for bringing the established goals to fulfilment was, firstly, with the municipal politicians, the four largest companies in the municipality and, with respect to the national infrastructure, the state. But others will also have to participate if all the proposals presented by the delegation are to be implemented. Municipal authorities and committees will have a key role to play, and both large and small industries will have to contribute. NGOs can also help with information and education. And everyone living in the municipality will have to adapt their living and buying habits to what the environment can withstand. The report states that the basis for positive social development in the Timrå region is high environmental quality, both in urban and rural areas. The quality of the environment is decisive to whether or not people choose to live in an area. Environmental protection and the availability of education and employment are the issues which will mean most for the future of Timrå in the long run.

The plan drawn up by the environmental delegation may be seen as the first leg of a ten-year relay race. Many markers will be passed along to members of the team inside and outside the region. The plan proposes that the goals be followed up with annual environmental audits, presenting developments to the inhabitants of the municipality, its politicians and its businesses. In the opinion of the municipality, the social contract between themselves and the individuals and industries in the region to co-operate with a view to solving the environmental problems by the year 2000 is the most important result of the project.

As soon as the scope of the problems was revealed, it was clear to the municipality that a municipal organisation alone was not enough. Environmental improvement requires the active, articulate, effective and knowledgeable participation of all parties involved if the goal is to be achieved.

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ÖVERTORNEÅ - INITIATING THE ECO- MUNICIPALITY PROJECT

The concept of "eco-municipality" was launched in the Nordic countries in 1980 by Suomussalmi municipality in Finland. Three years later, the concept was introduced in the Swedish municipality of Övertorneå. These then remained the only eco-municipalities in Scandinavia for several years.

The two municipalities are quite similar, both being northerly and sparsely populated, and both suffering from large-scale exoduses to metropolitan areas further south in the 1960s and 70s. In a national perspective, unemployment was high. Both municipalities had also been subject to internal restructuring processes which meant that the larger conurbations had grown rapidly at the expense of the villages. Both municipalities were in extremely difficult situations, and had attempted all the traditional means of reversing their problems with no success. This may explain why they were tempted to try a new, unconventional method.

Between 1983 and 1985, Övertorneå took part in a national project known as "Municipalities and the future". The idea of eco-municipalities was born in this project, as a comprehensive developmental strategy for Övertorneå.

Although the development work carried out in Övertorneå has not yet been thoroughly evaluated, it is quite clear that things are considerably brighter in the municipality today than in 1983. The municipality has been revitalised, and many new small business have been started, creating hundreds of employment opportunities. "Alternative gardening" has become very popular, an eco-village has been established, and a health centre founded. Regional culture is having a renaissance, and this is boosting self-respect and local self-confidence. All in all, the spirit of pessimism has been reversed, and the social climate is far more positive than it was. It is, of course, difficult to distinguish between cause and effect, but there is no doubt that the eco-municipality concept has provided Övertorneå with a collective developmental force.

As described, the ambition of bringing new, enduring employment opportunities to Övertorneå was the driving force behind launching the eco-municipality concept. The natural environment was relatively undisturbed, and the inhabitants of the municipality were adamant about its remaining so. This was partly because agriculture and forestry were still the main industries and provided a livelihood for many people. But for the people of Övertorneå, Mother Nature's "pantry" also supplemented their salaries. Hunting, fishing and berry picking are examples of activities which are still important sources of extra income for many people there. This "informal sector" is an important one, and the proximity of nature is also a key aspect of people's lifestyle.



Growth power!

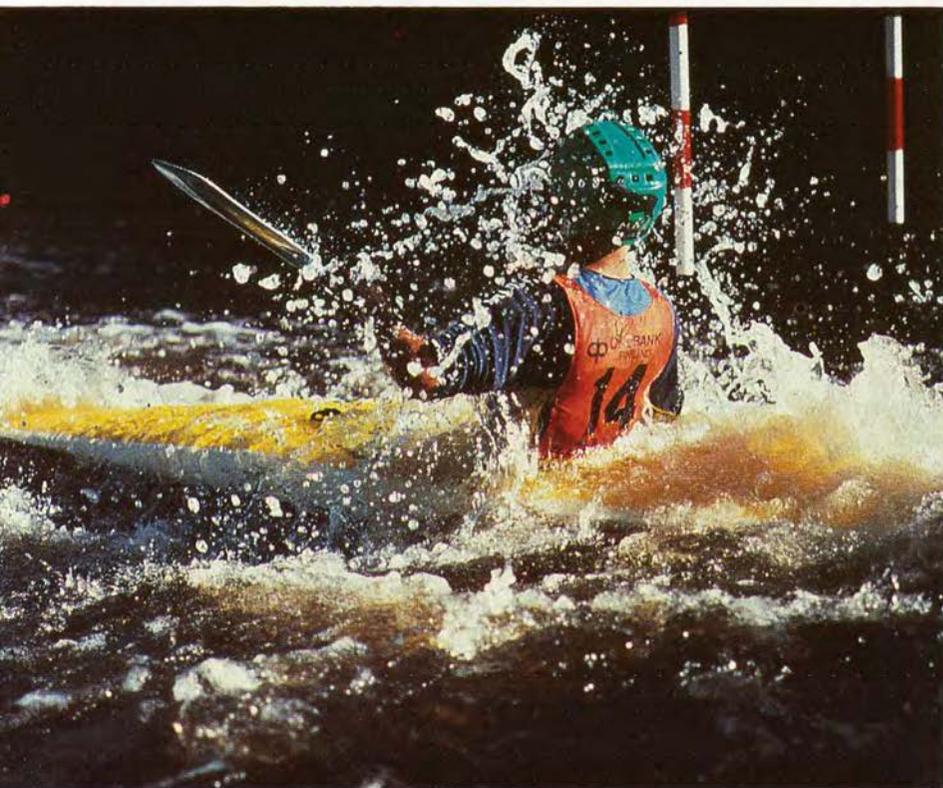
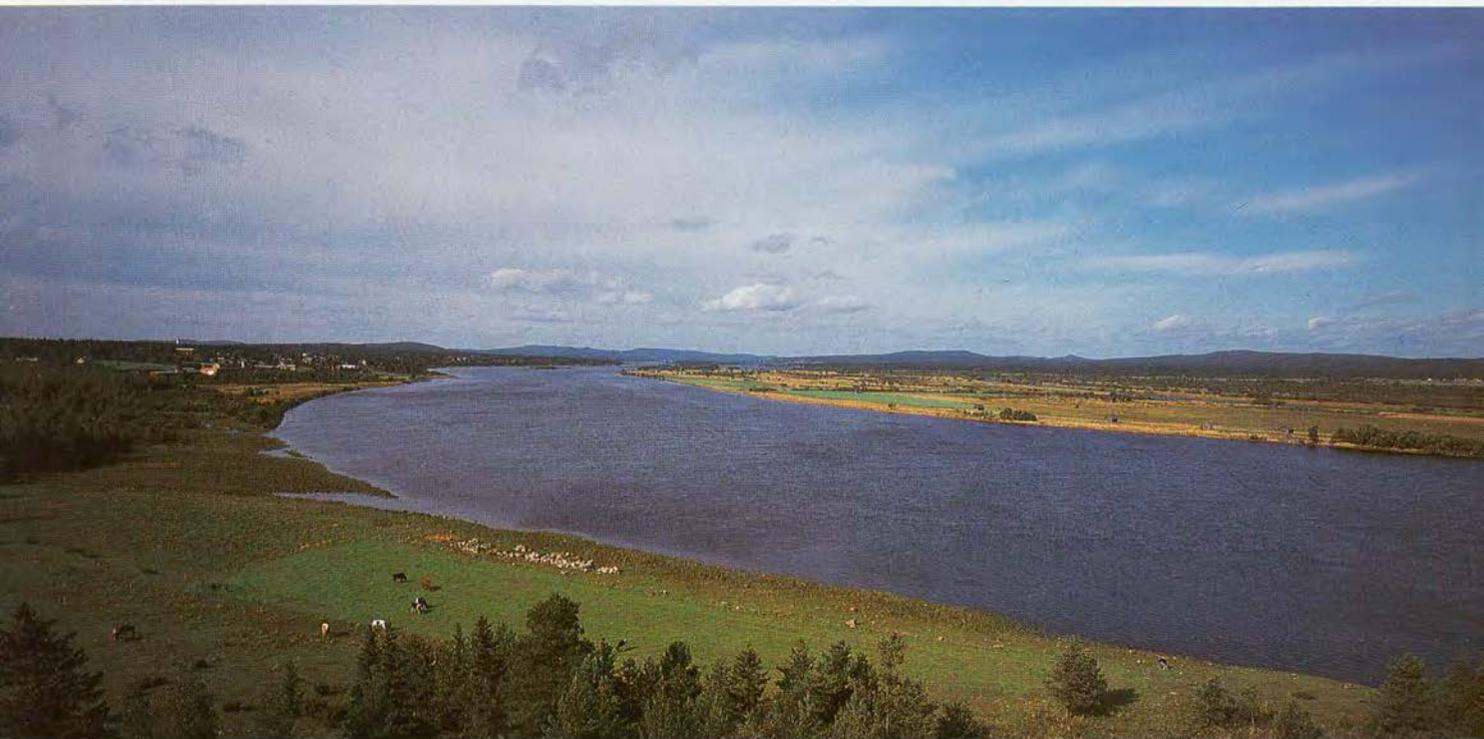


Photo: EIVON CARLSON

Eco-tourism is one of the new industries in Övertorneå.

*THE IMPORTANCE
OF VISIONS AND
THE POWER
OF EXAMPLES*

The eco-municipality concept was a development strategy focused on the excellent environment, the local structure of trade and industry, and the local life style. New employment opportunities were to be created with a view to the interplay between man and nature. Although the "eco-" prefix originally stood for ecology, it soon began to stand for economy as well. The 1986 action plan for the Ecotope in Övertorneå Foundation states:

"Economic development and ecological balance will, thus, be united in one and the same development strategy. We see this as the best way of utilising what this municipality has to offer in order to promote regional development."

THE "BOTTOM-UP" PERSPECTIVE

The work begun in Övertorneå on developing the concept of eco-municipality has been emulated elsewhere in Sweden. A network has been established – the preliminary Eco-municipality project – and fifteen municipalities are members..

The following points may serve as a summary of work in the eco-municipalities to date:

**THE FOLLOWING FIFTEEN
MUNICIPALITIES ARE
PARTICIPATING IN THE
ECOMUNICIPALITY PROJECT**

<i>Municipality</i>	<i>Population</i>
Hällefors	9 500
Kungsör	8 500
Lindesberg	25 000
Ljusnarsberg	6 500
Nora	10 500
Nynäshamn	21 000
Orsa	7 300
Smedjebacken	13 300
Sala	21 000
Sorsele	4 000
Tierp	20 000
Timrå	18 500
Tranås	18 000
Uppsala (kommun- delsnämnden)	
Almunge-Knutby	16 000
Övertorneå	6 000

- Use of the eco-municipality concept as an overall vision liberates development potential in a municipality. Everyone pulling in the same direction facilitates development work.
- Co-operation between "like-minded" municipalities under the umbrella of the eco-municipality concept opens up fruitful exchanges of knowledge and information between municipalities, despite their possible geographical, cultural and structural differences. Eco-municipalities are also beginning to experience themselves jointly as a power factor with a potential impact on national social developments.
- The eco-municipality concept breaks with the traditional sectorial division of society, and facilitates tackling structural problems. On the other hand, it is more difficult to find financial solutions for "holistic" projects like these, which do not fit into the cubby-holes of any given sectorial organisation of society.
- The "bottom-up" perspective has made it easier for the project to become rooted in the participating municipalities. Owing to their very different points of departure, it has been important that, on the basis of this "bottom-up" directive, the municipalities have had free hands to organise, determine priorities, and choose strategies individually. The concept of the eco-municipality does seem to have been adopted seriously by the participating municipalities, which would hardly have been possible without the "bottom-up" perspective.
- Opportunities to share experiences and be given joint training and counselling will remain important for the future. This must also be designed with the greatest possible flexibility, to suit the changing needs of each municipality over time.

*THE IMPORTANCE
OF VISIONS AND
THE POWER
OF EXAMPLES*

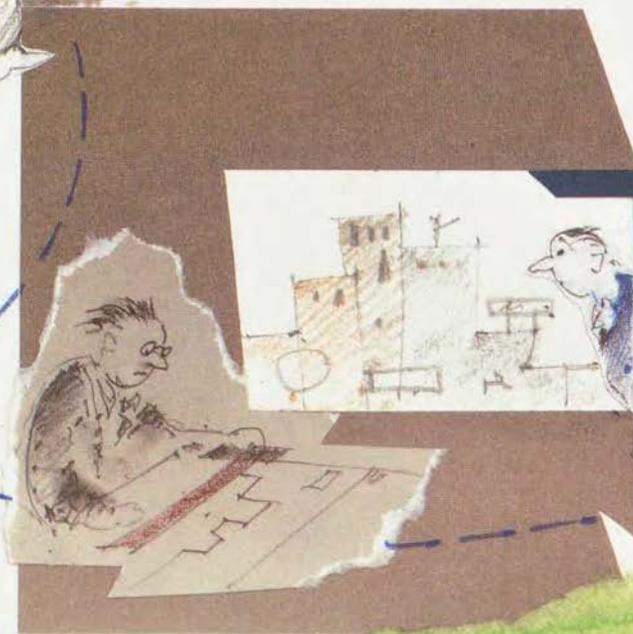
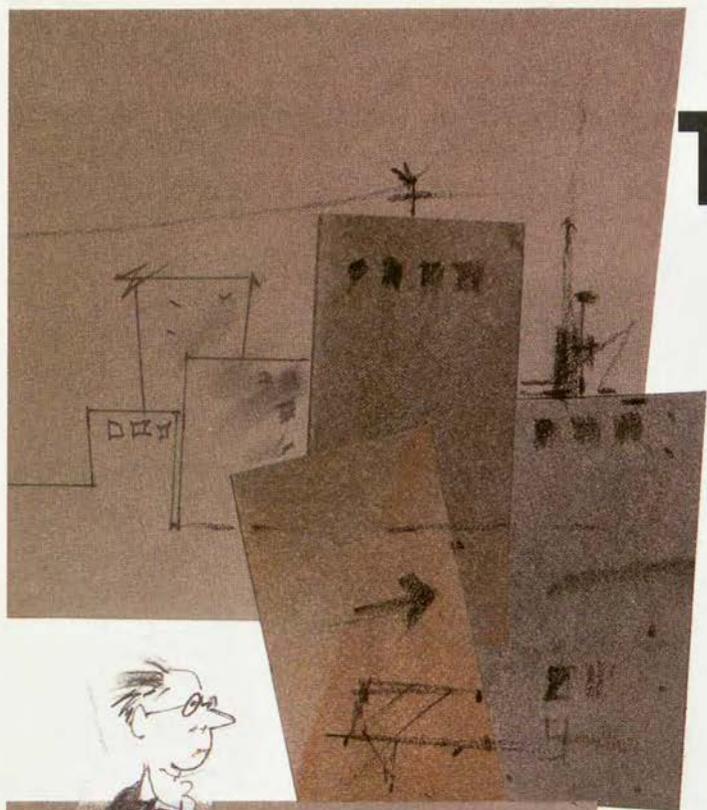


Photo: EIVON CARLSON

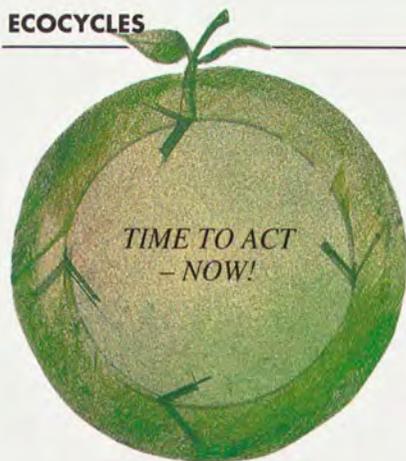
**Even north of the Arctic circle, the
vegetables grow green!**

TIME TO ACT – NOW!

To achieve sustainable urban development, measures will have to be implemented locally in addition in international fora







The demands for long-term sustainable development imply improving the quality of life for all of mankind. This can only be achieved in a world order in which poverty has been eradicated. With our rapid global urbanisation, a rapidly increasing segment of the world population is living in urban slums under unacceptable conditions. This means that the environment, development and urban renewal are intimately interrelated phenomena.

In an ecological perspective, contemporary cities — in Sweden and elsewhere in the world — are not sustainable over the long term. To achieve a sustainable world, every city will have to change. This is our common responsibility.

This book presents a number of concrete examples — technical and organisational — of how some urban problems are being solved. Other countries, with different cultural and historical backgrounds and different conditions will, of course, have to find solutions of their own. But all efforts to find new solutions to urban problems should share one aim : to bring ecological cycles full course wherever possible.

This joint search for new solutions to urban development requires international co-operation. We need to exchange experience, globally and locally, and to implement concrete collaborative projects.

REGIONAL CO-OPERATION IN EUROPE

At a regional workshop arranged by the Economic Commission for Europe (ECE) in Örebro, Sweden, 3-6 May 1992, strategies for sustainable urban development were discussed. Some fifty experts from fifteen countries including the Baltic states participated, as well as representative of the Commission of the European Community, the OECD and UNCHS (HABITAT).

The purpose of the seminar was to discuss and exchange experience on how various actors can contribute to more sustainable urban development. The discussions were conducted in four theme areas with a joint concluding discussion chaired by Ms. Görel Thurdin, the Swedish Minister of Physical Planning.

The themes of the working groups were:

1. Urban structure based on ecological principles.
2. Sustainable development of the built environment for sound and safe housing
3. Sustainable housing operation based on cooperation between users and management.
4. Women's participation in the planning and management of housing — a path to sustainability?

The participants at the seminar were in good agreement that a number of measures focusing on the local, national, national and global levels will have to be implemented to achieve a development towards increased



Photo: BOSSE JOHANSSON

sustainability. All these measures will have to be based on a number of generally accepted principles that serve a social norms and as guidelines for proposing concrete instruments. drawing up strategies for sustainable urban development. The main principles highlighted at the seminar were:

- That access to a good environment is a human right and should apply to every individual in society.
- That everyone in society should have the right to information and be given the opportunity to participate in the decision-making process, on

The Chairpersons at the ECE workshop in front of the old castle in Orebro. From left to right Ms. Sirkka Hautojärvi, ECE, Mr Douglas Stewart, Canada, Ms. Görel Thurdin, Sweden, Ms. Anne Querrien, France/OECD, Ms. Lisbeth Fall, Sweden and Mr. Nicholas Hanley, EC.

*TIME TO ACT
– NOW!*

democratic terms. The participation of women should receive attention and be encouraged.

- That decisions should be taken and measures implemented as close as possible to the individuals affected by them - the principle of subsidiarity.
- That the principle of ecological cycles should be the guiding principle with regard to use of natural resources. All such use should remain within the limits for what mankind and nature can withstand.
- That PPP - the polluter pays principle - should always be applied.
- That the principle of substitution should prevail - when one product is environmentally preferable to another, the environmentally sounder product shall be used to replace the currently used one.
- Environmental work should always be done on the basis of the preventive principle and the precautionary principle.

Many examples were presented at the seminar, showing ways in which sustainable living and housing conditions can be achieved. The discussions made it clear that there are many differences in different parts of Europe today with regard both to the problems and the resources available to solve them.

Of course, environmental protection requirements and the rate of developments must take these differences into account. While problem-solving for western Europe focuses on changing lifestyles, the solutions in the east must focus more on retaining a resource-conserving mentality as people's living conditions improve. One vision that was presented was the drawing up of a new form of market economy based on ecological cycles.

A rough sketch of five steps towards sustainable development was presented by one of the working groups. The steps were:

1. Ignorance — The environmental problems are unknown.
2. Lack of interest — The environmental problems are known but people do not care about them.
3. Faith in technology — People imagine that new technology will solve all environmental problems.
4. Towards sustainability — Conversion of society in the direction of more environmentally-adapted developments has begun.
5. Absolute sustainability — The ecological cycles have been brought full course.

No city in the world has yet reached step five — perhaps it is even a utopian vision. But the seminar considered visions a necessity. The absence of visions has led too often to the creation of poorly-structured societies which are very difficult to change once the environmental problems begin to be clear. Physical planning has a vital part to play in this respect, as the tool for shaping long-term visions and integrating them in the local decision-making processes.

The Chairman's summary of the seminar established the need for creative thinking in terms of many aspects of housing, building and

*TIME TO ACT
– NOW!*

planning. The "Athens Declaration", the Bible of all planners, argues for a functional division of cities, with residential neighbourhoods and working areas strictly separated. This needs to be reconsidered today. Users must be involved in the planning process at an early stage. A large group of people, namely women, are often neglected in this process. Women's experience is often different from that of men — women tend to be the consumers and men the producers. Women have an everyday perspective that is important to bear in mind when planning buildings and cities.

Examples of new ideas and solutions were also presented at the seminar. Although most work today is ongoing within relatively narrow bounds, the seminar did emphasise the need for new kinds of regional exchange and co-operation at all levels — global and regional, national and local. The old institutions must co-operate more and adapt their working methods to the new conditions alluding to international work today. But the seminar also pointed out that focusing on the large global issues is insufficient — real change happens at the local level.

GLOBAL NETWORKS FOR LOCAL WORK

Environmental policy to date has been characterised by a top-down perspective. In the future, it is a "bottom-up" perspective we need, one in which individuals may be actors rather than passive participants. The local level and organisations (for municipal authorities and cities) will thus gain importance.

The importance of the local level in promoting sustainable development was one of the things that was very clear at the thirtieth world congress of the International Union of Local Authorities (IULA), held in Oslo in 1991. The congress adopted a declaration on the environment, health and life styles, with a view to stimulating local authorities and cities to invest in long-term sustainable development by integrating the environment, health and social justice into economic development.

The IULA declaration particularly emphasises the importance of increased conservation of energy and greater effectiveness in its use, as well as the development of renewable source of energy with a minimum impact on health and environment. It also states that the human impact on the climate must be reduced, and measures taken to maintain cultural and biological diversity. And, finally, the declaration stresses that all parties in society should have the right to participate in making the decisions that affect our environment, health and social justice in relation to resource exploitation and the structure of society.

To achieve sustainable urban development, many measures will be needed, as well as co-operation at the local, national, regional, and global levels. Global networks will be needed at each and every one of these levels.

IULA – a worldwide network for

The International Union of Local Authorities, IULA, is an international organisation for municipalities and cities around the world. IULA represents some 30,000 local organisations in over 80 countries. An action plan for local work on improving urban environments was adopted at the thirtieth world congress, held in Oslo in June 1991.

AGENDA FOR ACTION

It is the right and duty of all Local and Regional Authorities to set priorities to and decide the means of achieving sustainable development. Sustainable development will require the integration of environment, health and social equity concerns into the economic development of their communities. Recognising that the shared environment binds all Local and Regional Authorities to a common future, we, the delegates at IULA World Congress 1991, strongly urge the rigorous implementation of the following agenda for action.

IN RESPECT OF GLOBAL CONCERNS

- a. Support national and international measures to improve energy conservation and energy efficiency and to develop source of energy benign to the environment and human health.
- b. Promote the elimination of substances depleting the ozone layer.
- c. Join in national and international efforts to reduce the levels of carbon dioxide, methane and other 'greenhouse gases' causing global atmospheric warming.
- d. Join in national and international measures which aim at reducing the emission of air pollutants such as nitrogen oxide, sulphur dioxide, and heavy metals.
- e. Support activities related to the conservation of cultural and biological diversity and genetic resources, including the conservation of significant areas of virgin forests and other important habitats including the wildlife and peoples native to these habitats.

IN RESPECT OF LOCAL AND REGIONAL CONCERNS

- a. Ensure the right of all interested parties in the community to be consulted as well as to participate in public decision-making aimed at ensuring that environment, health concerns and social equity are given highest priority in development decisions.
- b. Develop detailed plans for sustainable management of the environment and of natural resources. All budgeting, investment, policy and administrative decisions must be consistent with these plans.
- c. Establish and vigorously and consistently enforce legal sanctions; and advocate the establishment of effective penalty and liability provisions for the payment of appropriate compensation.
- d. Use economic incentives and disincentives in applying environmental policies.
- e. Promote the establishment of local indicators of environmental quality.
- f. Develop information programmes to promote sustainable management of the environment and of health support systems. Emphasise environment and health matters in all education programmes and personnel training.
- g. Promote intersectoral action and build alliances with public authorities at all levels to achieve sustainable development and have an impact on environmental quality.
- h. Initiate co-operation between local authorities, the employers and employees organisations, the business sector and community groups, thus combining resources and grass roots development expertise. One way of organising such co-operation would be to establish local councils for sustainable development.

actors at all levels

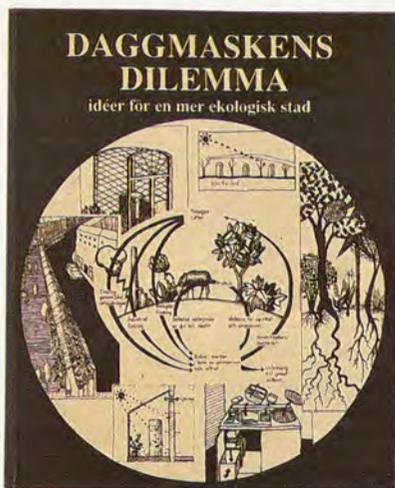
SPECIFIC LOCAL AND REGIONAL MEASURES

- a. Raise citizens' awareness of healthy lifestyles. Adopt policies which facilitate and reward healthy choices and which make these the socially most acceptable ones. Moderation of excessive consumption should be actively encouraged in order to halt unnecessary use of natural resources and limit adverse consequences on the environment.
- b. Strengthen district health systems based on primary health care, with an integrated management system in which professionals in many fields, as well as lay people, can implement preventive measures at the community level.
- c. Work out a comprehensive health promotion strategy based on the Global Strategy of Health for All by the Year 2000 suggested by WHO. The health promotion strategy should include developing leadership for primary health care, systematic health education for all, encouraging social networks and providing employment schemes aiming at minimising unemployment.
- d. Implement effective water supply, delivery, re-use and waste water treatment programmes. Reduce loss of water during delivery and adopt water conservation measures. Tax and administrative regimes worked out in co-operation with other relevant authorities should ensure the provision of clean drinking water for all citizens.
- e. Reduce garbage production and create awareness of garbage as a resource. Minimise the disposal of such resources through the establishment of pre-sorting, recycling and composting programmes. Assist households and business in reducing their use and in preventing the unsafe disposal of hazardous materials and compounds. Provide sufficient collection sites for reusable materials. Adopt waste management policies that maximise human health and minimise adverse environmental effects, and ensure adequate control over the reduced transboundary movement of waste.
- f. Reduce energy consumption and adopt conservation programmes. Establish and support energy pricing policies which encourage energy efficiency. Support the application of renewable and environmentally benign energy sources, such as solar power.
- g. Adopt land use plans, both in urban and rural areas, which aim at preserving healthy natural and human environments and at halting uncontrolled urban growth. Such plans should promote the long-term principles of sustainable development rather than short-term economic advantage, and must be guided by the need to reduce energy consumption. Protect and expand green areas in cities to ensure that people do not lose the sense of nature, crucial to mental and physical well-being. These policies must be co-ordinated with policies on public transportation, housing, social welfare, and health promotion.
- h. Strengthen mass transport in general and particularly in the cities, by improving the efficiency and availability of public transport services such as railways, light rail, underground trains, and buses. Discourage the use of private cars in urban areas by all appropriate means. Devise physical planning and traffic management policies which promote urban development based on sound and clean transport infrastructure and low transport demand. Encourage and support bicycle and pedestrian transportation. Consider the introduction of traffic-free urban areas.
- i. Ensure the right of urban citizens to live in safe environments. Support the renewal of old urban environments in such a way that both physical solutions, social relations and health aspects are sufficiently taken care of. Traditional architectural characteristics must be presented to the greatest extent possible. Tenants have a right to participate in important decision-making affecting the standard of housing, aesthetic concerns, cultural identity, established social structures and human values.
- j. Adopt tree-planting and reforestation programmes and promote agricultural practices to arrest the increase in atmospheric carbon dioxide.

EDITOR'S AFTERWORD



The future city – one of the mini-reports from the Swedish Association of Local Authorities.



The dilemma of the earthworm – sourcebook for ideas.

Cities and municipalities will be decisive in the breakthrough of an ecocycle orientation – think globally and act locally! For this reason, the Environmental Advisory Council, the body serving the Swedish government in terms of long-term strategic environmental issues, has initiated a project focused on doing what can be done to achieve sustainable development at the local level. As a first step, we have chosen to describe a number of examples of creative work, and present them in the present volume. It is our intention to continue this work, adding in-depth analyses to examine what changes will be needed to dismantle the various barriers to positive development.

This book has been prepared in collaboration between the Environmental Advisory Council and the Swedish Association of Local Authorities. From the association participated Rolf A. Karlsson, Lars Fladvad and Eva Grundelius. The Association's series of mini-reports on the environment and natural resources in physical planning have been important sources of information to us.

The basis of the material for this book is various reports by Eva Grundelius, Ros-Mari Edström, Jan Lothigius and Bengt Persson, which we have revised and edited. Documents and reports on the projects described here and interviews with the people from the municipalities we have chosen as examples have also served as sources to us. A degree project from Chalmers University of Technology called “The dilemma of the earthworm – ideas for more ecological cities” (available in Swedish only, ISBN number 91-7032-612-6) has also provided us with inspiration.

The cover illustration and chapter opening illustrations have been made by Maria Udriot. The figures were drawn by Birgit Eliasson. The main photographer was Bosse Johansson, the technical editor Ingvar Nilsson, and the English translator Linda Schenck.

The desktop work was done by Dan Palmbrink at Norstedts Tryckeri AB, where this book was printed.

Our thanks to all those who made it possible to produce this book so very quickly.

Stockholm, May 1992

Tommy Månsson
Expert on the Environmental Advisory Council



Photo: BOSSE JOHANSSON

The Editor Tommy Månsson in front of a model of Ladugårdsängen - the new housing area in Örebro constructed with a vision of bringing the ecocycles full course.



Statens offentliga utredningar 1992

Systematisk förteckning

Justitiedepartementet

Bundna aktier. [13]
EES-anpassning av kreditupplysningslagen. [22]

Socialdepartementet

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–en probleminventering ur socialtjänstens perspektiv. [3]
Psykiatri i Norden – ett jämförande perspektiv. [4]
Kroppen efter döden. [16]
Den sista undersökningen – obduktionen i ett
psykologiskt perspektiv. [17]
Tvångsvård i socialtjänsten – ansvar och innehåll. [18]
Statens hundskola. Ombildning från myndighet till
aktiebolag. [20]
Bostadsstöd till pensionärer. [21]
Rätten till folkpension – kvalifikationsregler i
internationella förhållanden. [26]
Smittskyddsinstitutet – ny organisation för Sveriges
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Risk- och skadehantering i statlig verksamhet. [40]

Utbildningsdepartementet

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Konstnärlig högskoleutbildning. [12]
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och möjligheter. [15]
Utvärdering av försöksverksamheten med 3-årig
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Arbetsmarknadsdepartementet

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Kasinospelsverksamhet i folkrörelsernas tjänst? [33]

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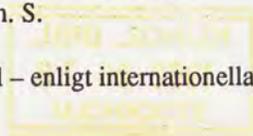
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10. Ett nytt bolag för rundradiosändningar. Ku.
11. Fastighetsskatt. Fi.
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38. Fristående skolor. Bidrag och elevavgifter. U.
39. Begreppet arbetsskada. S.
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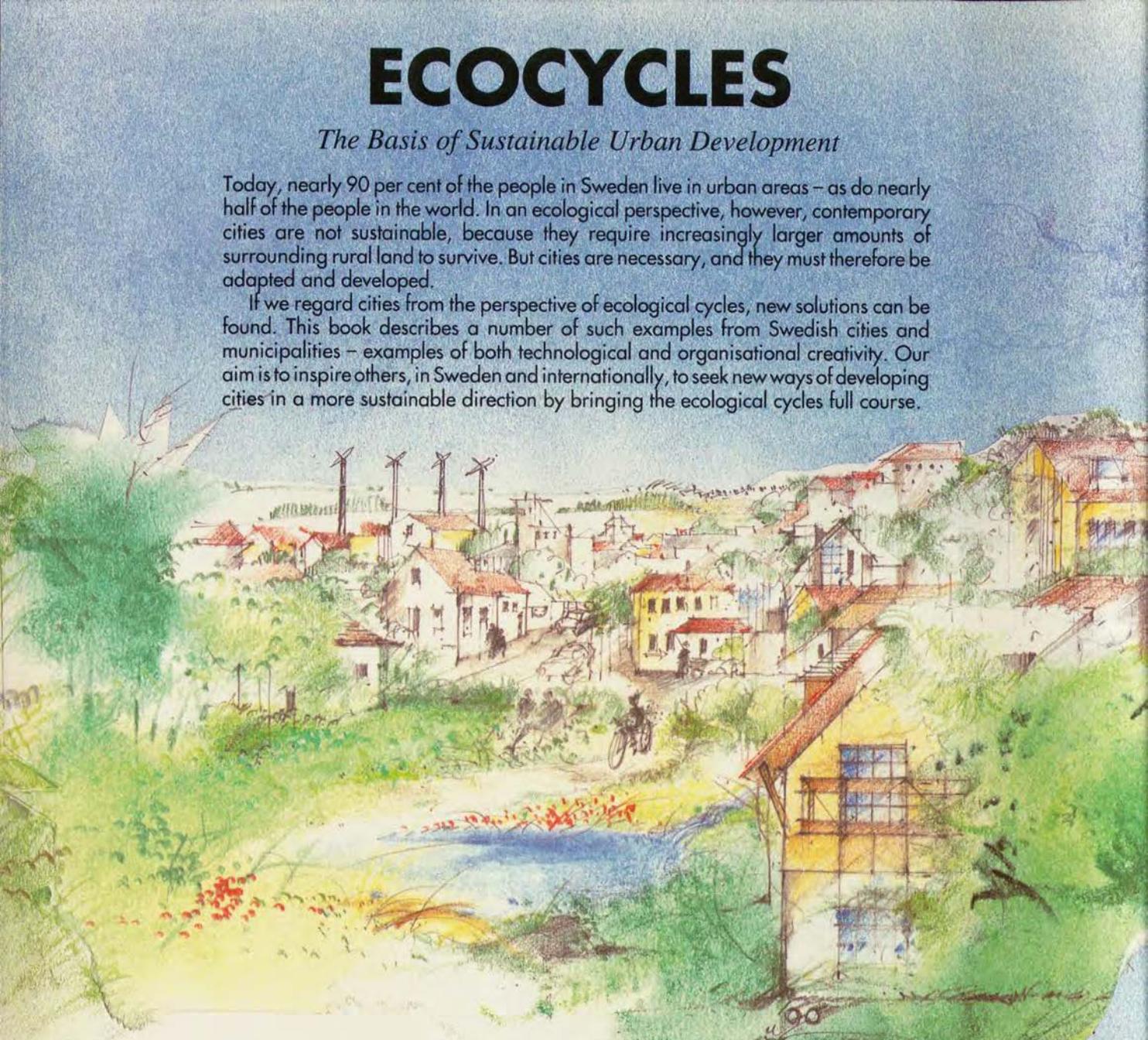


ECOCYCLES

The Basis of Sustainable Urban Development

Today, nearly 90 per cent of the people in Sweden live in urban areas – as do nearly half of the people in the world. In an ecological perspective, however, contemporary cities are not sustainable, because they require increasingly larger amounts of surrounding rural land to survive. But cities are necessary, and they must therefore be adapted and developed.

If we regard cities from the perspective of ecological cycles, new solutions can be found. This book describes a number of such examples from Swedish cities and municipalities – examples of both technological and organisational creativity. Our aim is to inspire others, in Sweden and internationally, to seek new ways of developing cities in a more sustainable direction by bringing the ecological cycles full course.



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