

Welfare for the Future

Iceland's National Strategy
for Sustainable Development
2002–2020



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The concept of "sustainable development" is intended to convey the thought that we must continue to strive for increased prosperity and well-being for the earth's population, while protecting the planet's resources and life-supporting systems for future generations. Now, 10 years after the Earth Summit in Rio, where the nations of the world committed themselves to promoting sustainable development at the global and national levels, we must ask the question: Is the guidance from Rio still useful?



The answer is undoubtedly yes. In fact it can be said that Icelanders were well aware of the necessity of sustainable development long before the term became part of the Icelandic language. We have tried to reverse soil erosion and reclaim man-made deserts. We manage fisheries in a sustainable way so that not more is taken than the fish stocks' renewable strength can handle. These tasks remain important, but we must also pay attention to the tasks relating to the future development of Icelandic society, which call for the guidance of sustainable development. We have ample renewable energy resources that are very valuable, especially when we see the increased problems related to the burning of fossil fuels. Iceland's rugged but beautiful landscape is a magnet for tourists and a treasure for Icelanders. Long-range pollution is a current and future threat, and Iceland has been especially active in working on curbing the pollution of the oceans.

The formation of Iceland's future vision with regard to sustainable development is a demanding task, yet at the same time, an exciting one. It can not be prescribed, once and for all, in a government strategy like this one. It is a dynamic project that must take into account changes in conditions and attitudes, and is in fact the task of the society as a whole.

This strategy is intended to create a frame for the discussion that needs to take place regarding Icelanders' vision of sustainable development at the beginning of the 21st century. It defines some of the main goals of the government in this respect, along with indicators that are intended to help monitoring progress. The strategy needs to be under constant development. It will be evaluated in indicator-based follow-up reports and discussed at future environmental assemblies.

Icelanders are lucky to live in a bountiful country and to enjoy general welfare and freedom. This freedom is accompanied by the responsibility to use the gifts of nature wisely. It also gives us the choice of setting the goal high. Icelanders should aim to be among the first nations in the world to be able to say that the development of our society is sustainable. I hope that this strategy can assist us in achieving this goal and serve as a useful guideline for all those who wish to participate in forming our common future.

Siv Friðleifsdóttir

*Siv Friðleifsdóttir
Minister for the Environment*

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In the 20th century, Iceland was converted from one of Europe's poorest nations into an independent country, with one of the highest standards of living in the world. The foundation for this change was new technology that made it easier for the nation to use the resources of the land and its surrounding fishing grounds. The fishing industry was the backbone of the Icelandic economy in the 20th century. The agricultural sector has dwindled, but it is still fundamental for the settlement of a large part of the country and makes Iceland self-sufficient to a large extent with respect to food production. The utilization of the country's energy resources provides heat and electricity for homes and is the basis for a considerable and growing export industry. The importance of Icelandic nature for the economy is ever increasing, as it is the main attraction to foreign tourists that visit the country. A flourishing economy based on these and other resources has made it possible for Iceland to build up a comprehensive healthcare and welfare system.

Sustainable Development

Most resources are limited. The qualities that are the basis of the welfare of Icelandic society can be strained. A good case in point is the erosion of vegetation and soil that began when forests were cleared at the time of the country's settlement and continued without interruption until the last century when systematic efforts to control and reverse the erosion began. In the latter half of the 20th century Icelanders also had to find ways to limit catches of fish, which has been one of the most important tasks for authorities in recent years, as well as one of the most complicated. The utilization of energy along with an increased number of tourists has created new and powerful economic sectors but opinions differ as to how they should be built up.

What is welfare?

Welfare for the future is the theme of this policy. The term "welfare" not only refers to economic aspects but also to a wider definition of the quality of life. Demands for quality of life have changed, at least among the wealthier nations of the world, and the public takes into consideration more factors than economic growth when prioritizing goals. The demand for qualities such as a healthy environment, safe food and access to areas for outdoor activities, such as sheltering forests or wilderness, are acquiring comparable importance to economic demands. Concurrently there is also an increased emphasis on various social qualities such as equality, social services and cultural diversity. This change in attitude calls for a new approach, and it can be said that sustainable development is an answer to the demand for a broader definition of what quality of life and general welfare entail.

Iceland is, of course, not the only country to deal with tasks of this nature. Rapid population increase and economic growth have caused resource management

and environmental issues to become a central task of most countries in recent decades. Mankind now has a considerable impact on the basic foundations of the

What is sustainable development?

Most people agree on the importance of "sustainable development" but what it really denotes is not always clear. The term first became prominent in international discussion in the 1980s and was the central theme of the UN Conference on Environment and Development in Rio de Janeiro in 1992. Sustainable development has been defined as development that meets the demands of the present, without reducing the possibilities of future generations to meet their needs. Principle 1 of the Rio Declaration states: "Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature."

Sustainable development has three pillars: economic growth, social welfare and environmental protection. These three pillars must be studied in context and economic and social development must be strived for without harming the environment. This is a complex and difficult task. The general consensus was that the previous approach, where environmental protection and economic growth were considered to be opposites and little effort was taken to coordinate policies in these fields, was not effective in the long term. In the decade since the Rio Conference, various criteria, incentives and technologies have been developed aiming at disconnecting economic growth from negative environmental impact. Many of these incentives are discussed in the strategy, as well as how they can be further implemented in Iceland. Sustainable development is not a magic term that contains simple solutions to mankind's problems, but it does contain a useful and successful approach that the nations of the world have agreed to have as their guidance in their effort to solve some of the most pressing problems of the 21st century.



earth's ecosystem. Disturbances to climate and the ecosystem can have unforeseeable consequences and create difficult problems for future generations.

To fight this problem, the countries of the world have joined hands to find a balance between environmental protection and the continuing build-up of economic and social welfare. The approach used in this regard has been termed "sustainable development". The criteria and basic rules behind sustainable development were approved and documented at the United Nations Conference on Environment and Development in Rio de Janeiro in 1992, especially in the Rio Declaration and in Agenda 21.

Iceland's Policy on Sustainable Development: Approaches and Purpose

Agenda 21 encourages countries of the world to prepare a national sustainable development strategy. At the UN General Assembly Special Session in 1997, countries were encouraged to complete such strategies before the 10th anniversary of the Rio Conference in 2002. The Icelandic government has been working on such a strategy. The first comprehensive policy of Icelandic authorities on environmental affairs, "Towards Sustainable Development", was prepared in 1993 and

followed to a large extent the decisions made at the Rio Conference. Following this policy, an implementation plan was prepared bearing the title "Sustainable Development in Icelandic Society", which was submitted to a special Environmental Assembly in 1996 and subsequently approved by the government.

The strategy presented here is intended as a general framework for policies set by authorities in fields relating to sustainable development in the near future. The strategy has been prepared by several government ministries, but the comments of municipalities, interest groups, non-governmental organizations and the public have also been sought.

The strategy has been formed for a period well into the future, or until 2020, which means that it is intended to be a dynamic document, responding to changes in circumstances and emphases. The main purpose of the strategy is to: 1) set long-term goals, 2) set priorities for the near future and 3) define and develop criteria to measure progress. The strategy is not an implementation plan, but it can help authorities and others to prioritize projects and gauge the success of trying to promote environmental protection and the quality of life.

Formation and Implementation of the Strategy

There is no specific blueprint for formulating a national sustainable development strategy in Agenda 21 or other international agreements. Each country is entrusted with forming a strategy that suits its circumstances and society. Individual countries have chosen different paths but experience has taught us how to work sensibly on this sort of policy-making. The strategy needs to set goals and general emphases but also refer, as far as possible, to other strategies where further implementation will take place. A sustainable development strategy could be compared to a large-scale map which shows promising sites and possible ways to get to them but does not necessarily contain a step-by-step description on how to reach the destination.

Sustainable development involves most fields of society and therefore it is neither possible nor desirable to

discuss all its aspects in detail in one strategy, or to describe in detail necessary actions in each field. This strategy points in many places to individual government plans that relate to environmental protection, economy and development of society. This is done to avoid repetition and discussing at length points that are dealt with clearly elsewhere. On the other hand, this strategy is intended to be a basic document for authorities and others to use in order to visualize and form priority projects in Iceland in the field of sustainable development. The intention is both to **give information** on the main goals and emphases of Icelandic authorities and to **provide guidance** on future policy-making in important fields.

For the strategy to be able to fulfil its role, the success of follow-up and regular reviews is of vital importance.

Consultation within the government as well as with outside parties will be central to the follow-up, as it was in preparing this document. The idea is to review the strategy regularly every four years in relation to the Environmental Assembly. To assist in evaluating success, the indicators must be regularly updated. They must also be developed further in order to improve their accuracy and usefulness.

The key part of this policy is Chapter II, where some of the main goals and means to achieve them are defined. The following sections in Chapter I give an overview of main actors and policy instruments, whereas Chapter II is the guideline, describing the goals and some of the first steps to achieve them. Chapter III contains indicators that should help evaluate whether we are heading in the right direction.



Policy Instruments for Sustainable Development

Plans and Policies

The primary condition for achieving results is to know what to aim for. General goals regarding sustainable development and its individual components can be set in government policy papers and strategies, such as this one. Many plans in the field of environmental protection, economy and national development relate to the subject of this strategy. Examples of plans that already exist or are in preparation, are: a national transport plan, a regional development strategy, a soil conservation plan, a master plan on of hydropower and geothermal energy, a national nature conservation plan, an implementation plan on biological diversity and policy with regard to climate issues. In addition, one could mention physical planning, such as the regional plan for the central highlands, which is here below. International planning in which Iceland participates also falls under this category. A recent Nordic strategy on sustainable development is an example thereof.

Laws and Regulations

Icelandic laws regarding environmental issues have changed drastically in the past decade towards modern ideas and working methods. Laws in the field of nature conservation, planning, pollution prevention and environmental and food safety have been amended in recent years and a new law has been passed on environmental impact assessment. The establishment of the Ministry for the Environment in 1990 has played an important role regarding amendments to environmental legislation, while various international obligations assumed by Iceland in the environmental field have also had a considerable impact on Icelandic legislation. In this regard one could mention various international agreements, both global and regional but the biggest changes have occurred as a result of Iceland's participation in the European Economic Area. By its membership, Iceland is committed to introduce European

legislation in the fields of pollution prevention, chemicals, etc., though not in the field of nature conservation. About 40% of the Acts that have been introduced into the Agreement on the European Economic Area concern environmental issues. Legislation relating to the economy has also taken the ideas of sustainable development into account. In this respect one could mention the Act on Responsible Utilization of Fish Stocks and the Act on Research and Use of Underground Resources. Icelandic environmental legislation does not contain general provisions regarding liability for environmental damages, but the aim is to commence work on a bill on that issue in 2002. Furthermore, clarity and consistency regarding penalties is lacking.

One of the characteristics of Icelandic environmental legislation is the right of the public to have access to the land. Similar provisions are uncommon in foreign legislation, but in Iceland this right has been in effect from the time of the first Icelandic Republic, dating back to the 10th century. It is important that this right be maintained in order to ensure the harmonious coexistence of the population and nature.



International Agreements

Presently, Iceland is a party to over 20 conventions in the field of environmental affairs, not including conventions in the field of fisheries or the utilization of resources. Some of these agreements are international while others are regional. Among the most important global conventions are the UN Framework Convention on Climate Change, the Convention on Biological Diversity, the UN Convention to Combat Desertification, the Ramsar Convention on Wetlands, the Montreal Protocol on Substances that Deplete the Ozone Layer and the Stockholm Convention on Persistent Organic Pollutants, which was a turning point in the fight against oceanic pollution. The UN Convention on the Law of the Sea plays a key role regarding the utilization of oceanic resources. The Agreement on the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks took effect recently, and Iceland participates with neighbouring countries regarding the utilization of common species. The Convention for the Protection of the Marine Environment of the North-East Atlantic (the OSPAR Convention) is an important regional convention that initially was aimed at pollution prevention but has recently been developed further and now also includes protection of marine habitats. The Bern Convention on the Conservation of European Wildlife and Natural Habitats is also an important regional convention in the field of nature conservation.

Much discussion has taken place recently regarding improved implementation of international conventions in the field of environmental affairs. Great progress has been achieved in recent years in developing a set of agreements on many key environmental issues, but it is becoming difficult for many countries to meaningfully participate in all of the meetings and work within the framework of those agreements. Therefore it is to be expected that the emphasis in the near future will be on coordinating and streamlining international work and to strengthen implementation, rather than on approving comprehensive new conventions in the field of environmental affairs.

Economic Instruments

Economic instruments in the field of environmental protection and resource management have been studied closely in recent years by many countries and

international organizations. There are two main advantages to economic incentives. On one hand they can result in the cost of environmental protection being born by those who cause pollution or who use resources, which is the idea behind the Polluter Pays Principle and the User Pays Principle. On the other hand they can make it easier for industries and others to achieve goals in a more efficient and cost-effective way than through commands and bans. Economic instruments are most often in the form of taxes or fees.

Economic incentives have been used to a certain extent in Iceland, for instance with the levy of a fee on hazardous waste and a deposit fee on disposable beverage containers. The quota system on fish catches is also an example of an economic incentive. The aim is to introduce more economic instruments in the field of environmental protection and resource utilization in the near future.

Physical Planning

Physical planning is one of the most effective instruments for harmonizing different requirements on resource utilization, economic development and environmental protection. Physical planning is a distinct process in the preparation of policies that ensures that as many interested parties as possible participate in the decision-making. There are three types of planning: regional, municipal and local. Local planning stipulates land use of individual areas within the municipality, municipal planning applies to the municipality as a whole, whereas regional planning applies to a larger area and is therefore the joint project of several municipalities.

The Planning and Building Act stipulates that the aims of the Act include: “to encourage the rational and efficient utilization of land and natural resources, to ensure the preservation of natural and cultural values and to prevent environmental damage and overexploitation, using the principles of sustainable development as a guideline for all of these”. An example of the use of planning for this purpose is the regional planning for the central highlands. This is an experiment in harmonizing demands for the development of transport, power works and tourism on one hand, and demands for nature conservation on the other.

Environmental Impact Assessment

An Act on Environmental Impact Assessment was passed in Iceland in 1993 and a new Act was passed in 2000. The Act has caused a change in working methods regarding large projects, and considerably increased the input and participation of the public in the planning of projects and decision-making.

The aim is for European Directives on Strategic Environmental Assessment (SEA) to be passed as law in the near future. In this way, the environmental impact can be assessed earlier in the decision-making process, which makes it easier for the government to take different interests into consideration and can reduce the necessity of assessing the environmental impact of smaller projects. Environmental impact assessment in the planning stage can therefore lead to more efficient environmental protection and make it easier for implementing parties to adjust their plans to the goals of sustainable development.

Education

The public's general understanding of environmental and societal issues is a necessary prerequisite for democratic discussion and decision-making with the purpose of implementing sustainable development. To enhance such an understanding, good education on the basics of sustainable development must take place in schools and there must be a good information flow from government, non-governmental organizations and other parties. The aim of environmental education shall be to give individuals knowledge of their closest environment and the dangers to that environment from human activities, as well as providing an understanding of the relationship between their actions and the condition of the environment.

Environmental education in schools has increased in the past decade, from nursery school to university. The University of Iceland now offers a Master's degree in environmental studies, and many secondary schools and professional schools offer courses in the same, or place a special emphasis on environmental issues in their curriculum. Studies of environmental issues in primary schools are included in many subjects, especially natural sciences but also in subjects such as life skills and home economics. In addition many schools have shown initiative in harmonizing environmental education and general education. However, it should

be noted that environmental education is not a part of the curriculum of primary schools as a separate subject, according to the General Curriculum from 1999. Therefore environmental education in schools can be strengthened further and made more efficient.

General discussion on environmental issues, including information to the public through the media and the Internet, has increased considerably in recent years. Non-governmental organizations also play an important role in disseminating information to the public. Iceland is, however, lacking in some areas of public education compared to many developed countries, for instance regarding consumer education. It is important for public education to be part of policy-making in individual aspects of sustainable development. As an example, one could mention that in the governmental policy on climate change, emphasis is placed on education and a special effort in disseminating information to the public is decreed. This is seen for example in regard to fuel use of cars and possible ways of reducing emissions of greenhouse gases from the home, due to decomposition of waste and from transport.

Museums play an important role in education. Museums and exhibitions on natural sciences, culture and industrial structure have been established around the country in recent years, promoting increased public awareness of the relationship between mankind and nature. Regional Environmental Research Institutes have also been established in many places around the country in cooperation between the government and municipalities. These Institutes play a role in education as well as in research. A satisfactory national natural science museum has, however, yet to be established; this will be one of the priority tasks in the field of public education in the near future.

Monitoring and Research

It is important to base decision-making on environmental issues and resource management on a scientific basis and the best available information. Research is necessary in this respect, and it is important for research policies established by the government and others to reflect the need for information on which to base sustainable development. This has been done in the research plans established by the National Research Council in recent years, where sustainable development has been one of the priority themes.

Regular monitoring of the environment is necessary to view how situations develop and to be able to respond if necessary. It is important for the main environmental factors to be monitored regularly. The importance of good information over a longer period of time can, for example, be seen in the regular monitoring by the Icelandic Meteorological Office on the strength of the ozone layer. These measurements not only provide information for the Icelandic government but are also an important reference regarding the global thinning of the ozone layer, because nowhere in the world has the ozone layer been measured for as long a period as it has in Iceland. Clear emphasis in monitoring and a will to take into consideration the best available scientific knowledge, are important bases for decision-making from the viewpoint of sustainable development.

Indicators of Sustainable Development

Research and environmental monitoring are of no use if the results are presented in such a way that the public and decision-makers can hardly understand them. It is important to bridge the gap that often prevails between science and political decision-making.

In recent years, many countries and international organizations have developed indicators intended to measure results in implementing sustainable development, similar to how indicators of economic growth, inflation, etc. are used to show the status and development of economic affairs. Sometimes, a few key indicators are chosen that show the status of environmental affairs, economic affairs and social affairs that together are supposed to give an indication of how matters are progressing towards sustainable development. The aim of this work of developing indicators of sustainable development is to simplify results of scientific measurements so that they can be used in policy-making. The indicators must be numerous enough to give a comprehensive picture but not so numerous that it is difficult to have an overview of them all. Attempts have been made to combine such indicators into a single statistic, which is then supposed to be an index of sustainable development. Such an index can be interesting but also creates the danger of oversimplification.

Not much work has been conducted in Iceland in defining and developing indicators in the field of envi-

ronmental affairs and sustainable development that are related to goal setting in these fields. Statistics Iceland collects various figures relating to environmental issues and resource utilization, which it publishes regularly, but such information is not intended to be a recognized measure of progress in those fields. This strategy takes a step towards relating statistical information to goal setting with regard to sustainable development. This work needs to be further developed and key indicators in the field of environmental issues and resource utilization defined on the basis presented here. Such indicators must be based on solid scientific grounds, be useful regarding comparisons in time and space, and have a clear connection with policy as a good measure of effectiveness.

Development Aid

Sustainable development cannot be established in an individual country, regardless of developments in the rest of world. A large proportion of the world's population lives in poverty, and it is necessary to improve conditions for those who suffer the worst, i.e. by development aid. It is beneficial both to developing and donor countries that aid promotes sustainable development of societies, for instance by the transfer of environmentally sound technology. The cooperation between developed and developing countries is a prerequisite for sustainable development on a global scale.

Funds for development aid in Iceland have increased in recent years but are still well below the target figures set by the government. The biggest portion of Iceland's development aid is in fields that relate to the core of sustainable development: to promote the sustainable management of resources and the expansion of education and healthcare. Examples of such projects include assistance in the build-up of a sustainable fishing industry in Africa and elsewhere, and the UN University's Geothermal Training Programme in Iceland, where specialists from developing countries receive training in the utilization of geothermal energy. Recently the UNU Fisheries Training Programme also opened in Iceland based, to a large extent, on the same premises as the UNU Geothermal Training Programme. Icelanders have the capability to communicate knowledge and experience in other fields, for example in the field of soil conservation.

Sectoral Integration

The core of this strategy is the presentation of certain goals relating to environmental protection, sustainable use of natural resources and the maintenance and improvement of the quality of life. In order for these goals to be achieved, national and local authorities and

industry need to integrate them into sectoral developments. The following table shows the relation of some key sectors to the policy goals, and the text below discusses briefly the main tasks in each sector.

	Agriculture	Fisheries	Industry	Energy	Mining	Transport	Tourism
1. Clean air		•	•	•			•
2. Clean freshwater		•	•	•			
3. Safe food products	•	•	•				
4. Chemicals	•	•	•				
5. Outdoor activities	•						•
6. Natural disasters		•		•			•
7. Iceland's biota	•	•	•	•			•
8. Geological formations				•	•	•	
9. Wilderness areas	•			•	•	•	•
10. Living marine resources		•					
11. Soil conservation	•			•			
12. Renewable energy		•	•	•		•	
13. Waste	•		•				•
14. Clean ocean		•	•				
15. Climate change	•	•	•	•		•	
16. Ozone layer		•	•				
17. Biological diversity	•	•		•			



Fisheries

The main task within the Icelandic fishing industry is to use living marine resources in such a manner that the long-term capacity of the exploitable marine stocks is maintained or increased. The utilization of marine resources is a fundamental pillar of the nation's basic economic prosperity. It also has considerable environmental effects. Policy on the sustainable utilization of living marine resources must take all these factors into account. The sustainable utilization of marine stocks should contain the incentive to protect the marine stocks ecosystem, with the interest of future generations in mind. It should also provide the opportunity for the fishing industry to utilize living marine resources in the most efficient way possible. This is the aim of the current Fisheries Management Act. The fisheries management system is supposed to promote the conservation and efficient utilization of the marine stocks and thus to ensure stable employment and settlement throughout the country.

The views of sustainable utilization are the guiding light in international cooperation on the management of marine stocks. In the international arena, Iceland has promoted the concept of ecosystem management in the development of policy on the sustainable use of living marine resources. The biggest step in this regard was the approval of the Reykjavik Declaration on Responsible Fisheries in the Marine Ecosystem in 2001. In international fora, Iceland has emphasized that countries have the right to use living marine resources, including marine mammals, in a sustainable manner.

Regular monitoring of the ocean's ecosystem and of the pollution of Icelandic fishing grounds is necessary, to ensure that it is possible to prove that Icelandic marine products meet the strictest requirements made by consumers. Further research on the effects of fishing gear on the ocean floor is needed. The fishing fleet is a source of almost a third of the emission of greenhouse gases in Iceland; ways of reducing these emissions need to be sought. The fishing industry is further discussed in part 10 of Chapter VII, which deals with the sustainable use of living marine resources.

Industry


It must be ensured that industrial production is conducted in a way that promotes maximum efficiency and minimum negative impact on the environment.

This is achieved, for instance, by reducing pollution as much as possible, minimizing the use of hazardous chemicals and promoting efficient utilization of raw materials and energy. Industrial companies must comply with rules regarding pollution prevention and the use of chemicals, although to an increasing extent they have set their own goals regarding environmental issues. A few Icelandic companies have received internationally-recognized certification of their environmental policies or manufacturing products and processes. Many more have formulated an environmental policy. The government consults with industry regarding the setting of goals and regulations in the field of pollution prevention and related issues. The aim is for the responsibility to be increasingly shifted to the companies, so that they themselves can aim at achieving their goals in the most efficient manner possible.

Agriculture

Agriculture's contribution to sustainable development is many-faceted and not limited to food production. One of the main tasks of Icelandic agriculture in this regard is to establish sustainable grazing and to promote land reclamation along with the build-up of farming and rural settlements. An agreement on sustainable land use has been signed between sheep farmers and the government. A reduction in the number of sheep has resulted in less pressure from grazing, although grazing must be further reduced in sensitive areas. Through the conservation of land, grazing control and revegetation, conditions can be created for increased utilization of grazing areas in the future. The participation of farmers in land-improvement projects has increased and should be further developed. The build-up of tree farms is part of this development. Increased worldwide interest in environmental issues can create new opportunities for Icelandic agriculture, where pesticide use and pollution problems are largely absent. It must be ensured that the positive image of purity of Icelandic agricultural products continues to be based on solid grounds. The purity of water sources in the countryside must be ensured. The government has promoted countryside beautification projects; this work should be continued. Attempts should be made to establish a process for the disposal of agricultural plastics. The number of abandoned buildings and facilities in the countryside increases along with the decrease in the number of farms; a way must be found to remove many of these





structures. Pollution from fertilizers needs to be studied further, even though this is minimal compared to most other countries.

Energy

Energy is one of the basic needs of a modern society. A secure supply of energy and efficient energy production are prerequisites for maintaining and improving the country's standard of living. All energy production has some effect on the environment. Most of the energy production in the world takes place through the burning of fossil fuels, which causes concern from the standpoint of sustainable development, in part because coal and oil supplies are limited but mainly because the burning of coal and oil causes air pollution and has an impact on the earth's climate. Nuclear energy is the second most important energy source in the world, but it creates radioactive by-products, and the danger of serious environmental accidents. In order for mankind to meet its future energy needs in a sustainable manner, the most promising option is to utilize renewable energy resources, such as hydro, wind, solar and geothermal energy. These sources of energy account for less than 5% of the world's energy production, whereas about 70% of Iceland's energy use comes from clean and renewable energy resources, the largest percentage of any developed country. Iceland could possibly become the first country in the world to cease using fossil fuels for the most part, especially by staying in the forefront in introducing alternative fuels such as hydrogen for vehicles, as domestic energy resources would be used for the production of hydrogen.

The use of the country's renewable energy resources has improved Icelanders' standard of living and increased economic diversity. However, despite its advantages, energy production using geothermal energy and hydropower does have negative effects.

Reservoirs of geothermal energy are often renewed more slowly than they are used, although there is little danger of depleting them based on present use. Power plants also affect ecosystems and wilderness areas. Negative environmental impact must be minimized and the use of imported fossil fuels should be further reduced. Work is underway to harmonize the viewpoints of energy use and environmental protection in the development of a master plan for hydro and geothermal energy resources.

Transport

Transport has an impact on most areas of society and many of the goals put forward in this strategy. The construction of roads and other transport structures needs to take environmental factors into account, and vehicles emit pollutants and greenhouse gases. A considerable effort has been put into integrating sustainable development concerns into transport policy. In the transport plan ratified by the Icelandic Parliament (Althing) in 2002, sustainable transport is one of the four main goals introduced. Particular emphasis is put upon the role of transport in minimizing emissions of greenhouse gases, for example through the shortening of transport routes, better transport facilities and traffic control.

Tourism

Tourism has been ever increasing in Iceland in the past few years and is now a major employment sector. Increasing numbers of tourists have a positive effect on the economy and enhance the need for nature conservation, because Icelandic nature is the magnet that draws most tourists to the country. Increased funding has recently been made available for the build-up of facilities in tourist areas to reduce stress on the land. Work will continue to be put into projects in this field, as specified in the Chapter "Outdoor Activities in Harmony with Nature".

Local Agenda 21 and Regional Development

This strategy has been prepared by the national government and the means specified in Chapter II are mainly its responsibility. Iceland, however, has two administrative levels, and local authorities work along-

side the central government in implementing many of the projects that are of major importance for the advancement of sustainable development. It is therefore important for individual municipalities to set their

own goals regarding their sustainable development that suit their economy and specific circumstances. They should also define the local views on how the region can be strengthened and similar or improved living standards ensured for future generations. Chapter 28 of Agenda 21 contains guidance for local authorities' initiatives in support of Agenda 21. One of the values of such initiatives is that they are prepared at the administrative level closest to the local population and it should therefore be possible to get the general public to participate.

In recent years Icelandic municipalities have done considerable work under the label Local Agenda 21. In April 2002 a total of 48 municipalities had joined in the local agenda work in Iceland in one way or another. Approximately 93% of the population lives in these municipalities. Of these 48 communities, 12 have already approved a Local Agenda 21 and work on Local Agenda 21 is well underway in approximately 15 more municipalities. Among the municipalities that are

furthest along in this work are all the biggest ones in the country, such as Reykjavik, Akureyri, Hafnarfjörður and Kópavogur. The local agenda work is complementary to national policymaking regarding sustainable development, and local and national authorities must continue to cooperate in this respect.

Governmental Regional Development Strategy

This strategy does not deal specifically with regional development because a national regional development policy is in effect and is regularly reviewed. In the new regional development strategy, approved in 2002, sustainable development is mentioned as one of the main pillars of regional development. The policy states: "Communities, economic development and the natural environment are not opposites but synergetic factors. Sustainable development aims at integrating economic, social and environmental goals. Sustainable development and regional development have many of the same goals."



Role of Civil Society

The Public and Non-Governmental Organizations

The active participation of the public is essential to achieve progress towards sustainable development. Each individual bears responsibility and affects environmental and societal issues with his or her daily activities, consumption, transactions and participation in organizations and activities. Therefore it is important for the public to be well informed about the choices available in daily decision-making and to use those choices to have a positive impact.

Non-governmental organizations, in particular in the field of environmental affairs, have expanded in the past few years, and they now participate actively in public debate and in the implementation of various projects. The government has recently increased its

public participation in environmental decision-making, and intends to ratify it soon.

Companies

Companies play a key role in sustainable development. The operations of companies have a great impact on natural resource use and environmental pollution. A large part of the government's environmental policy is therefore focused on regulating such operations and monitoring them. In many places industry has taken an increased initiative in the field of environmental issues. There are many reasons for this. Some companies seek increased goodwill and market share where consumers have an acute awareness of environmental affairs. An active company environmental policy can also reduce expenses, for example by better utilizing raw materials and creating less waste. Companies'



cooperation with non-governmental organizations. Indeed, the Ministry for the Environment has completed a cooperative agreement with NGOs, providing them with support and regular consultation. The Icelandic government has signed the Aarhus Convention on access to environmental information and

internal control can in some cases replace public monitoring of operations. Voluntary agreements between the government and industry to that effect have been tried in many countries, for example in Iceland, regarding the implementation of the Act on a Special Fee on Hazardous Waste. Increased use of economic incen-

tives increases companies' latitude to meet environmental demands in a more flexible and efficient manner than is possible through prescriptive regulations.

The emphasis in corporate environmental affairs has changed. Previously the focus was primarily on environmental effects at the end of the manufacturing process, e.g. through the installation of pollution prevention equipment, whereas the emphasis has shifted towards changing the manufacturing process itself so that it causes the least damage to the environment. Cleaner manufacturing technology has, for example, been implemented in large-scale industries in Iceland and is required for new energy-intensive industry projects. Concurrently with this development, industry's responsibility for environmental affairs has increased, a development that is expected to continue. Recently, provisions on green accounting of companies subject to licensing by authorities have been put into law, increasing their duty to provide environmental information.

Media

Our view of the world and general discussions in society are, to a great and increasing extent, shaped by the media. It has been pointed out that sustainable development issues are not prominent in the media because they entail slow development that is considered to be less newsworthy than individual major events and catastrophes. This may lead authorities to focus on responding to popular issues and events rather than on long-term development. This places a responsibility on the media and those who shape public opinion and discussion but also on those who work on projects promoting sustainable development, who must introduce issues clearly and disseminate information in a clear and useful manner to the media and the public.





II. Goals and Means

This chapter discusses seventeen objectives that relate to specific environmental issues, the utilization of natural resources and the adaptation of industry and operations towards sustainable development. The order of the sub-chapters does not reflect their extent or importance, but they are divided into four sections:

Healthy and Safe Environment
Conservation of Icelandic Nature
Sustainable Use of Resources
Global Issues

Each sub-chapter is divided into four parts. The objectives are presented in the title of each chapter, then in the first part these objectives are further elaborated and sub-goals are presented. The second part contains a brief discussion on the situation, while the third specifies the means to these goals. This is not a detailed implementation plan but rather touches on a few key issues that deserve attention. The last part contains indicators to measure progress towards achieving the objectives in question. The indicators are listed at the end of each sub-chapter here, but are then presented in Chapter III.

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Healthy and Safe Environment



- 25 1. Clean Air
- 26 2. Clean Freshwater
- 28 3. Safe Food Products
- 30 4. An Environment Free of Hazardous Materials
- 31 5. Outdoor Activities in Harmony with Nature
- 33 6. Protection Against Natural Disasters

The state of the environment has a great impact on human health and wellbeing. This section's objectives all relate to human well-being, although they also affect the health of other organisms and the biota in general.

One of the most pressing health issues in the world is the pollution of air and drinking water, although the situation in Iceland in this regard is relatively good. The demand for safe foods has increased in recent years and so have concerns about increasing quantities of new, artificial substances in the environment and in various consumer goods, as certain new chemical compounds have proven to be hazardous to human health. Outdoor activities and access to nature are considered important aspects of the quality of life in modern metropolitan society. The last issue in this section deals with ways to increase national security in relation to natural disasters such as earthquakes, volcanic eruptions and violent storms.

Icelanders enjoy, in general, a sound and healthy natural environment, though there are certain pollution problems that must be dealt with. This is not only on account of human health and wellbeing but also because Iceland's image as an unpolluted country and a source of pure and healthy products, is vital for Iceland's important food and tourism industries.

1. Clean Air

OBJECTIVES

- ★ To ensure that Iceland's inhabitants breathe clean air, with air pollution levels below the strictest levels.
- ★ To minimize air pollution caused by traffic, industry and other activities.
- ★ To reduce air pollution in the greater Reykjavik area with the aim of significant improvement in the next few years.

The Situation

The air in Iceland is, in general, clean and less polluted than in more densely populated countries in Europe and North America. This is partly the result of a small population living in a large country, far from the major sources of air pollution in the northern hemisphere. Clean power sources of geothermal energy and hydro-power also contribute to the cleanliness of the air. Air pollution outside of the Reykjavik area is generally not considered a problem in Iceland, except in isolated incidents where there is polluting industry such as odour pollution from fishmeal plants. These problems can be dealt with by licencing to individual factories.

Air pollution in the greater Reykjavik area is a problem, however, even though it is less than in many comparable cities in developed countries. The main cause of pollution is increasingly heavy traffic. Stricter air pollutant levels that will come into force in the European Economic Area in the years 2005–2010 will demand increasing efforts to deal with this issue. Traffic is expected to grow with Greater Reykjavik's increasing

population, and if air pollution is to be significantly decreased, more environmentally sound technology must be developed for transport – in addition to government action and a public will to use such means of transport. Particulate pollution, which is partly the result of the use of studded tyres on cars, is a problem not widely known outside of Iceland and is a priority issue in relation to local air pollution. The Minister for the Environment has nominated a special workforce to study the causes of particulate pollution in the Reykjavik area and recommend ways to improve the situation. The workforce is expected to turn in its findings in 2003. Particulate pollution can also occur outside of the Reykjavik area, especially in the vicinity of eroded areas during high winds. Curbing soil erosion can therefore mitigate air pollution.

Pollution trends during the past decade have varied depending on which air pollutants are in question. Emission limits in relation to air pollution are first and foremost based on requirements of the EEA. These requirements are now found in seven regulations. As

was mentioned earlier, new limits for air pollutants will come into effect in the years 2005–2010, and further limits will be set for specific air pollutants such as benzene, PAH and certain heavy metals.

Iceland has agreed to minimize discharge and to sustain the quality of air in accordance with the Convention on Long-Range Transboundary Air Pollution (LRTAP) and the Nordic environmental strategy.



Means of Implementation

★ Better monitoring of air pollution and increased information flow to the public:

The monitoring of pollutants in the air should be improved so that it fulfils requirements of a framework Directive on the quality of air. Results from pollution monitoring shall be published in an accessible manner. Real-time measurements should be published on the websites of monitoring agencies. Daily information on pollution should be published in the media in a simple and clear manner, in a similar way as weather reports and forecasts are presently published. In areas where pollution is not thought to be sufficiently substantial to be monitored, methods must be developed to calculate the concentration of pollutants in the air in relation to emission from industries, traffic and other factors.

★ Reduction of particulate matter in the air:

The concentration of particulate matter in the air should be reduced in the Reykjavik area. Probably the most important factor in achieving this objective is to reduce the use of studded tyres and encourage drivers to use alternative means for safe driving on icy roads. Research on developing environmentally-friendly substitutes for the traditional studded tyres, or to find ways to minimize their utilization, shall be endorsed. The taxing of traditional studded tyres will be consid-

ered and such a fee would be in relation to the wear on roads. Better cleaning and washing of streets and increased usage of public transport are also important factors for minimizing particulate pollution due to road traffic.

★ Cleaner fuel and more environmentally sound vehicles:

Fees on fuel should be in relation to the level of pollution it causes. Fees on pure diesel oil would thus be less than on more polluting fuels and fees on methane and hydrogen even less. Fees and taxation on private cars and other vehicles should also be in such a manner that it would be more economical to drive thrifty cars than fuel-greedy vehicles and that cars that use non-polluting fuels will be subject to the lowest fees.

Indicators

- 1.1. Concentration of NO₂, O₃ and SO₂ in the atmosphere in Reykjavik, 1994–2000.
- 1.2. Concentration of airborne particulate matter in Reykjavik, 1995–2002.
- 1.3. Concentration of lead in the air in Reykjavik, 1986–1996.
- 1.4. Index of population, number of private cars and the use of public transport in Reykjavik, 1970–2000.

2. Clean Freshwater

OBJECTIVES

- ★ All inhabitants of the country should have access to abundant clean water unpolluted by chemicals and micro-organisms, for drinking and other uses.
- ★ Incidents of drinking water contamination should be rare or non-existent.
- ★ Pollution of rivers and lakes should be non-existent or so miniscule that it does not affect freshwater ecosystems, fish migration or the recreational value of an area.

The Situation

Over one billion people in the world are considered to lack access to safe drinking water and almost two and a half billion people lack adequate sanitary facilities. The lack of plentiful and clean water is widely consid-

ered to be one of the most serious environmental issues that the world faces in the 21st century. It is safe to say that Iceland does not face this problem. Fresh water in Iceland is generally the purest in Europe, and it should be easy to keep it this way.



Heavy rainfall (an average 2000 mm per year) and the fact that Iceland is the most sparsely populated country in Europe, means that there is abundant water per inhabitant and the majority of the population has access to fresh water. Most of the water, over 95%, is untreated ground water originating from springs, boreholes and wells. Some municipalities are still dependent on surface water, which in most cases is irradiated by ultraviolet light in order to do away with microbial contamination from animals and soil. This method by and large cleanses the water efficiently. Unfortunately there are a few populated areas that still use untreated surface water. Monitoring has shown that this water is sometimes contaminated and is not up to regulatory standards for drinking water. The main reasons are a high total bacteria count and contamination due to coliform bacteria. Such contamination can be caused by temporary problems due to heavy rainfall and ablation or may be caused by an increase in microorganisms in distribution systems. Coliform contamination is usually due to improper construction around water sources but can also be due to the use of surface water or surface water mixed with ground water. Coliform bacteria are occasionally found in drinking water, which is then usually infectious. *E. Coli* is almost unheard of in drinking water in Iceland and there are only four known cases of more than one individual being infected that originated from water in the past 15 years, two of which occurred in the past two years. In confirmed incidents, bacterial contamination is usually due to *Campylobacter*, but it is plausible that

both viruses and parasites are to blame in the case of unconfirmed incidents.

The microbial condition of drinking water is regularly monitored in Iceland by sampling of water resources and distribution systems. Over 90% of samples have passed standards required for microbial conditions for water since 1995. Ground water is usually free of turbidity but soil and other grime frequently contaminate surface water. About 95% of drinking water in Iceland is ground water, unlike in many other countries where surface water is used to a large extent for consumption. This is why there has been little emphasis put on the monitoring of drinking water in Iceland, resulting in limited public information on the concentration of soluble matter in drinking water. Chemical measurements indicate a low concentration of soluble minerals, heavy metals and other hazardous matter, far below the standards. Where drinking water has been analyzed, persistent organic substances and pesticides have never been above limits of detection. The concentration of persistent substances has been very low where it has been measured in a freshwater ecosystem (Lake Thingvallavatn) and it is safe to say that the main source of these agents in the Icelandic environment is transboundary pollution which has been carried by wind to Iceland. The traces of heavy metals found in freshwater (rivers) in the country are mainly natural background levels of these substances in the Icelandic environment and not caused by human contamination. The contamination of freshwater by agriculture and the use of fertilizers is a problem in many countries. This is not so in Iceland; the concentration of nitrate is, in most cases, very low and always within limits. The contamination of freshwater due to draining is also miniscule as most water runs into the sea, although there are isolated incidents where this is a problem and where improvements are necessary.

In the year 2000 a framework Directive for Community action in the field of water policy was issued on potable water that addresses the protection of surface water on land, water in estuaries and sea-blended water, coastal water and ground water. The Directive defines referents, means of implementation and how monitoring is to be executed. The Directive comes into effect before the end of 2003. Iceland is committed to enforcing the section of the Directive that deals with the protection of drinking water and the protection of



water from contamination due to industry and population.

Means of Implementation

★ Legislation on water protection:

Legislation on freshwater should be adopted, that will involve integral protection of water and aquatic ecosystems, sustainable development and monitoring and is based on the EU Framework Directive on potable water.

★ Improved monitoring of freshwater and drinking water:

A network of monitoring stations should be set up to monitor the quality and contamination of water in Icelandic rivers, lakes and ground water in accordance

to international standards. Added emphasis needs to be put on factors that affect public health, such as microbial contamination. Human impact on the quality of water and aquatic ecosystems shall be assessed.

★ All drinking water should measure up to health standards:

Water protection zones shall be defined for water sources. Efforts must be made to improve the condition of small private water sources, which are unacceptable in many places.

Indicators

2.1. Concentration of N and P in selected rivers and lakes.

3. Safe Food Products

OBJECTIVES

- ★ Consumers should always be able to trust that they are offered only products safe for consumption.
- ★ The labelling of food products should give sufficient information on the contents of the product.
- ★ Iceland must continue to be esteemed as a producer of healthy and safe food products made in an unpolluted environment.

The Situation

With increasing international trade and modern food production technology, the diversity of food products has increased. This calls for increased information flow to the consumer and a stronger demand for consumer safety. A strong demand for food safety helps maintain the high status of Icelandic food products. Close cooperation between all parties of food production is necessary. The demand for safe foods grows continually louder internationally, amongst the public and authorities alike. The goal of safe foods is important for Icelanders, not only from the consumers' perspective, as the production and export of food is one of the cornerstones of the country's economy. It is vital to strengthen Iceland's image as a manufacturer of safe, high-quality food products with strict supervision and

preventive measures against pollution from hazardous materials or microbes.

Changing patterns of consumption and an increased variety of foods, which in some cases contain added nutrients and additives, contribute to the importance of conducting consumer surveys, to obtain reliable information on patterns of consumption. Such information can be used to take measures to prevent diseases that are caused by excessive intake of nutrients.

It is important to influence and keep track of developments in the EU foodstuff legislation. A large part of food imports in Iceland comes from the United States, where regulations on the labelling of food products often differ from EU regulations. It is important for

Iceland to ensure that standardization of regulations does not result in lower safety standards on foodstuffs from outside of the EU and that the consumer's best interests are always put first. The testing of imported food is an important factor in ensuring its safety for the consumer. In order to guarantee its safety for food products it is important that there is a standardized, active inspection for the whole country.

Means of Implementation

★ Monitoring and prioritization of risk factors:

Good and regular monitoring of pollutants, additives and possible pathogens in foods, whether imported or domestic, must be ensured. News of pollution or infection related to foods must be dealt with immediately and with the best interests of the consumer and exporters in mind. Strict requirements must be made for risk evaluation on health and environmental grounds of genetically modified organisms, and caution should be a priority in the marketing of genetically modified products.

★ Hazardous materials and additives in foods:

The use of drugs and pesticides in food production should be as limited as possible. Monitoring of pesticides in foods is an important factor in controlling the use of these agents. The use of additives shall only be permitted if they have been proven not to cause health problems. Changing patterns of consumption demand regulations on the use of additives in food products in order to prevent hazards from their excessive consumption. Food supplements and natural food products need to be regulated.

★ Battle against microbial diseases in foods:

Work should continue on decreasing incidents of

diseases caused by microbes that are carried in food products, such as salmonella and Campylobacter. It is almost impossible to eradicate these pathogens as they are found widely in the environment; nevertheless, experience has shown that with systematic action it is possible to decrease the number of cases. Environmental requirements shall be set for the surroundings of food production sites.

★ Increased information to the consumer:

It is necessary to increase the public's awareness and knowledge of the handling of foods. It must be clear to the consumers whether the product contains ingredients from genetically modified organisms: this can be implemented with clear rules on product labelling.

★ Environmental requirements in relation to food manufacturers:

A polluted environment can have negative effects on food production but the production of food can in itself be a factor in the pollution of the environment. Waste material from food manufacturers in both populated and rural areas is an example of this. These factors need further inspection and surveillance to ensure that food manufacturers abide by rules for environmentally sound production.

Indicators

- 3.1. Confirmed cases of Salmonella and Campylobacter in Iceland 1990–2000.
- 3.2. Pesticides above permissible maximum levels, percentage of samples 1991–2000.



4. An Environment Free of Hazardous Materials

OBJECTIVES

- ★ The use of chemicals and chemical products should not threaten the environment or human health.
- ★ Consumers should have access to conclusive information on how to utilize products with chemicals, and information on potential hazards that may arise from chemicals in the product.
- ★ The use of biocides and pesticides should be decreased.
- ★ The disposal of materials hazardous to health and the environment should be limited as much as possible, and cease completely within 25 years.

The Situation

Modern society is dependent on chemicals and chemical products and each year new chemicals are introduced. With increasing international trade these chemicals spread wider and faster than before and international cooperation is therefore important. It is especially important for Iceland to partake in EU policies on these matters and in international collaboration for the limitation of use and disposal of hazardous materials that have destructive effects at a global level.

Of over 100,000 chemical compounds that were recorded in Europe in 1980, around 30,000 are in circulation today. In most cases there is insufficient information on the properties of these chemicals or potential hazards to human health or the environment. Detailed information on the more than 2000 new chemicals that have entered the market since 1980 is needed. Chemicals on the market prior to 1980 are still being researched but progress is slow. Reports and research on the properties of chemicals and products are important for evaluating and reducing risks in the utilization of these chemicals and for making rules on their usage if necessary. Caution is always important and sometimes restrictions have been put on certain chemicals, banning them in products for sensitive consumer groups such as children.

The EEA agreement that came into effect in 1994 meant that Iceland had to adopt EU legislation on hazardous materials. This is an ongoing process and substantial changes have been made on the classification of chemicals. The category of chemicals that are considered hazardous to human health has grown and so has the category of chemicals hazardous to the envi-

ronment. In some cases the use of chemicals has been banned or restricted to limited fields if they have proven to be undesirable. Some firms have replaced hazardous substances at their own initiative, when alternative chemicals that do not cause similar problems have been available.

Lack of perspective over the quantities of chemicals and chemical products that are imported into the country is one of the problems that needs attention as far as chemical use is concerned. Laws and regulations



stipulate the monitoring of imported pesticides, toxic and ozone-depleting substances, and some additional chemicals. Import and production control of toxic materials is patchy and in need of reform, as is the control of other hazardous materials.

Disposal of hazardous materials into the environment is limited as far as possible, with provisions in business licences and regulations on the chemical content of fuel. A regulation on green accounting that takes effect in 2003 contains provisions aimed at further reducing the disposal of hazardous materials into the environment.

Means of Implementation

★ Surveying and control of chemicals:

Authorities should commence compulsory registration of chemicals and chemical products that are produced domestically or are imported. Surveying should be restricted to chemicals and chemical products that are considered hazardous along with certain other chemicals and products such as ozone-depleting substances and pesticides. Registration should record the volume of marketed chemicals, how they are employed and how they are labelled.

★ Responsibilities of industry:

Industry's responsibilities shall be increased and businesses encouraged to analyze and rate chemical products related to their operations and to ensure that the

utilization of these does not jeopardize the environment and public health.

★ Decrease use of biocides and pesticides:

The use of the most hazardous biocides and preservatives must be decreased. Permission to use substances that may have severe damaging effects on human health or the environment will not be granted if other less hazardous substances can be found. Technology that does not involve the use of dangerous materials will be encouraged, such as the use of biological control in agriculture and horticulture and disinfecting without the use of hazardous chemicals.

★ Plan of action for limited disposal of hazardous materials:

A plan of action should be produced with the objective of limiting as far as possible the disposal of hazardous substances that threaten health and the environment. The plan should take into consideration international and regional agreements on chemicals and chemical products, and define how the aforementioned objective is to be achieved in a systematic manner within a certain timeframe. The precautionary principle should be the guiding light in this plan of action and the replacement rule should apply where possible, for instance with agreements between businesses and government on replacing hazardous substances with safer ones that serve the same purpose.

5. Outdoor Activities in Harmony with Nature

OBJECTIVES

- ★ The public's right to free access to common land should not be restricted, unless it is vitally necessary for the purposes of nature conservation.
- ★ Outdoor activities considerations should be taken into account in planning and decisions on land use.
- ★ The growth in tourism in Iceland should be further encouraged, and accompanied by preventive measures to protect nature from damage caused by increased traffic.

The Situation

Iceland is a sparsely populated country that offers many opportunities for outdoor activities. In the

modern metropolitan society access to nature and the outdoors is becoming an ever more important factor for the quality of life. According to the Nature Con-



ervation Act, the public may travel the country, but every traveller must treat it with respect and take caution so as not to damage the environment. Increased interest in the outdoors and growing traffic around the countryside calls for regulations and action to integrate demands of different groups and to ensure that free access to the land goes hand in hand with nature conservation views and other land use.

The number of foreign visitors to Iceland more than doubled in the past decade, which is seen as considerable growth compared to international standards. Domestic tourism has also grown. The increase in tourism and the increased importance of the tourist industry for the national economy enforces the need to prevent negative effects of human traffic in the country. Pressure from tourism can have damaging effects on the country's nature, for instance from off-road driving and traffic from horse riders or even hikers through sensitive vegetation such as that found in the highlands. It is therefore imperative that outdoor activity is developed in harmony with nature. At the same time it is important that outdoor activity is taken into consideration during land use planning.

The situation in Iceland is such that tourism and nature conservation should not be at odds with each other but go hand in hand. Intensive nature conservation ensures that popular natural phenomena maintain their attraction and the increasing number of tourists increases the economic value of nature. Experiences abroad have shown that the majority of tourists are prepared to abide by rules and instructions that are meant to prevent trampling and damage to the land and natural phenomena.

Various measures have been taken in recent years to deal with increased stress on sensitive areas. The government has greatly increased funds to improve conditions in popular tourist spots and provide more and better information to tourists. Efforts to encourage a more even distribution of visitors, both geographically and seasonally, have proved successful. Highland roads are not open except during those periods that the Nature Conservation Agency and the Public Roads Administration deem acceptable. A clause has been added to nature conservation laws that authorizes the closing of protected areas if they are in danger of damage caused by human traffic.

Means of Implementation

★ Right to Travel:

The right of the public to travel freely around and stay in the country shall continue to be secure, as this is a right that has been in effect from the time of the first settlers. With the freedom of travel comes the respon-



sibility to treat the land with respect and it is important that the means to protect the country from increasing traffic do not unnecessarily restrict access to the land.

★ **The carrying capacity of tourist sites:**

Research on the carrying capacity of particular places is relatively new in Iceland. It is government policy to endorse such research in the years to come in order to get a better idea of the capacity of many of the main tourist sites. The findings of this research will then be used in general policy formulation and to prioritize actions to reduce stress in nature and improve the carrying capacity of the places in question.

★ **Improvement of conditions in tourist sites:**

More funds have been put into the improvement of tourist spots in recent years, amounting to an increase of ISK 60–90 million per year. These funds are used to improve conditions in popular places, for instance by clearing paths, making parking spaces and improving access.

★ **Increased patrolling and information to tourists:**

It is certain that the majority of travellers, both domestic and foreign, choose to treat the land with care and avoid causing damage. Therefore increased information to tourists can be very productive; it is, for instance, important to make it clear that off-road driving is not permitted. It is necessary to develop patrolling in the years to come, in keeping with increasing tourism and the protection of new areas.

★ **Tourist participation in monitoring costs:**

Tourists should increasingly cover costs of monitoring and development of tourist sites and tourist information.

★ **Outdoor activity and planning:**

The value of outdoor activity should be considered in planning and the future potential of outdoor areas should be examined parallel to alternative possibilities for utilization. It is important to bear in mind the public's access to outdoor areas in the making of a strategic framework. With a new Directive on Strategic Environmental Assessment (SEA), there is a chance for developing a methodology that centres on the value of areas for outdoor activities, during decision-making for land use.

Indicators

- 5.1. Total number of foreign tourists to Iceland 1990–2000.
- 5.2. Total number of overnight stays categorized by regions 1998–2001.

6. Protection Against Natural Disasters

OBJECTIVES

- ★ All inhabitants of the country should live in reasonable safety from natural disasters.
- ★ The risk of natural disasters should be taken into account during planning of land use.

The Situation

Nature is the basis for human survival, but the forces of nature can also pose a threat. This is especially true in Iceland, as the country's geographical position and geological character make it a place of harsh natural forces that often cause danger to people and structures. It is quite common that in one person's lifetime there will be a number of volcanic eruptions, earthquakes, violent storms, landslides and avalanches. Once in a while in the nation's thousand-year-old history there

have been incidents of terrible catastrophe. The country's inhabitants have adjusted to these conditions as much as possible. Therefore structures, houses, harbours, dams, bridges and electrical lines are designed to withstand the pounding of nature's forces while scientific understanding of the behaviour of the forces of nature is increasingly improving.

Natural disasters can be meteorological such as storms, floods, avalanches and landslides, but they can also

stem from geological activities such as volcanic eruptions and earthquakes.

Iceland is an island in the middle of the North Atlantic Ocean where warm and cold ocean currents meet and is in the path of frequent low pressure areas. This location causes strong winds, which can cause heavy rainfall, landslides and avalanches. Even though scientists keep a close watch on weather developments and weather forecasts are becoming ever more accurate, the weather can take a different turn to what is expected and cause accidents. Because of the proximity to Greenland and the Arctic and the direction of ocean currents, sea ice sometimes drifts to the shores, which can create problems.

Most deaths related to natural disasters are caused by accidents at sea and drowning. Around 4000 people are thought to have drowned in the last century, including drowning incidents in rivers and lakes. A large number of deaths by drowning occur in accidents at sea in storms and breakers. Larger vessels and improved structuring have increased the safety of sailors, so casualties have decreased. On land the main meteorological threat is avalanches. The economic damage caused by avalanches in the past 25 years amounts to ISK 13

billion, taking into account both the loss of life and property. In 1995 avalanches in the West Fjords claimed many lives in Sudavik and Flateyri. After those incidents, authorities substantially altered the organization of surveillance and risk evaluation in addition to launching extensive preventive action by raising defence strongholds.

Few places experience as much geological activity as Iceland. The Atlantic ridge lies straight across the country and the Eurasian and American continental plates pull the country apart to the east and west. Volcanic and seismic activities have often caused great damage, the eruption in the Westman Islands in 1973 being a good example. Direct financial damage as a result of the eruption is thought to have amounted to ISK 18 billion, a figure that does not include indirect damages caused by the shutting down of businesses and disturbances to individuals. Earthquakes can also cause great damage, as was seen during the earthquakes in the south of Iceland in the summer of 2000. Most structures built in the past 40 years are designed to withstand pressure of quite powerful earthquakes, which reduces the risk of human casualty. Scientists have installed an extensive monitoring network to gauge movements in the earth's crust that might forecast events.



Means of Implementation

★ Design of structures and planned areas:

The safety of people from natural disasters must be ensured by the continued design of structures that can withstand pressures from storms, earthquakes and other natural threats. Defences should also be erected in hazard zones or communities vacated from such zones.

★ Strengthen civil defences:

The safety of people should be ensured by public preparedness and planning of security. The present monitoring system should be improved and its efficiency increased.

★ Promote research:

Support should be increased to research which aims to provide a better understanding of natural activities that may have serious environmental consequences. Emphasis shall also be placed on continued development of probability analysis on natural activity, in order to improve the reliability of predictions.

★ Mapping and risk analysis:

Risk analysis should be executed for planned settlements so land use can be managed with regard to natural hazards.

Indicators

6.1. The budget of the Avalanche Fund 1996–2000.



Protection of Icelandic Nature



37 7. Protection of Iceland's Biota

39 8. Protection of Unique Geological Formations

40 9. Wilderness Conservation

The conservation of unspoiled or untouched nature is an important factor of sustainable development, as well as the sensible utilization of natural resources. Unspoiled nature is valuable in itself, and is a source of human well-being and quality of life that is not easily measured in economic terms.

Icelandic nature is in many ways unique; it is characterized by intense activity of internal and external forces as well as a biota that has had to adjust to harsh conditions. With the exception of soil and wind erosion caused by humans, and drainage of lowland wetlands in the 20th century, Icelandic nature has been less tampered with than in most industrialized countries. Conditions are therefore good for conserving and even reclaiming part of the country's original natural features, which is valuable in itself and is an attraction to outdoor enthusiasts and travellers.

The discussion in this part is divided into three sections. Part 7 deals with the conservation of living nature while part 8 focuses on the country's unique geological aspects. Part 9 dwells on the protection of wilderness, that is to say large areas of land where visible human impact is non-existent or miniscule.

7. Protection of Iceland's Biota

OBJECTIVES

- ★ The diversity of species and habitat types should be conserved.
- ★ Further diminishing of wetlands, birch woodlands and other key ecosystems in Iceland should be avoided.
- ★ Attempts to reclaim wetlands and other important ecosystems should be made where possible.

The Situation

Iceland's ecosystem is shaped by the country's isolation and active natural forces, such as frequent volcanic eruptions and loose volcanic soil. The number of species in the country is rather small but the number of individuals within each species is often high. Iceland is, for instance, globally important as a habitat and nesting place for various species of birds. The Icelandic biota has altered greatly as a result of human interference, including deforestation, soil erosion and drainage of wetlands.

About 485 species of vascular plants are thought to grow wild in Iceland, including imported species that have gained a foothold in the wild. About 570 moss species have been found in the country, 580 species of lichen and around 1700 types of fungi; all in all, there

are around 3300 species of vascular and non-vascular plants. About 540 species of freshwater algae have been registered and 650 types of benthic algae are known. Thermophilic micro-organisms and algae are found in hot springs and geothermal areas. The arctic fox is the only terrestrial indigenous mammal but six additional species of mammals have migrated or been introduced. About 76 species of birds nest regularly in Iceland and several others have nested at least once. Iceland is an important base for European water birds and the populations of most types of sea birds around Iceland are of international importance; the largest bird colonies in coastal cliffs are amongst the largest bird habitats in the North Atlantic. Five domestic species of fish live in part or solely in freshwater. Overall, 1250 types of terrestrial invertebrates have been recorded in Iceland – insects, arachnids, molluscs, etc.



– including vagrants and animals that are carried by people and products. Extensive research on marine invertebrates around Iceland (BIOICE) has resulted in the discovery of several new species known to Iceland and some even new to science. Around 270 species of fish have been found within the 200-mile exclusive economic zone, of which 150 are known to spawn in the area. Two species of seal breed on the coast of Iceland and around 13 whale species live in its waters. Despite efforts in recent years to record the number of species in Iceland and evaluate their distribution and condition, progress is slow and much remains to be done.

The Icelandic Institute of Natural History has issued two red lists of endangered species. Of the 76 bird species that regularly nest in Iceland, 32 are on the list. Also on a red list are 51 of 485 vascular plants.

Much disturbance has taken place to many of the main ecosystems in Iceland since its settlement. Birch woods are thought to have covered a quarter of the country at the time of settlement but today they only cover about 1% of its total area. Little remains of undisturbed wetlands on the lowlands, mainly because of drainage and the cultivation of marshes. Studies have shown that only 3% of all the wetlands in the south of Iceland, are undisturbed and only 18% in the western part. Efforts have been made to reclaim wetlands in recent years.

Means of Implementation

★ Mapping of the biota's condition and possible threats:

The chief habitat types of Iceland shall be defined and charted in the near future. Organisms on land and sea should be recorded and categorized and red lists of endangered species produced that will span the whole Icelandic biosphere and provide a basis for regular monitoring.

★ Increased protection of key habitats and habitat types:

Efforts should be made to protect those habitat types that have suffered the most, on the basis of defining and charting habitat types in Iceland. Priority issues include the wetlands and birch woodlands. A comprehensive appraisal of wetlands will be published in conjunction with nature conservation plans. Member

states of the Ramsar Convention have decided to try and double the number of areas listed in the Convention in the next few years. It is therefore desirable to nominate at least three wetlands in the next five years in addition to those three areas that are already protected by the Ramsar Convention. Conservation of habitats in Iceland was first adopted in 2002, when the habitat of the white-fronted goose near Hvanneyri was protected. More habitats will be protected in coming years on the basis of the national nature conservation plan.

★ Reclaiming of wetlands and other damaged ecosystems:

Efforts to reclaim wetlands that have been drained should be continued, especially in those areas with the highest percentage of wetland drainage. Research on the success of earlier wetland reclamation projects should be used for guidance. Systematic experiments and action to reclaim birch woodlands will begin in the next few years. A policy on reclaiming original ecosystems, such as birch woods, should be formulated, and be part of a general policy for soil and land reclamation, that would address issues such as methodology, species selection and other criteria. Where important ecosystems are disturbed by human activities, the general rule should be that the responsible party must try to reclaim comparable land areas.

★ Sustainable fishing and hunting of game:

Hunting and fishing in rivers and lakes should be managed in a sustainable manner. In the past few years a sound foundation has been laid for sustainable hunting of birds, land mammals and freshwater fish by legislation, monitoring of stocks and systematic gathering of data on hunting. Hunting on land and fishing in fresh waters is generally not thought to threaten stocks, but hunting and fishing must be monitored closely and stock protected temporarily or regionally when needed.

Indicators

- 7.1. Drainage of wetlands (with ditches), 1942–1993.
- 7.2. Total area of wetlands reclaimed, 1996–2001.
- 7.3. Area of key ecosystems as a percentage of original state (at the time of settlement).
- 7.4. Breeding pairs of selected rare bird species.
- 7.5. Rare and endangered species.

8. Protection of Unique Geological Formations

OBJECTIVES

- ★ The diversity of geological formations should be conserved by protecting those formations that are distinct or unique regionally, nationally or globally.
- ★ A methodical survey of geological formations in Iceland should be conducted, which will provide a basis for their systematic preservation.

The Situation

Iceland is a volcanic island that is geologically unique on account of the interplay of a mantle plume and an oceanic ridge (the Mid-Atlantic Ridge). The country's existence in the middle of the North Atlantic is due to these factors while external forces, such as oceanic waves, glaciers and rivers, further mould the country. It is a priority issue to preserve geological formations and systems that are rare or unusual on a global scale, such as shield volcanoes, lava rings, volcanic craters, palagonite formations, freshwater springs and active glacial landscapes, in addition to landscapes and unique phenomena that are unusual for this part of the world but characteristic of Iceland, such as lava fields, palagonite mountains, waterfalls and geothermal areas.

Conservation of natural phenomena has been implemented in Iceland with the designation of protected areas and the production of a Nature Conservation Registry. It would be preferable that such conservation be carried out in a systematic manner, and not just on the basis of obvious aesthetic viewpoints, as has so often been the case. Nonetheless, the beauty of natural phenomena is of course a valid reason for their conservation. Preliminary studies on Icelandic nature provide a basis for the systematic conservation of natural phenomena. Geological formations need to be defined and charted, which will result in a summary of what formations exist and which of them are protected. There will also be a summary of the geology of each region and what is typical, unique or special on a national or global level. There are around 40 geological formations that receive special protection today as natural monuments or nature reserves, while some remarkable formations are within other protected areas. According to legislation in nature conservation, there are a few geological formations that are under special protection and must remain as undisturbed as possible. These formations include hot springs, volcanic craters and pseudocraters and lava fields.

There are numerous threats to extraordinary geological formations, not least because of various human activities. Mining for building material is an example. The best and most accessible material is often found in volcanic cones and lava fields, some of which are nationally and globally unique. The greatest and most obvious damage to volcanic formations due to mining is in the southwest corner of the country. It is thought that over 2000 open mines can be found in Iceland.

The Icelandic Institute of Natural History and the Nature Conservation Agency intend to record geological formations using a sorting system that will be set up in a geographical information system. The Master Plan on Hydro and Geothermal Energy implements a systematic evaluation of topography and its conservation value. Iceland has also taken the incentive in the international arena, for instance in Nordic cooperation and within the Bern Convention on Conservation of European Wildlife and Natural Habitats, to bring attention to the value of "geodiversity" and systematic



conservation of geological formations on the basis of international standards of classification.

Means of Implementation

★ Systematic surveying of geological formations:

Surveying projects that will create a basis for the conservation of geological formations should continue. An accessible map of extraordinary geological formations should mitigate the risk of unnecessary damage to them as far as mining and other activities is concerned. Icelandic nature conservation management should continue to encourage continuing development in the international arena, for an international standard sorting system for geological formations.

★ Conservation of geological formations:

Work towards the conservation of geological formations should continue, with extended protection on the basis of systematic classification and the evaluation of their conservation value. The objective is that all major types of formations will be sufficiently preserved. Amongst other things, systematic conservation of this sort can be used in natural sciences education. Formations that should receive priority with regard to

conservation in the coming years include geothermal areas, volcanic craters and geologically recent lava, pseudocraters and locations of rare stones.

★ Decrease the number of mines and seal open mines:

It is preferable that the mining of materials is performed in relatively few, demarcated areas; a few large mines have less negative visual impact than many small ones, and there is less risk of damage to unique natural phenomena. This is why authorities will aim to continue reducing the number of active mines. Efforts will be made to seal off mines where mining has ceased, using the guiding steps listed in a recent report, on how to seal mines. An appraisal of marine mining should be produced and possible negative environmental impacts estimated. The surveying of Iceland's geological foundations should continue and provide a basis for systematic processing of materials in the future.

Indicators

8.1. Number of open mines.

8.2. Number of sealed mines per year.

9. Wilderness Conservation

OBJECTIVES

★ Large areas of wilderness should remain untouched in Icelandic uninhabited areas.

★ Man-made structures should preferably be built outside of defined wilderness areas. When this is not deemed possible, care should be taken that the structures cause minimal damage and minimal visual effect.

The Situation

Great expanses of wilderness, where the impact of man is small or non-existent, are hardly to be found in Western Europe – the exceptions being the far north of Scandinavia and Iceland. It is fair to assume that such wilderness areas will grow more valuable in the future, both in a straight economic sense in relation to the tourist industry and in a subjective sense as access to untouched nature is one factor contributing to the quality of life in modern metropolitan society. It is

therefore imperative to protect wilderness areas and to take great care to minimize the visual impact of projects undertaken in such areas.

The concept of "wilderness" or "untouched wilderness" is fairly new to Icelandic nature conservation and policy-making regarding the conservation of these areas is still in its early stages. The idea of protecting wilderness, in addition to the conservation of unique natural phenomena, habitats and species, is based on



the notion that it is desirable to set aside great, open spaces or landscapes where there is little or no human impact. Such areas continue to decrease globally, so it is likely that their value will increase. There is still much left to be done in the definition of the term "wilderness", in defining the objective of the protection of these areas and the best way to coordinate wilderness conservation and the continued utilization of the land and its natural resources. It can be said that a step towards the conservation of these areas was made with the regional plan for the central highlands.

Untouched wilderness areas are defined in the Nature Conservation Act on the basis of motions put forward by a special team designated by the Minister for the Environment. Amongst other things, the team recommends the setting aside of open, untouched spaces for future generations; the conservation of open, untouched areas for outdoor activity, research and education; and to ensure and strengthen Iceland's image as a country of unspoiled nature.

Means of Implementation

★ Monitoring of industrial projects in wilderness areas:

A map of officially defined wilderness areas should be produced and updated on an annual basis, with new projects in wilderness areas marked.

★ Limitation of projects in wilderness areas:

Man-made projects and structures should ideally

remain outside of declared wilderness areas. If structures need to be built within such areas, for instance in the central highlands, they should to the extent possible be built in designated structure belts defined in the Central Highlands Regional Plan so they will not unnecessarily breach wilderness areas.

★ Conservation of continuous wilderness:

The imminent establishment of the Vatnajökull National Park, which will be the largest national park in Europe, will be a big step towards the conservation of wilderness areas. The plan is to enlarge it little by little, so it will extend further than the ice cap itself. The park will be the largest conserved wilderness area in Europe and will include some of the greatest volcanic and geothermal areas in the world as well as Europe's largest glacier.

★ Charting and closing of roads:

The charting of roads should be concluded, particularly in the highlands. The charting will provide a basis for decisions as to which roads should be maintained and which should be closed off. By banning traffic on some roads, areas that are defined as wilderness can be enlarged.

Indicators

- 9.1. a) Total area of wilderness areas and protected areas.
- b) Percentage of wilderness areas of the total area of Iceland.



Sustainable Use of Resources



43 10. Sustainable Use of Living Marine Resources

46 11. Sustainable Use of Vegetation and Reclamation of Land

48 12. Increased Utilization of Renewable Energy

50 13. Reduction and Improved Handling of Waste

The utilization of natural resources has been the livelihood of Icelanders through the ages and the economy still relies heavily on natural resources. Sustainable use of resources is therefore vital for present and future generations. The consequences of overexploitation can be seen by extensive desertification and soil erosion, which warn against the overexploitation of other resources.

This section discusses the utilization of three natural resources: marine living resources, the resources of the land and energy sources. The last chapter deals with better utilization of waste, which can be said to be the other side of resource use as by mitigating refuse and waste, pressure on natural resources is diminished and wealth can be produced.

10. Sustainable Use of Living Marine Resources

OBJECTIVES

- ★ The utilization of fish stocks and other living marine resources should remain on a sustainable basis and based on the best available scientific findings.
- ★ Fishing of stocks that call for a limitation of harvesting, according to scientific assessment, must be managed and a cautionary viewpoint taken to achieve the maximum yield of stocks in the long run.
- ★ Long-term policies for the utilization of certain stocks should be developed, for instance by applying catch rules and the use of a multi-stock approach where possible.
- ★ Methods and management for the utilization of living marine resources should take into account the diverse interplay of the marine ecosystem and should aim to minimize negative effects of utilization on other sections of the ecosystem.

The Situation

The living marine resources in Icelandic fishing grounds are the backbone of the Icelandic economy, and the export of marine products has been the nation's basis for international trade. Marine products account for around 45% of the total value of exports, in relation to products and services combined, but around 64% of the total export of goods. The total catch of the fishing fleet in Icelandic fishing grounds in 2000 was 1.9 million tons. In spite of its small population size Iceland is the fifteenth largest fisheries nation in the world.

Iceland's jurisdiction over its fishing grounds and the management of its own fisheries has developed in stages throughout the twentieth century but the last major breakthrough was in 1976 when the Exclusive Economic Zone was extended to 200 nautical miles. Managing fishing from important stocks was difficult until Icelanders gained full jurisdiction over their fisheries grounds. Since 1976, efforts have been made to create a fisheries management system that will ensure sustainable and efficient fishing. The right to fish in Icelandic waters is part of the right to choose a profession but experience has shown that unrestricted access to the fishing grounds will lead to over-exploitation of fish stocks. Scientific evaluation of the condition of the marine resources and advice on the maximum catch of each stock, is the basis for total allowable catch that the government decides annually for each stock. It is necessary to designate total allowable catch for most commercial stocks but fishing of other stocks is not restricted and in some cases they are not fished at all.

Act 38/1990 on fishery management is the cornerstone for the present fishery management system. This legalized the system of transferable quotas for most fishing practices and fishing permits were awarded to particular vessels.

Fishing can be divided into the fishing of demersal fish, pelagic fish and the fishing of crustaceans and molluscs. The total catch of demersal fish in 2000 was about 25% of the total catch of all stocks. The catch of pelagic fish, mainly capelin, herring and blue whiting, was around 73% and the catch of shrimp, lobster and scallop was about 2% of the total annual catch. In relation to the catch value, the ratio is different: demersal fish account for 80% of the value, pelagic fish 12% and shrimp, lobster and scallop 8%.

Cod is the most important of all commercial stocks in Icelandic waters and in 2000 cod products accounted for 41% of the value of exported marine products.

Whaling was practised around Iceland until the International Whaling Commission decided on a temporary ban on commercial whaling in 1986. A limited number of whales were killed for scientific purposes until 1989. The Marine Research Institute has proposed a catch limit for fin whales and minke whales based on a count of whales in Icelandic waters. Iceland participates in international collaboration regarding whaling by way of the International Whaling Commission (IWC) and the North Atlantic Marine Mammal Commission (NAMMCO), and they have confirmed research findings on the size of certain



whale stocks. The policy of the Icelandic government is that whales will be harvested in a sustainable way in the future.

The precautionary approach in fisheries mainly focuses on managing fisheries so that they are in line with the productivity of the fish stocks and that the uncertainty as to the size and movement of stocks are taken into consideration. The precautionary approach puts emphasis on a long-term utilization policy, for instance by applying certain catch rules. Ecosystem dynamics, and interaction between species must also be taken into consideration.

The fishery management system in Iceland is aimed at sustainable fishing and responsible treatment of commercial stock. Scientific findings on the productivity of fish stocks are used to decide on total allowable catch with sustainable development as a guiding light. So-called catch rules have been applied that have either been approved by the government (cod) or developed through time (summer herring, capelin). The regulations for cod were developed in cooperation with economists and biologists, in the spirit of the methods that have been discussed within the International Council for the Exploration of the Sea and in line with its advice. The Icelandic government has also used various procedures to increase catch handling such as the no-discards rule. The separation of small fish from other catch has been studied and regulations on the appropriate gear have been changed to fishing gear more efficient at separating the small fish from the catch. In addition, changes in legislation have been made that encourage fishermen to bring all the catch ashore and the number of inspectors has been increased.

The policy of the multi-stock approach and the ecosystem approach is multifarious. Further research is needed, both on individual stocks, their interactions, the marine ecosystem in general and the impact of fishing and fishing gear. Increased research can render to us the keys that open up the secrets of how to integrate different factors and what effect a change in the fishing of one species can have on another. This means that it is possible to develop and implement catch regulations on more stocks than are in the management system now. While the best scientific findings are used as a basis, it is also necessary to take into account the



long-term economic impact on business and the national economy. Intense marketing and food product research is needed in addition to product development, in order create more valuable products from limited materials so the fishing industry can continue to be a major pillar of the Icelandic national economy and high living standards.

Means of Implementation

★ A legal basis for fishery management:

The first article in the current Fishery Management Act states that the prime objective is to promote the

conservation and efficient utilization of the exploitable marine stock in Icelandic waters, and thus ensure stable employment and settlement in the country. Economic goals are key factors in fishery management and go hand in hand with conservation objectives and sustainable utilization. Fishery management in the past decades has therefore developed in such a way that economic instruments are increasingly used and the society's fisheries and economic policies in general are integrated. Permanent allocation of quotas encourages stakeholders to use the resources with care and efficiency, while the individual transferable quota system enables the quota to be transferred to the most efficient and progressive enterprises. In 2002 a fishing fee was adopted in the fishing industry for the first time in Icelandic legislation. The legal grounds for domestic fishery management are and will continue to be in development. In addition to the general framework, there are various subsidiary measures taken to conserve the marine ecosystem. For instance, laws and regulations deal with mesh size, closure of fishing grounds, inspection and enforcement, and no-discard rules. The legal grounds for fishery management in the international arena are to be found in the United Nations Convention on the Law of the Sea (UNCLOS) and in the Agreement on the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks. According to these, the control and management of fishing outside economic zones is subject to cooperation, including within regional bodies like the North-east Atlantic Fisheries Commission (NEAFC) and the North Atlantic Fisheries Organization (NAFO).

★ **Scientific advice:**

In the objective section there is a reference to the use of the best scientific knowledge available at any time. Iceland works on this issue both domestically and internationally. The Marine Research Institute does extensive surveying and monitoring of the ocean's biota and encourages regular public discussions about these projects. The advice for utilization is based on this research.

The Icelandic method of managing fish stocks in order to achieve maximum yield is cautionary by adopting catch rules that take into account the long-term yield capability of stocks and see that their utilization is economical. This is based on available information on

interplay in the marine ecosystem, especially between species. It is important to use this growing body of information on the interaction of species, to determine catch rules.

★ **The ecosystem approach:**

Iceland and the Food and Agricultural Organization (FAO), supported by Norway, initiated a policy on an ecological approach in a conference hosted by the FAO where representatives of over 60 countries discussed the political and scientific aspects of an ecosystem approach. The Reykjavik Declaration on Responsible Fisheries in the Marine Ecosystem was a product of the conference. The Declaration is very important for international policy formulation in regard to the ecosystem approach, as it is very clear on fishery matters.

★ **Environmental impact of fishing gear:**

It is imperative to consider the effects of fishing and fishing gear on the marine ecosystem. A new marine research vessel, the Arni Fridriksson, enables scientists to chart the ocean floor with much better technology than before. This project will continue. It is also important to further study the pros and cons of fishing gear, to enhance the possibilities of selecting the composition of the catch in relation to size and species.

Indicators

Statistics on the Icelandic fishing industry are extensive in regard to catch quantity, the deployment of catch for processing, the catch value, fishing fleet and scientific assessments on the state of the fishing stocks. The fishery management is partly based on this data, for instance for the determination of the cod rule.

It can be difficult, however, to identify indicators that provide a good assessment in regard to the sustainable utilization of living marine resources. The size of fish stocks is affected by many factors, in part by fishing and other human interference but also in part by natural environmental conditions such as the ocean's temperature, plankton, etc. There is however, often some degree of scientific uncertainty on stock sizes. There is ongoing work internationally to find indicators that can depict the sustainable utilization of marine resources.



11. Sustainable Use of Vegetation and Reclamation of Land

OBJECTIVES

- ★ The land's soil and vegetation resources, including forests, should be sustainably utilized according to the best scientific information available.
- ★ Grazing should be controlled in accordance with the land's tolerance levels and the risk of erosion.
- ★ Systematic soil conservation activities should be conducted in eroded areas, in accordance with policies on land use and nature conservation in each area. Extreme soil erosion should be curbed, especially in settled areas and in the lowlands.
- ★ The development of farm forestry should strengthen rural settlements and employment, and fit in with the country's landscape and ecosystem.

The Situation

Soil erosion and desertification has often been said to be Iceland's greatest environmental problem. The total forested area in Iceland is less than in any other European country. Over half of the country's vegetation coverage is thought to have disappeared because of erosion since the settlement period. This is particularly due to clearing of woodlands and overgrazing, which have facilitated the erosion of the sensitive volcanic soil. According to the findings of a general survey of soil erosion in Iceland, 52% of the country, excluding that covered by the highest mountains, glaciers and lakes, is seriously eroded. Additionally, information from vegetation maps shows that the condition of soil and vegetation is much poorer than growing conditions would allow.

Soil erosion is no longer a serious threat to settlements and the livelihood of people, as was the case at the beginning of the 20th century, thanks to a century of systematic soil conservation. The project remains urgent nevertheless, and a majority of the nation supports revegetation to repair the damage of past centuries, strengthen the biota and create a resource of robust vegetation for future generations. Amongst other things, this public will has been expressed in great participation in forestry and soil conservation projects.

About 0.2% of the country is covered with natural birch woodland that is at least 5m tall, about 1% of the country is covered in birch thicket, while around 0.2% of the country has been planted with new forests, most of it in the past 10 years. It is estimated that about 30% of the country was covered by woodland at the time of the settlement. Overgrazing, especially during the

winter, was a major reason why the birch woods could not recuperate after logging. Sheep grazing still halts the spread of birch in some areas.

It is a priority issue to manage grazing so it corresponds to the tolerance levels of the land. The reduction of the sheep population has decreased pressure from grazing. Even so, overgrazing still occurs in many parts of the country. Management of land use needs to take into account the viewpoint of local communities. This does not mean that grazing will be permitted in areas that are unsuited for grazing but rather that farmers will be provided with incentives to participate in land improvement projects, for instance in connection to quality management in sheep and horse farming. The revegetation of eroded and barren areas needs to be implemented in a systematic manner so that it will be in accordance with the conditions and land utilization policies of each area. Farmers have worked on land improvement on their estates for many years, both individually and in collaboration with the Soil Conservation Service in relation to the project "Farmers Heal the Land".

The importance of biodiversity and the various interests related to land use must be taken into account during the planning stages of soil conservation and forestry. The use of imported species must not threaten natural biota.

Means of Implementation:

- ★ **Sustainable utilization of both common and private grazing land:**

In the year 2000 the government and sheep farmers signed a declaration of goodwill for the utilization of





land, which will be implemented in the years to come. The main criteria on the use of land for grazing is that it shall be sustainable, the condition of the land acceptable and the state of vegetation stable or improving. Farmers that apply for participation in quality-managed sheep farming must produce confirmation that they have access to grazing land that is in an acceptable condition and that the grazing is sustainable. Barren and eroded areas should not be utilized for grazing and plans of implementation must be produced for land improvement.

★ **Support for land improvement plans for farmers:**

The Agricultural Research Institute, the Farmers Association of Iceland, the Soil Conservation Service (SCS) and the Ministry of Agriculture collaborate on a project called *Land for Use*. It is meant to be a comprehensive record of landholding in Iceland. Amongst other things, it will gather basic data on the size of individual properties in Iceland together with vegetation details and will provide a basis for assessing whether there is sufficient vegetation for grazing. The project improves the database that certification of sustainable utilization must be based on. *Better Estates* is a collaborative project of the Agricultural College, the Farmers Association of Iceland and the SCS on revegetation and land use in cooperation with farmers. Emphasis is put on farmers making their own plans, but they receive

education and advice on how to do so. Data from *Land for Use* is used as a basis. Farmers who need land improvement plans for quality certification in sheep farming, can produce plans in relation to the project for verification, as can horse farmers.

★ **Long-term soil conservation strategy:**

In 2002 the Icelandic parliament (Althing) approved a 12-year soil conservation project the first long-term strategy of its kind. It forms a framework for land improvement and the protection of land quality. Emphasis is placed on curbing soil erosion, revegetation, monitoring of the condition of vegetation and soil, land

use management, research and dissemination of information. The strategy envisions increased efforts for revegetation. Measures will be taken so that soil conservation will be in line with policy on development and nature conservation. The strategy also aims to fulfil international agreements on desertification and nature conservation that Iceland is a party to.

★ **Increased forest farming:**

It is government policy to encourage afforestation projects. Regional forestry projects have been established in all regions of the country, which provide funds to farmers and other landowners for this purpose. The forests that are being planted are designed for multiple uses. They are intended for outdoor activities, as habitats for other organisms and as protection for the soil from erosion. In some cases they will also produce timber. It is important that the forests are maintained in harmony with the landscape and that afforestation will not disturb important habitats, natural phenomena or archaeological sites.

Indicators

- 11.1. Total number of sheep and horses 1980–2001.
- 11.2. a) Forest and woodlands as percentage of vegetated land in the year 2001.
b) Total area of forests and woodlands in 2001.



12. Increased Utilization of Renewable Energy

OBJECTIVES

- ★ Iceland's renewable sources of energy should be further utilized, using economic and environmental considerations as a guiding light.
- ★ The proportion of renewable energy resources in the nation's energy budget should be increased, and the use of fossil fuels should become insignificant within a few decades. The aim is that transport will use energy from renewable energy resources as soon as it is feasible to do so.
- ★ Electricity and geothermal heating systems should be managed in a way that ensures effectiveness, safety and optimum economic efficiency.
- ★ Increased energy efficiency should be encouraged.

The Situation

In Iceland, the proportion of renewable energy in relation to gross energy use is 70%. This is a higher proportion than in any other nation. The domestic energy sources— geothermal energy and hydropower – are renewable energy sources and there is almost no fossil fuel used for district heating and electricity production, as can be seen in Table 1.

Table 1.
Relative energy use for district heating and electric production

	District Heating %	Electric Production %
Geothermal energy	89.0	17.2
Hydropower	9.5	82.8
Fossil fuels	1.5	< 0.1
Total	100.0	100.0

Large-scale industry uses about 64% of the total electricity produced, but the remaining 36% is for public use.

As the use of fossil fuels for stationary energy is almost non-existent, it will be difficult to increase the percentage of energy from renewable energy sources in the nation's energy consumption. Fossil fuel is used for transport on land, sea and air. Hydrogen is the hope for the future, where electricity from renewable energy sources would be used to produce the hydrogen. The development of fuel cells makes hydrogen a more attractive option than in the past but there are still many issues that need further research, such as the storage of hydrogen. While the possibility of using hydrogen as a fuel is being tested, intermediate solutions may be used in Iceland, such as electric vehicles and fuel cells powered by methanol. Methane gas from

refuse dumps is currently used as fuel in a project that should be further expanded.

The energy resources of Iceland are immense compared to the current use of energy in the country. It is estimated that only about 10% of technically feasible hydropower has been harnessed. It is thought that around half of the unexploited hydropower could be harnessed efficiently, so that economically feasible hydropower is five times greater than the energy that has already been harnessed. This proportion is more favourable in terms of geothermal energy than in hydropower. When all the geothermal energy sources of the country are taken into account, i.e. geothermal energy that can be used both for heating and electricity production, unexploited geothermal energy is considered to be a thousand times more than the geothermal energy that is now being utilized. Geothermal energy that is solely intended for electricity production is at least ten times more than what has already been harnessed for the production of electric power. There is reason to believe that unexploited geothermal energy is even more, maybe even a hundred times more than the heat that has been harnessed up to now for electrical power.

The utilization of geothermal energy for district heating saves Iceland over ISK 8 billion in foreign currency each year, assuming that imported fossil fuels would otherwise be used. Positive environmental effects are just as important, as emissions of CO₂ would double in Iceland, if oil were used instead of geothermal energy for space heating. A great effort has been made in the past decades to use geothermal energy for



district heating: in 1970 half of the nation had access to a district heating service, but today it is 86%.

It is clear that great wealth lies in the renewable energy resources of the country but their utilization is subject to market conditions, nature conservation policies, etc.

Means of Implementation

★ Integration of utilization and conservation policies:

Work on the Master Plan on Hydro and Geothermal Energy should be continued. The objective of the Master Plan is to integrate utilization and conservation policies and to create a greater consensus on which harnessing options are most viable from both economic and environmental point of view. A total of 100 possible hydro and geothermal projects are intended for evaluation. In May of 2002, temporary findings for 15 harnessing options for hydropower were presented but the first part of the plan will conclude in the beginning of 2003 with an evaluation and comparison of 20–25 harnessing options of hydropower and geothermal energy.

★ Energy Research:

Economic utilization of the nation's energy resources in harmony with the environment cannot be ensured unless there is available information on the resources. It must be ensured that sufficient basic research is available at any given time for the harnessing options of hydropower and geothermal power stations. Therefore research in this field must be active and conclusive. It is also important to increase knowledge and the development of technology for the utilization of the renewable energy sources of the country. Environmental research, physical planning and surveying of possible industrial sites should be made in conjunction with plans for energy utilization.

★ Cleaner fuel:

Developments and research on new energy sources and fuels should be closely followed. It is necessary to regularly revalue the economic feasibility of new environmentally friendly technology. It is also imperative to create an enabling environment for testing and trial runs of vehicles driven by clean and renewable energy, both for business and private use.

★ Increased efficiency of power sources:

Creating competition where there is no natural monopoly best ensures total efficiency in the operation of district heating services and electric power companies. Where there is monopoly, there is need for encouragement for improvements in operations. Clear responsibility in areas of infrastructure and management must be ensured in relation to delivery safety and quality. Long-term predictions for demand and supply must be produced.

★ More efficient use of energy:

It is important to create incentives for more efficient use of energy. Better scientific knowledge and improved technology in energy generation can lead to more energy efficiency. It is important to inform energy users of ways to save energy. It is also important that the pricing and metering of energy use be designed in a way to encourage energy efficiency.

Indicators

12.1. a) Total energy use per capita 1990–2000.

b) Division of electricity between industry and public use 1990–2000.

12.2. Proportional division of energy by source 1990–2000.

13. Reduction and Improved Handling of Waste

OBJECTIVES

- ★ Waste generation should be reduced as much as possible and the handling of waste should cause minimal negative impact on the environment. It should be ensured that hazardous waste does not find their way into the environment.
- ★ Current and future legislated targets for the recycling of different kinds of waste, including packaging, organic waste, electronic devices and equipment, should be met.
- ★ Disposal expenses should be taken into account in the pricing of goods.

The Situation

Two types of goals can be achieved by decreasing the generation of waste and encouraging responsible handling. On one hand there is the reduced risk of pollution to the environment and on the other there is a decrease in the wastage of valuables and the area of land needed for landfills. Handling of waste should be prioritized according to the following: 1) the generation of waste shall be systematically decreased, 2) waste that is produced shall be recycled and reused, and 3) disposal of waste shall be conducted in a responsible way, so that it reaches equilibrium with its environment and the risk of pollution is minimized.

In 1999, just under 250,000 tonnes of waste was generated in Iceland. Over 60% of that was disposed of in landfills, 30% was recycled in ways other than for energy production and 7% was incinerated. All in all, 67% of waste was disposed of, 32% was recycled and 1% is unaccountable. Disposal of waste in unlicensed landfills and dump sites was around 2%. In 1998 the volume of waste was divided up as follows: household waste 28.9%, commercial waste 41.2%, metals 14.9%, beverage containers 1.5%, slaughterhouse waste 4.2%, hazardous waste 2.8%, garden waste 2.2%, old tyres 0.2% and municipal sludge 2.1%. The overall waste per capita was 867 kg in 1998, of which household waste was 250 kg per capita.

Ever since the Ministry for the Environment was founded in 1990, emphasis has been placed on waste disposal and progress has been made in improving the handling of waste, increasing recycling and shutting down open pit burning and unsatisfactory landfills. Municipalities have joined forces to find solutions and to deal with these issues. The results are fewer, larger and more efficient places for waste disposal. The renewal of licences has been systematically imple-

mented and stipulations on waste disposal inserted into licences. Even so, some municipalities still have problems concerning waste handling.

The most important legislation on the handling of waste is the 1998 Public Health and Pollution Control Act and regulations thereof, that stipulate, amongst other things, municipal obligations for waste disposal. Icelandic legislation on waste disposal is primarily based on European Union regulations since the validation of the EEA agreement. In the wake of the 1996 Act on Special Fee on Hazardous Waste, very good results have been obtained in recovering hazardous waste for recycling or safe disposal. Laws on toxic and hazardous materials in addition to legislation on marine pollution prevention deal with several issues that concern the handling of waste. In the beginning of 2000 the Minister for the Environment designated a committee with the task of promoting the recycling of waste. The committee has drafted a bill for processing charges, in which it proposes the creation of economic conditions for the processing of waste concerning tyres, vehicles, heavy machinery and packaging.

Means of Implementation

★ Introduce economic instruments:

Processing charges should be collected on domestically produced goods and imports to cover the cost of recycling. This would achieve two things: on one hand the Polluter Pays Principle is adopted instead of the cost falling on a third party. On the other hand an economic stimulus is created to decrease the quantity of waste and to find the most efficient means to recycle or dispose of it. Voluntary agreements should be encouraged on the handling of certain categories of waste where industries and business will be given opportunities to achieve fixed goals in an economic and efficient manner. The systematic reduction of



landfill sites is scheduled in order to improve land utilization, increase efficiency in waste management and decrease both pollution and the visual impact of landfills. Stipulations should be legislated on the responsibilities of landfill operators concerning monitoring, analysis and compensation liability for at least 30 years after the landfill site has been closed. Taxation of landfill waste should be considered.

★ **National waste management plan:**

A comprehensive national plan on waste management should be produced. Municipalities should then produce regional plans that are based on the objectives of the national plan. These plans will serve as basic management instruments in keeping in line with government policies on waste management.

★ **Recycling targets:**

In the years to come numerical targets concerning the recycling of various kinds of waste will become obligatory within the EEA. It will be a priority issue for the government to ensure that these objectives can be obtained in the most efficient and economic manner. Amongst these objectives is one stating that no less than 50–65% of all packaging waste will be recycled. Between 25–45% of the weight of all packaging in packaging waste must be recycled and the percentage of recycling in each category must be at least 15%. A plan for the reduction of organic waste for landfills needs to be made and implemented. Additionally, statistical goals will be set in the near future for the recycling of old tyres, cars and car parts, as well as electronic equipment; concrete plans to reach those goals need to be made.

★ **Improved handling of construction waste:**

Efforts should be made to recycle construction waste such as concrete and ground materials. Today 97% of this type of waste goes into landfills and earth mounds, but it is certain that a large part of it can be recycled in an efficient manner.

★ **Safe disposal of hazardous waste:**

Great progress has been achieved in the wake of legislation that introduced hazardous waste charges. This progress should be followed through with the ultimate goal that all hazardous materials will receive responsible handling. This can be achieved by, amongst other things: increased information to the public, by adding more products to the legislation and by introducing a recovery fee for certain products where that is deemed possible and efficient.

★ **Best available technology for waste handling:**

Technological developments concerning waste management should be followed closely and the best available technology applied to the extent possible.

Indicators

- 13.1. Total amount of waste per capita 1992–2000.
- 13.2. Proportion of waste recycled (including energy recovery), incinerated and put in landfills 1992–2002.
- 13.3. Number of locations with open pit burning 1995–2001.
- 13.4. Reception of hazardous waste, percentage of retrieval.

Global Issues



53	14. Clean Ocean
55	15. Limitation of Climate Change
58	16. Protection of the Ozone Layer
59	17. Protection of Biodiversity

The subject of this section concerns health issues, nature conservation and sustainable utilization of resources, as in the previous chapters of this strategy, but what the subjects of this section have in common is that they cannot be dealt with without the combined forces of the world's nations. The boundaries between global and regional issues are not always clear but it is safe to say that the issues discussed earlier in this report can be dealt with first and foremost within Iceland. In relation to the combat against the greenhouse effect, the depletion of the ozone layer and marine pollution, however, unilateral actions by Icelanders are insufficient and the measures taken must be part of global efforts to get to the root of the problem. The conservation of biodiversity is also in essence a global issue. Chapter 17 focuses particularly on the global aspects of this but the discussion of the conservation of the Icelandic biota and the sustainable use of living resources of land and sea are to be found in other chapters.

14. Clean Ocean

OBJECTIVES

- ★ The concentration of man-made pollutants in marine products from Icelandic waters should always fall below the strictest standards of domestic and foreign health authorities.
- ★ The disposal of hazardous materials into the ocean by vessels and from land should cease – especially the disposal of persistent organic substances, radioactive materials and heavy metals.
- ★ Iceland should continue to show leadership in international cooperation on marine pollution prevention.

The Situation

The ocean around Iceland is one of the cleanest waters known and the level of contaminants in Icelandic fish is almost without exception below the strictest reference levels of its trading partners. Pollutants have been found at minimal yet measurable concentrations in Icelandic waters and in marine organisms. Some of the pollutants measured are due to human activity in Iceland but part is transboundary and originates from other countries.

The concentration of contaminants in seafood seems to be decreasing, both because of stricter domestic measures and because the international community is tightening regulations on discharges. The discharge of pollutants into the environment was closely connected to increased industrialization in the world and it increased immensely in the years after WWII until 1970–80, or until people became more aware of the hazards to the environment on account of unrestricted discharge. It should therefore be realistic to achieve the aforementioned objectives if active measures do not slacken. It is important, though, to keep in mind that the demands made by consumers and the public grow increasingly strict and media coverage of contamination problems in fish in other parts of the world may affect the Icelandic fishing industry. It is therefore vital to reduce marine pollution by domestic and foreign polluters and so ensure that Icelandic waters and marine products remain clean. Iceland is critically dependent on its marine resources and needs to be able to prove the cleanliness and wholesomeness of its products. Intense monitoring of the ocean and its biota and active participation in the international struggle against marine pollution therefore remains a priority in Iceland. It is important to be in the forefront in research of the occurrence of new substances that might threaten

public health and the purity of products produced in Iceland.

About 80% of marine pollution is land based. Icelandic authorities have advocated a comprehensive assessment of the state of the marine environment within the UN Environment Programme (UNEP) and during preparations for the World Summit on Sustainable Development in Johannesburg in the autumn of 2002. There is a lack of comprehensive perspective in this field and assessments have not been made of the socio-economic consequences of continued deterioration of the environment.

Pollution in Icelandic waters is minimal, yet there are regional problems that may escalate if nothing is done. The concentration of radioactive substances in Iceland is the lowest in the North Atlantic. Due to the Sellafield nuclear reprocessing plant in Britain, more significant amounts of radioactive caesium are measured in the ocean to the north and east of Iceland than in the south and the west. The concentration is still very low: the concentration of caesium in commercial fish in Iceland is less than 1/1000 of international reference levels. Sellafield has reduced the release of caesium but a few years ago the release of technetium-99 was increased and it is likely that this substance will start showing up in samples in Iceland. The concentration of heavy metals such as copper, zinc and cadmium is higher in Iceland than commonly occurs in the North Atlantic. There is reason to believe that this is not due to human pollution but rather is due to the volcanic bedrock of the country, which is different in its chemical composition from that of mainland Europe. Lead and mercury are found in lower concentrations around Iceland than elsewhere. The concentration of PCBs and other persistent organic pollutants (POPs) is miniscule compared to that of the European mainland. Analysis





and distribution of POPs confirms that they are carried here over great distances. Some areas around harbours suffer isolated problems caused by tributyl tin, which is used in paint on the hulls of ships. Iceland has not experienced the same kind of problems as have occurred in the Arctic area, where high quantities of POPs have been found in many organisms, especially in the blubber of marine mammals and polar bears, and even in humans in some places. Recent findings of dioxins in fishmeal calls for further research and measures, even though studies that have been made on dioxin in Icelandic fish products show that their concentration is well under EU reference levels. All kinds of litter can be seen on the shores of the island and some of it has been carried from afar but some is obviously from domestic ships or from land.

Means of Implementation

★ **Participation in international actions to combat the release of POPs and heavy metals:**

Iceland has ratified the Stockholm Convention on Persistent Organic Pollutants and will implement the Convention in Iceland. Attempts will be made to deal with pollution from other chemicals and chemical compounds, such as mercury. Iceland will ratify the amendment to the Marpol Convention in relation to the ban on TBT use and measures to prevent TBT pollution.

★ **A plan of action against land based marine pollution:**

The plan that the Icelandic government produced in the autumn of 2001 should be systematically imple-

mented. Contributions to the activities of Washington Global Programme of Action for the Protection of the Marine Environment from Land Based Activities will continue, with the objective of stimulating the implementation of the GPA internationally.

★ **Improved sewage treatment:**

The current action programme to process urban wastewater shall conclude at the end of 2005 at the latest, so that the sewage treatment will be in line with legal requirements.

★ **Improved monitoring of pollutants:**

Monitoring of pollutants in Icelandic waters should be improved in accordance with stipulations in international agreements. With future monitoring in mind, it is necessary to be prepared for research on the spread and existence of new pollutants in Icelandic nature, to preserve the country's clean image and the wholesomeness of marine products.

★ **Eliminate radioactive pollution in the North Atlantic:**

Iceland should continue to press for the shutting down of nuclear reprocessing plants in the North Atlantic, and ensure that decisions within the OSPAR Convention on the termination of the release of radioactive waste from reprocessing plants before 2020 will be observed. The release of radioactive materials should be decreased and stopped as soon as possible. Iceland should continue to participate in international cooperative projects to minimize the risk from possible radioactive pollution originating in the Barents Sea.

★ **Improved reception of waste and sewage from ships:** Satisfactory reception of waste and sewage from ships should be established in all main harbours in Iceland within five years. Facilities to receive sewage from ships should be built, so that when the treatment of sewage from land has reached a satisfactory level by 2005, there will be means to receive sewage from ships. Regulations based on the Marpol Convention should be introduced to stipulate the duties of ships to return sewage to land.

Environmental liability:

★ Environmental liability should be incorporated into Icelandic legislation for marine pollution and it should be clear where they apply. There must also be stipulations on the insurance duties of those that ship hazardous cargo or engage in operations that can cause major marine pollution. A special clause on such envi-

ronmental liability is included in a bill for the protection of the ocean and coast; this bill will be discussed in the Icelandic parliament (Althing) in the autumn of 2002.

★ **Global assessment of the state of the marine environment:**

Iceland will promote action to undertake a comprehensive global assessment of the state of the marine environment.

Indicators

- 14.1. Percentage of inhabitants with waste water treatment 1990–2000.
- 14.2. Concentration of PCB, mercury and Cs-137 in cod 1994–2000.

15. Limitation of Climate Change

OBJECTIVES

- ★ Iceland should participate actively in international cooperation to combat dangerous disturbance of the earth's climate by human activity through reduction of emissions and increased sequestration of greenhouse gases.
- ★ The use of fossil fuels should be decreased.
- ★ Icelandic expertise in the utilization of renewable energy sources should be transferred to developing countries.

The Situation

The concentration of CO₂ in the atmosphere has increased by 33% since the Industrial Revolution in the early 19th century. The concentration of other gases such as CH₄, N₂O, HFC, PFC and SF₆ has also increased. This increase is in most part due to human activity, especially the burning of fossil fuels and deforestation. The average temperature on the planet has risen by 0.6°C in the past 100 years; part of that rise can be attributed to increased greenhouse effects due to human activity.

The Intergovernmental Panel on Climate Change (IPCC) has developed projections for emissions of greenhouse gases (GHGs) until the end of the century

and has defined different scenarios based on population increase, economic developments, technological developments and measures to mitigate the emission of GHGs. The most favourable scenario assumes that the concentration of CO₂ will be 540 ppm at the end of the century, although it could be as high as 970 ppm in the worst-case scenario. By comparison, the concentration was 280 ppm at the beginning of the Industrial Revolution and 368 ppm in the year 2000.

Increased concentration of GHGs in the atmosphere is the cause of changes in climate, such as rising temperatures. The magnitude of that rise in temperature depends on developments in GHG emissions but the IPCC predicts that temperatures will rise about



1.4–5.2°C in the next hundred years. Such changes will not only lead to droughts and a rise in sea level but will also have other consequences for living conditions.

It is uncertain what impact climate change will have in Iceland. A scientific committee on climate change turned in a report in October 2000 called *Climate Change and its Consequences*, in which possible effects of a rise in the average temperature in Iceland are discussed. Temperature fluctuations in Iceland between decades are substantially more than estimated temperature increases due to the greenhouse effect for the next decades. Such natural fluctuations can increase or decrease rising temperatures due to the greenhouse effect, depending on the direction of the short-term climate fluctuations.

Iceland ratified the UN's framework Convention on Climate Change in 1993 and the Kyoto Protocol in May of 2002. On the basis of the framework Convention, the Icelandic government approved a plan of implementation in 1995 to endeavour to keep levels of GHG emissions in 2000 equal to or below the emission levels of 1990, excluding emissions from industrial processes of new energy intensive industries that are based on clean and sustainable energy sources. This objective was achieved.

According to the Kyoto Protocol, the Annex I Parties, (i.e. the industrial nations, including Iceland) commit themselves to keep emissions of six GHGs between 2008 and 2012 below emission levels that are 5.2% lower than those for 1990. In June 2002, 74 countries, which are responsible for 35.8% of emissions from industrial nations, had ratified the Protocol. The Protocol will enter into force 90 days after at least 55 states, including the industrial nations that are responsible for 55% of emission from industrialised nations, have ratified it.

According to the Kyoto Protocol and its implementation regarding Iceland, Iceland's emission limit is divided into two categories: in the first place, general



emissions of GHGs from Iceland shall not increase more than 10% from 1990, that is, on average, it must be within 3,100 thousand tonnes CO₂ equivalents annually in 2008–2012. Secondly, CO₂ emissions from new energy intensive industries that have been set up since 1990 shall not, on average, be more than 1,600 thousand tonnes annually in 2008–2012.

An emission estimation for GHGs predicts that the average emission of CO₂ equivalents in the commitment period will be three million tonnes when carbon sinks created by soil conservation and afforestation have been taken into consideration. This is within the

aforementioned emission limit. This projection assumes that measures decided on by the Icelandic government in March 2002 will prove successful. The government's measures are based on Iceland fulfilling its commitments in relation to the first commitment period of the Kyoto Protocol for 2008–2012. As is mentioned in the chapter on renewable energy sources, the long-term objective is that the use of fossil fuels will be further reduced within a few decades and that this will reduce GHG emission even more in Iceland after 2012.

Means of Implementation

★ Fuel for transport:

GHG emissions from transport should be reduced by general action and with modifications to diesel taxation, which should lead to increased importation of diesel cars for private use. The current system of weight tax will be changed, at least in part, into an oil charge system, which will create an economic incentive for fuel efficiency. Taxation should be in such a manner that it will be relatively more viable to operate small diesel cars than it is today. Imports of fuel-efficient vehicles should be further encouraged with modifications to import duties on vehicles. Traffic control can be improved by the increased synchronization of traffic lights. Emphasis should be put on means to decrease the need for using private cars for transportation and to include the shortening of routes as one of the objectives of town planning. Public transport should be boosted, for instance by abolishing weight tax.

★ PFC formation during aluminium processing:

Action should be taken to ensure that aluminium industries take adequate measures to keep PFC emissions from processing to a minimum. An agreement will be made with aluminium producers in the country on measures to keep the emission of PFCs from aluminium processing to a minimum in line with the best available technology in the aluminium industry. Formal cooperation will be established between the Ministry for the Environment, the Ministry of Industry and the aluminium industry, on measures to keep the emission of GHGs for each production unit to a minimum.

★ Energy use and the use of refrigerants in the fishing fleet:

Measures should be sought to decrease the fishing fleet's energy use. The education of captains and ship

owners on energy efficiency should be increased. New and renovated vessels registered in Iceland in years to come should be equipped with the best available technology to improve energy efficiency. The use of HCFCs for refrigeration should be reduced where possible.

★ Emissions from landfill sites:

The disposal of waste in landfills should be reduced, especially that of organic waste. Emission of GHGs from landfill sites should be further reduced.

★ Carbon sinks through afforestation and revegetation:

Carbon sinks should be further enhanced through afforestation and revegetation. Those afforestation and soil conservation measures should be planned and implemented in such a way that the net carbon sink enhancement will be maximised while at the same time taking into account, as much as possible, other objectives such as the conservation of biodiversity and the strengthening of local communities.

★ Participation in international climate change cooperation:

Iceland will actively participate in international cooperation for the reduction of the risk of climate change caused by mankind, for example within the UN's Framework Convention on Climate Change and the Kyoto Protocol. The UN University Geothermal Training Programme, which is located in Iceland and transfers expertise in the utilization of geothermal energy to other nations, should be further strengthened. Goals concerning climate should be taken into consideration in the formation of Iceland's policies for development aid and in cooperation with developing countries and Eastern European nations.

Indicators

- 15.1. Total emissions of 6 greenhouse gases (including carbon sequestration) 1990–2000.
- 15.2. Variation of mean annual temperature in Stykkishólmur, 1990–2000.
- 15.3. The use of fossil fuels as a percentage of total utilization 1990–2000.
- 15.4. Emissions of GHGs, divided by origin 1990–2000.



16. Protection of the Ozone Layer

OBJECTIVES

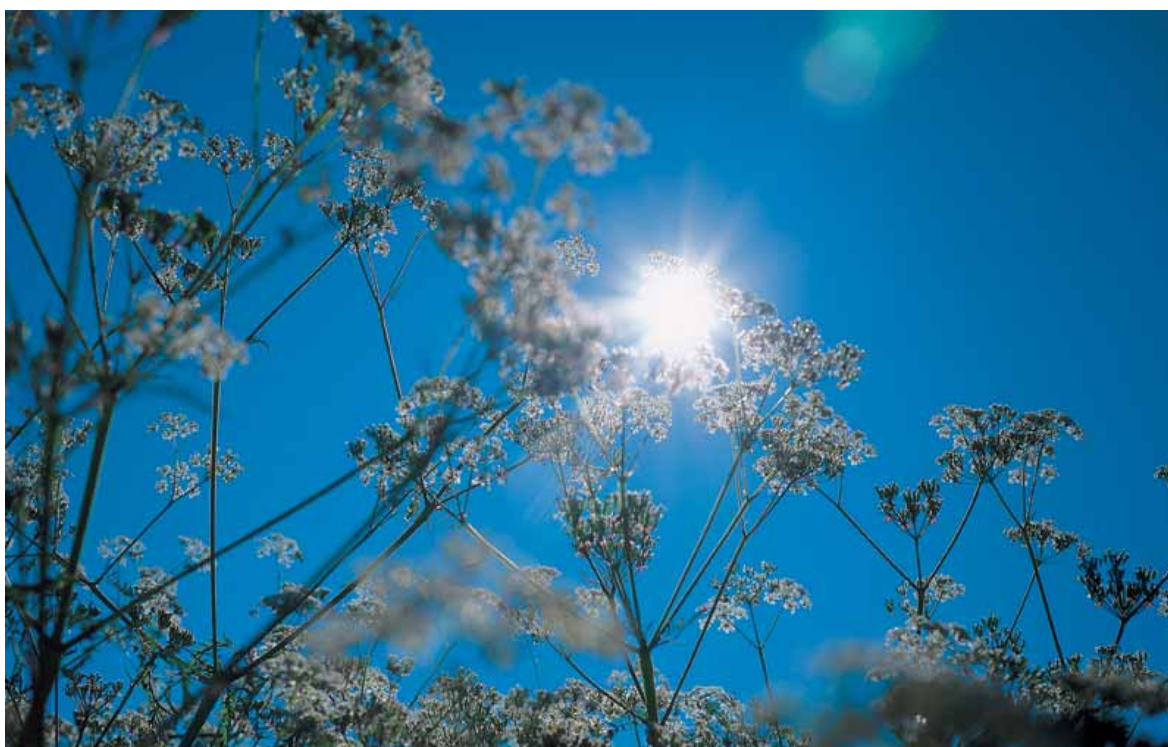
- ★ Iceland should continue to be at the forefront in the restriction of the utilization and emission of ozone-depleting substances.
- ★ Iceland should cease using ozone-depleting substances by 2010.

The Situation

The thinning of the ozone layer is an international issue that was first discovered when a so-called hole in the ozone layer over Antarctica was detected. In recent years this thinning of the layer has increased and the ozone hole stretches continually further. The thinning of the ozone layer has also been quite substantial around the Arctic but is, however, less serious over Iceland than in many places at similar latitudes.

The reason for this thinning of the ozone layer is the emission of certain man-made substances that are carried into the stratosphere where they can deplete ozone very quickly, given certain conditions. The ozone in the upper atmosphere shields the Earth from hazardous ultraviolet rays from the sun. The depletion of ozone results in increased radiation that may harm the health of humans and the biosphere in general. International measures are being taken to protect the

ozone layer, on grounds of the Vienna Convention from 1985 and the Montreal Protocol from 1987 on the restriction of emission of ozone-depleting substances. It is generally considered that these international efforts have proven successful and in many ways they are exemplary for international cooperation on other environmental issues. The use of ozone-depleting substances has substantially decreased in recent years. There are various indications that their concentration has reached its maximum and will decrease in the years to come. It can therefore be said that the root of the problem has been eradicated, although it will take a long time for the ozone layer to fully recover. It will probably not happen until the middle of this century and only if the world's nations stick to their commitments. Immense temporary ozone depletion over areas in the northern hemisphere in recent years indicates, however, that the situation may deteriorate before signs of recovery can be seen.



The basis for Iceland's role in these issues is Iceland's involvement in the Montreal Protocol and the implementation of this protocol but work is also being done on the basis of EU regulations that take measures further in some fields. Iceland has in certain areas restricted the use of ozone-depleting substances more than is stipulated in both the Montreal Protocol and EU regulations. The first legislation for the decrease in the utilization of ozone-depleting substances was introduced in 1989 and banned the import and sale of spray cans with ozone-depleting propellants. The import and sale of halons were banned at the beginning of 1994 and methyl bromide was added to that list later that year. The import and sale of other ozone-depleting substances was either banned in 1995–1996, or restricted by law. A quota for the import and sale of HCFCs was implemented on January 1, 1997; this quota will be reduced in stages until 2015. New, expected regulations in Iceland will ban imports and sale of HCFCs by 2010. In addition, HCFCs in refrigeration and ventilation devices will be banned as of January 1, 2015. Considerable amounts of ozone-depleting substances still exist in older equipment, such as fire extinguishers and cooling systems, and it is important for those that employ such equipment to replace them with materials that do not harm the environment. With the new EU legislation, the demand is made that halons will be removed from all fire extinguishing systems before the end of 2003.

Means of Implementation

★ Ban of import and use of ozone-depleting substances:

The sale and import of all ozone-depleting substances is now banned, with the exception of HCFCs. The sale and import of HCFCs should be progressively restricted and completely banned by 2010 at the latest.

★ Removal of ozone-depleting substances from older equipment:

Ozone-depleting substances should be removed from older equipment. Halons should be removed from fire extinguishing systems and CFCs from old cooling and refrigerating systems. HCFCs are to be removed from older cooling systems before the end of 2014. It is important that the public returns broken refrigerators, freezers and halon fire extinguishers to depots for hazardous waste at recycling centres or municipal maintenance centres for their safe disposal.

Indicators

- 16.1. Import of ozone-depleting substances, 1986–2000.
- 16.2. Import of ozone-depleting refrigerants (onboard vessels), 1990–2001.
- 16.3. Thickness of the ozone layer over Reykjavik, 1980–2000, in comparison to the average thickness of the ozone layer over the northern hemisphere.

17. Protection of Biodiversity

OBJECTIVES

- ★ Efforts should be made to conserve the biodiversity of Icelandic habitat types and ecosystems by the protection of animals, plants and other organisms, together with their genetic resources and their habitats.
- ★ All utilization of living natural resources should be sustainable.
- ★ The precautionary approach and ecosystem approach should be applied in all operations that may alter or disrupt ecosystems, in order to keep negative impact to a minimum.

The Situation

A diverse biota is the prerequisite for life on the planet. The term biodiversity is used to cover the diversity of

all of the millions of species that live on the planet, their genetic material and ecosystems, that is, the complex interactions of the organisms and their environ-



ment. The conservation of biodiversity is therefore an extensive project that is, in one way or another, connected to almost all environmental issues.

In the four billion year history of life on earth, an incredibly diverse number of organisms have developed and their species can be counted in millions, even tens of millions. Human activity has a great impact on ecosystems and organisms. Species vanish, especially due to the deterioration and depletion of rich habitat types such as tropical rainforests and coral reefs. It is thought that the rate of extinction of species has not been greater in the last 60 million years and up to 25% of species may vanish in the next 30 years. It is not clear what impact this perturbation of the planet's ecosystem will have but it will diminish the ability to

cope with disturbance and it will reduce those resources that humans have used for their livelihood and may be able to use in the future.

The UN Convention on Biological Diversity plays a key role internationally; it aims to conserve biodiversity, ensure sustainable use of natural resources and encourage a just distribution of wealth derived from the use of biological resources. Recent legislation has been based on the Convention and the basis for the implementation of the Convention in Iceland has been strengthened. Laws on genetically modified organisms that were introduced in 1996 are based on the UN Convention, as are many clauses in the Nature Conservation Act. These include the production of a strategy for nature conservation, landscape protection and

the importation, breeding and distribution of exotic organisms. Other international agreements that Iceland is party to also revolve around the conservation of biodiversity, such as the Bern Convention on the Conservation of European Wildlife and Natural Habitats, the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), the Ramsar Convention on Wetlands and the UN Convention to Combat Desertification.

The main threats to biodiversity in Iceland are connected to the destruction of habitats due to cultivation and man-made structures and the deterioration of habitats due to land use, such as grazing and use of fishing gear that can damage marine habitats. The use of imported species can have negative effects on biological diversity. It is uncertain what impact climate change will have on biodiversity. The conservation of the Icelandic biota is discussed at length in Chapter 6 while utilization of natural resources is discussed in Chapters 9 and 10.

Means of Implementation

★ National strategy on conserving biodiversity:

A comprehensive national plan on conservation and sustainable use of biodiversity should be implemented, taking all relevant sectors of society into account. Cooperation within the Government is needed to coordinate actions of different ministries in relation to the conservation of biodiversity.

★ Restriction of the distribution of imported organisms:

To fulfill Iceland's commitments on biodiversity, and in order to ensure biodiversity in Iceland, regulations should be introduced concerning the import of invasive animal species, as well as their breeding and distribution within the country. These regulations, along with current rules on the importation, breeding and distribution of alien plants, must be enforced. Supervision of the importation, breeding and distribution of alien organisms should be tightened and measures taken to eradicate or limit the distribution of those species that are considered undesirable for the biodiversity of the Icelandic biota.

★ Genetically modified organisms:

Iceland intends to ratify the Cartagena Protocol on Biosafety of the Convention on Biological Diversity

and should introduce regulations for the importation and distribution of genetically modified organisms in accordance to the Protocol. Regulations should be introduced on how to report, in relation to importation, utilization and distribution of genetically modified organisms in Iceland, in accordance to provisions of the Protocol.

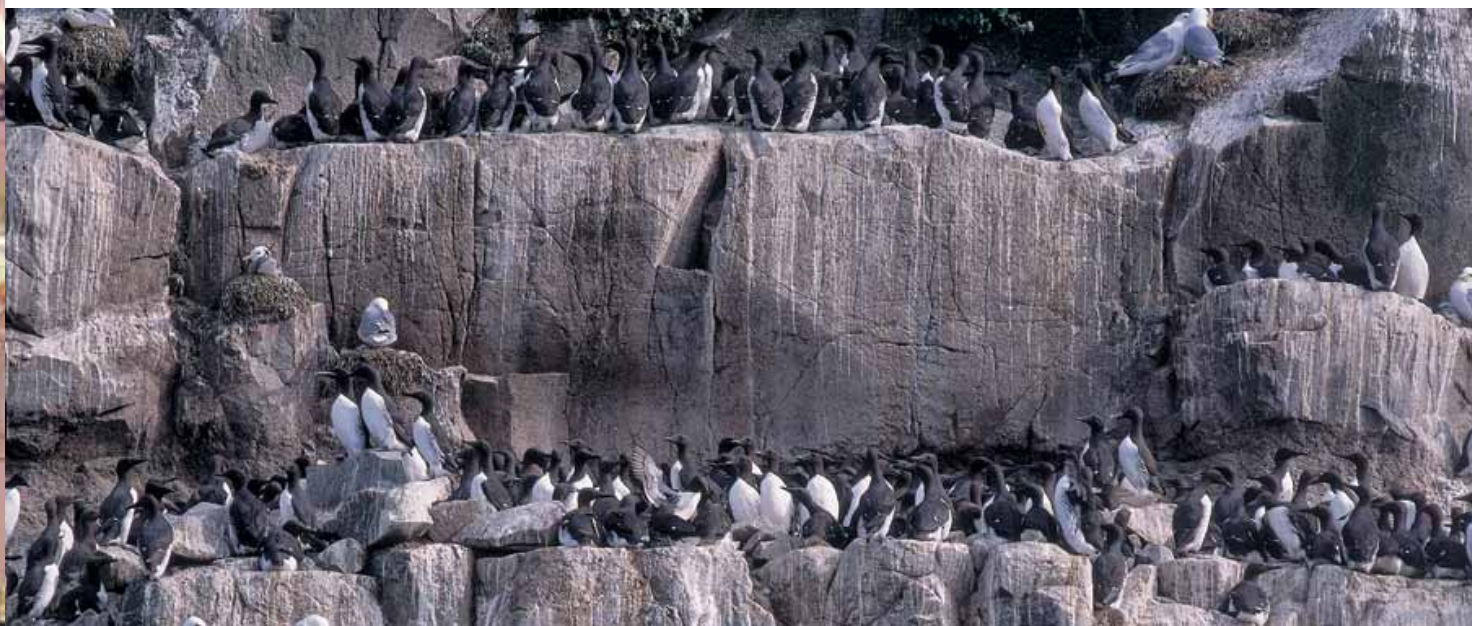




III. Indicators



Indicators



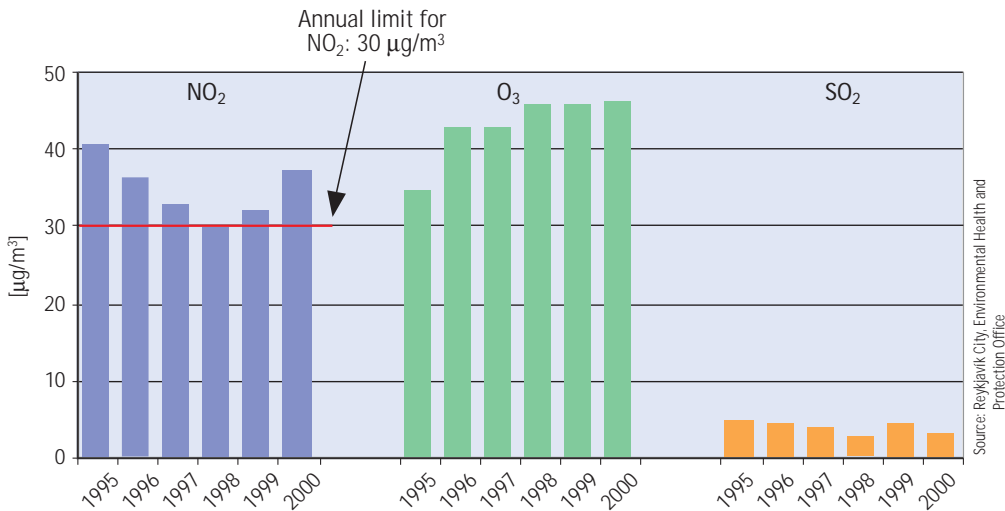
For goal setting to be of any value, a way to estimate progress towards the goals must be established. Finding methods to measure progress toward sustainable development is neither simple nor easy. International institutions and many states have in recent years worked on developing statistical indicators whose purpose is to measure the state of the environment and progress toward sustainable development in much the same way as economic indicators are used to evaluate the state of the economy. So far, little work has been done in Iceland on identifying and developing environmental indicators, or indicators of sustainable development. This chapter attempts to link statistical indicators to some of the goals presented in chapter two. These indicators should be helpful for evaluating how successfully the strategy is being implemented.

Finding indicators that truly measure whether objectives are met is more difficult for some of the issues dealt with in this strategy than others. At this point, no indicators are presented for three of the seventeen main objectives and among the indicators presented some are better suited for measuring progress than others. The quality of the data these indicators rely on also varies. More work is needed on identifying the indicators best suited as indicators of sustainable development. Such indicators must be based on reliable data, be useful for comparison in time and space and be clearly relevant to policy.

Clean Air

1.1

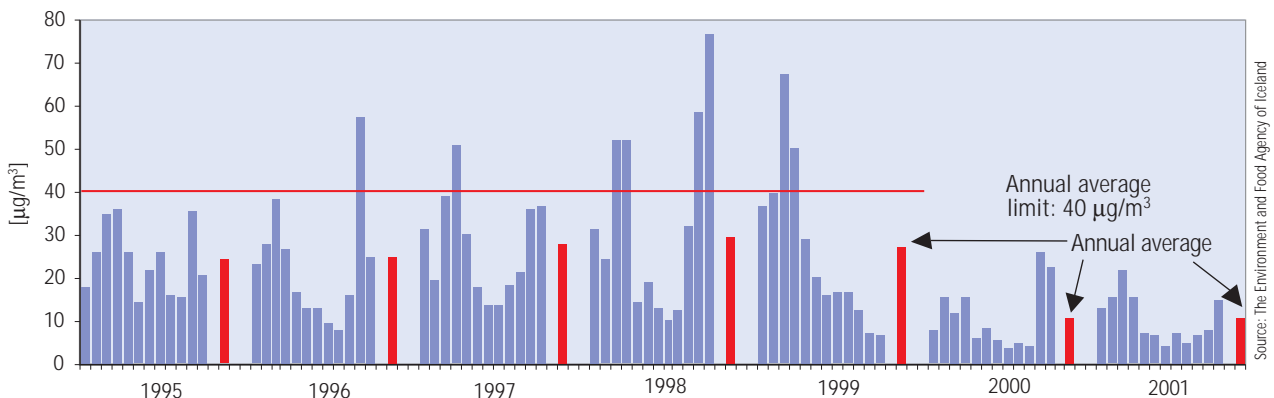
Concentration of NO₂, O₃ and SO₂ in the atmosphere in Reykjavik 1994–2000



The columns show annual means from a single observing station in Reykjavik, close to the city's main traffic artery. Overly high concentrations of these pollutants can be harmful for human health and the environment. The concentration of NO₂ has been close to or above the yearly limit of 30 µg/m³ for the last years; however, it very rarely exceeds the 24-hour limit of 75 µg/m³. No comparable annual limits have been set for SO₂ or ground-level ozone. The concentration of SO₂ is usually far below the 24-hour limits, while ozone is sometimes above the 24-hour limit. More research is needed to find out if ground-level ozone pollution in Reykjavik has natural or human-induced causes.

1.2

Concentration of airborne particulate matter in Reykjavik 1995–2002

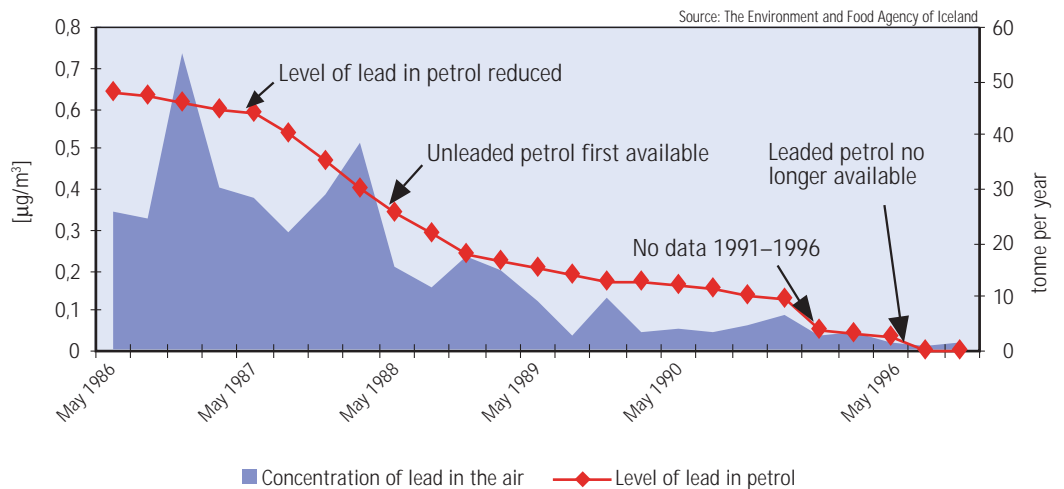


Particulate pollution can cause respiratory problems and diseases. The blue columns show the annual average of particulate pollution in Reykjavik, while the red ones show monthly averages. The graph shows that while the yearly averages are below annual limits, the concentration of particulate matter is still considerable and quite



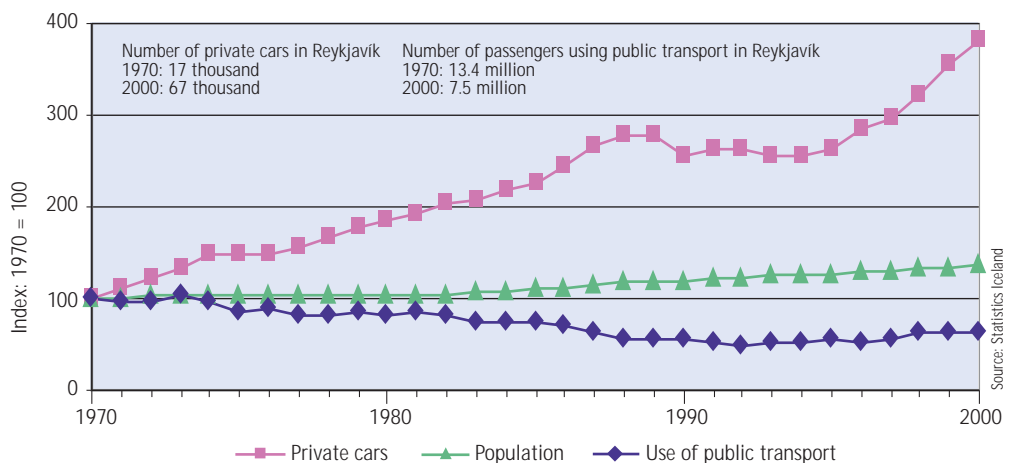
high in certain winter months. The peaks usually occur in winter months when there is little snow, supporting the theory that the use of studded tires is the leading cause of particulate pollution in Reykjavik. Other known causes of such pollution include vehicle emissions, incinerators and soil erosion. The limits for particulate pollution will be gradually lowered in the next few years, increasing pressure on authorities to identify the main sources of the pollution and limit emissions.

1.3 Concentration of lead in the air in Reykjavik 1986–1996



This picture clearly illustrates the changes in lead pollution in Reykjavik from the time when unleaded petrol was first available in 1988 until the phase out of leaded petrol use in 1996. High levels of lead concentration in the air is dangerous to human health. Today lead pollution in Reykjavik is almost non-existent.

1.4 Index of population, number of private cars and the use of public transport in Reykjavik 1970–2000

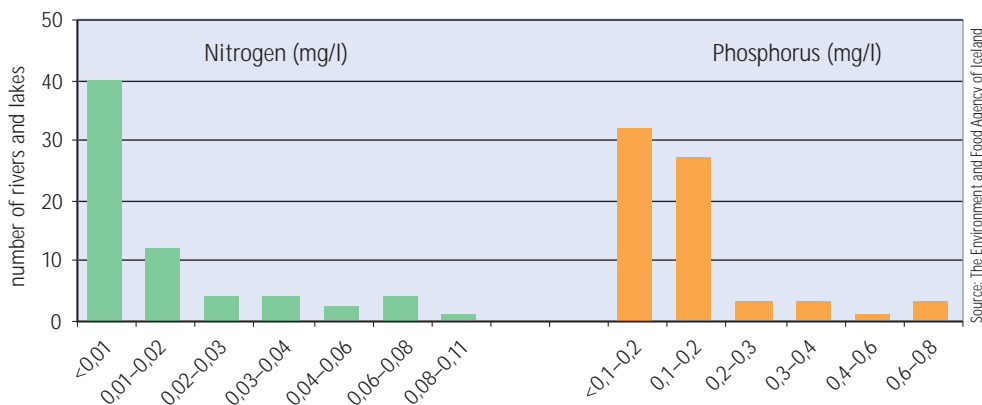


Traffic is one of the main sources of local air pollution in urban areas in Iceland. During the last three decades the population in Reykjavik has increased but the same can not be said about passengers using the public bus system. On the contrary, passengers are fewer than they were in 1970. During this same period increase in privately owned cars has been much faster than population growth. More traffic is therefore not mainly due to population growth, but rather because a larger share of the population owns and uses private cars for daily travel than before.

Clean Freshwater

2.1

Concentration of N and P in selected rivers and lakes

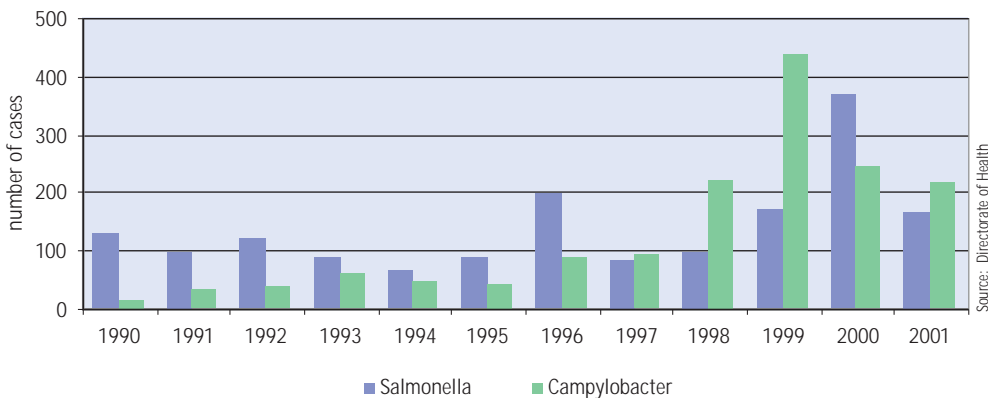


This graph shows the concentration of nitrate and phosphate in selected rivers and lakes in Iceland and is based on means of samples from 1996–2000. Compared to concentration of these chemicals in other European countries, the concentration level in Icelandic freshwater is very low. The danger of harmful fertilizer pollution and eutrophication is therefore not great in Iceland.

Safe Food Products

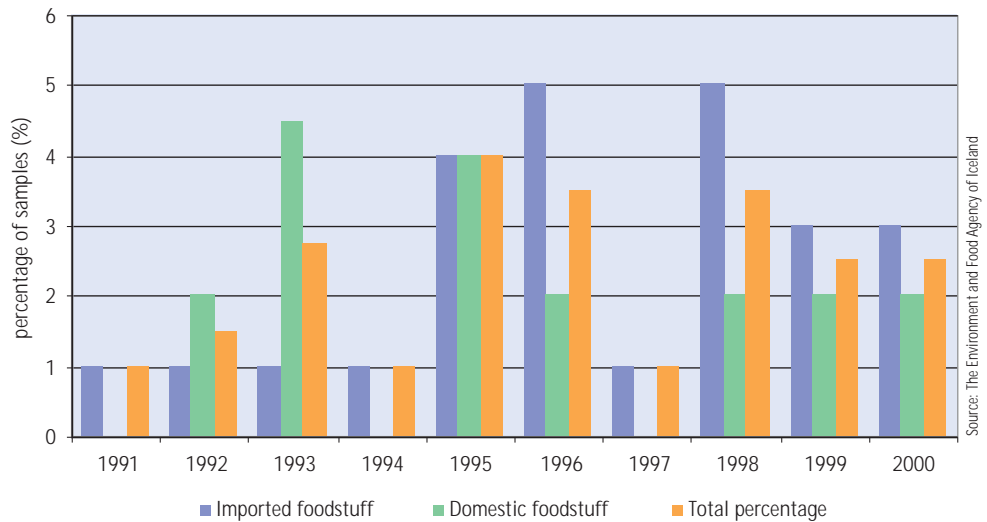
3.1

Confirmed cases of Salmonella and Campylobacter in Iceland 1990–2000



The Salmonella bacteria is found widely in the environment and is often detected in animals. It is a significant risk factor in regard to contamination of food and drinking water. Research on Campylobacter indicates that it is mainly found in raw poultry products and drinking water from small public and private wells. An outbreak of Campylobacter cases in 1999 prompted the government and the poultry industry to take renewed measures, which appear to have succeeded in lowering the number of cases.

3.2 Pesticides above permissible maximum levels, percentage of samples 1991–2000



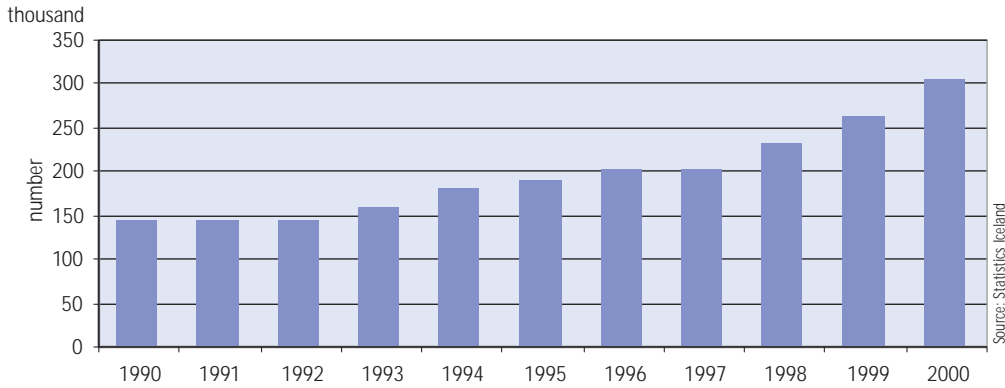
Pesticides are widely used in the production and preservation of many foodstuffs. Remains of these chemicals are sometimes found in foodstuffs, especially in the outermost layer of fruit and vegetables. Between 1 and 5 percent of the samples taken in the recent decade have been above the recommended criteria. No trend is seen in this regard. It should be made clear that criteria for pesticides is very low and much lower than the limit where their consumption is believed to be hazardous to human health.



Outdoor Activities in Harmony with Nature

5.1

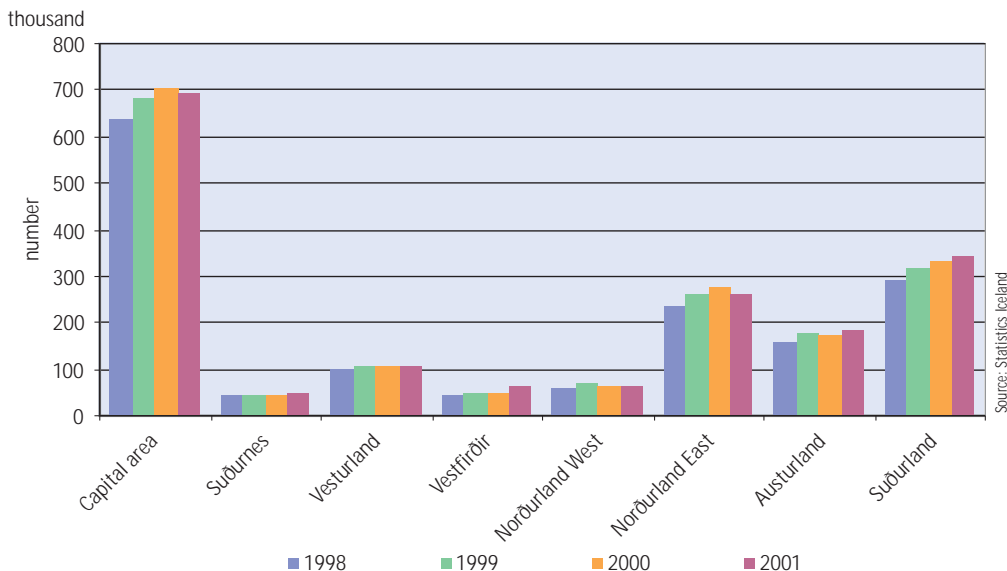
Total number of foreign tourists to Iceland 1990–2000



The number of foreign tourist arrivals in Iceland has risen sharply in recent years. According to polls, nature is the prime reason tourists cite for visiting Iceland. The increase in tourist arrivals is thus a signal of the growing value of Icelandic nature, but also a reminder of the importance of nature conservation, as growing traffic means more stress on the land.

5.2

Total number of overnight stays categorized by region 1998–2001



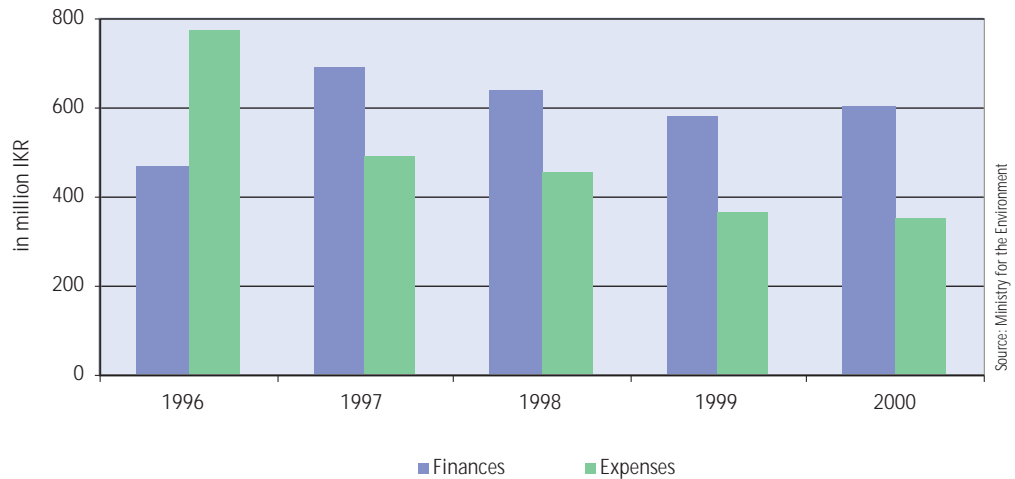
This graph shows the total number of overnight stays of tourists, Icelandic and foreign, in hotels and other commercial accommodations. Icelanders account for about one third of the nights, but their relative share is decreasing due to an increase in the number of foreign visitors. Tourists are not evenly spread around Iceland, and some of the most popular destinations may be negatively affected by high number of visits.



Protection Against Natural Disasters

6.1

Finances of the Avalanche Fund 1996–2000

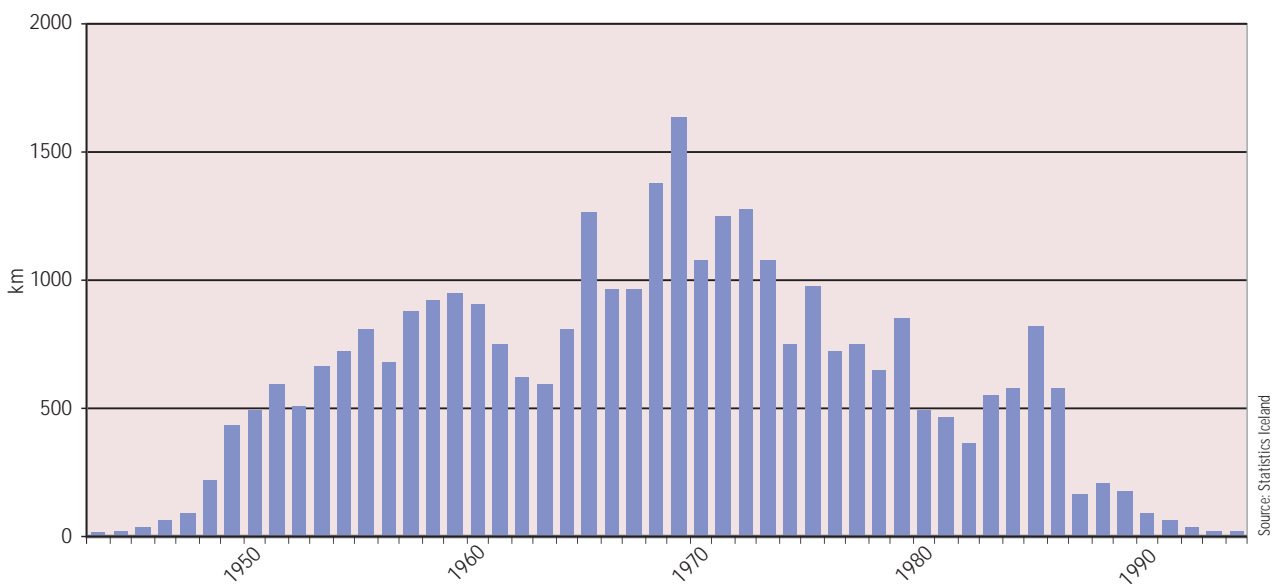


This graph shows on one hand the finances available to the national Avalanche Fund and on the other the expenses of the Fund. The expenses are for the most part construction of defensive structures against avalanches and buy-ups of homes in areas of risk. The money available to the Fund and its expenses increased considerable after two deadly avalanches in 1995, claiming 35 lives.

Protection of Iceland's Biota

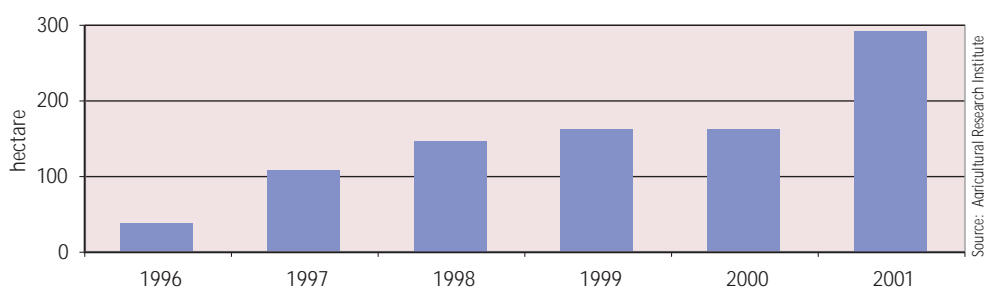
7.1

Draining of wetlands (with ditches) 1942–1993



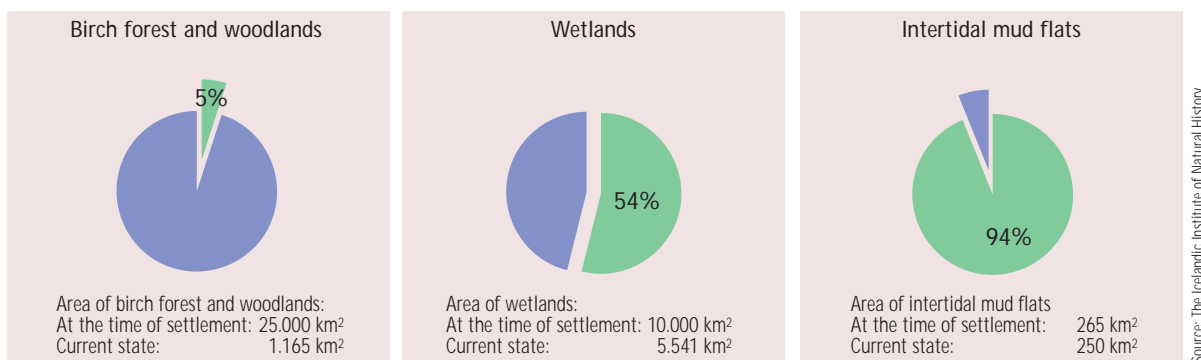
Government-subsidized draining of wetlands for agriculture reached an all-time high in 1968, when 1.633 kilometers of ditches were dug up. A change of policy occurred in the 1990s, when subsidies were abolished, and from 1993 little draining has taken place. The draining of wetlands has increased agricultural production, but also greatly affected the ecosystem, as wetlands provide an important habitat for birds, plants and other organisms.

7.2 Total area of wetlands reclaimed 1996–2001



The effects of the draining of wetlands will in many places be gradually reversed in time, as ditches that are not maintained become silted. In some places, an attempt has been made to speed this process by filling old ditches. This effort at reclaiming wetlands is seen in this graph.

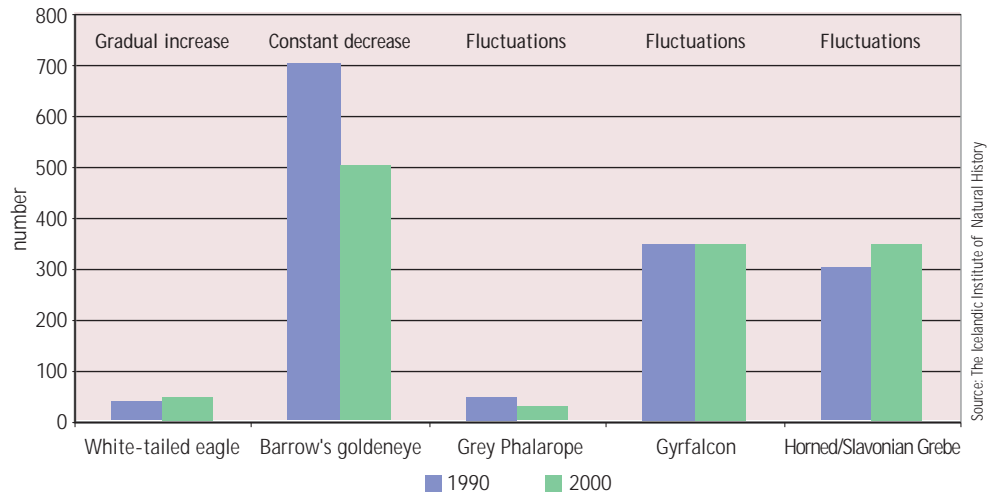
7.3 Area of key ecosystems as a percentage of original state (at the time of settlement)



Iceland's biota and the appearance of the land has changed considerably since the time of settlement in the late 800s AD. The biggest change has been that the once-extensive birch forests and woodlands have largely disappeared, and cover only about 5% of their original size. Wetlands are currently only a little over half of their original area. Intertidal mud flats, which provide important habitats for many birds and marine organisms, are much less affected, as much of Iceland's coastline remains pristine and undeveloped.

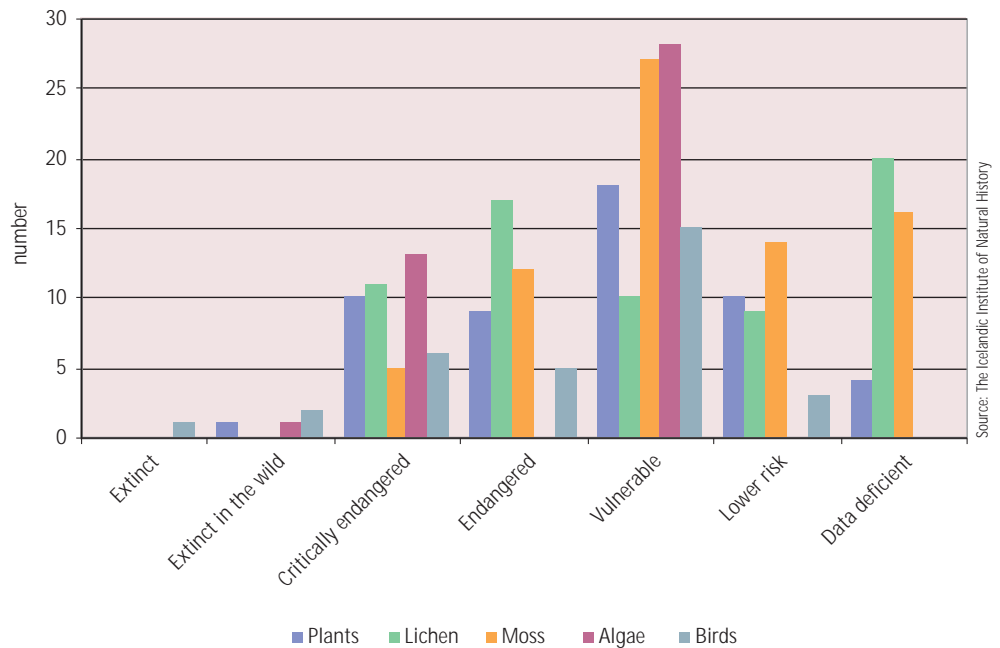


7.4 Breeding pairs of selected rare bird species



The population size of certain species can often be used as an indicator for the health of ecosystems and changes affecting them. The Icelandic Institute for Natural History monitors the population size of several bird species, including these rare species.

7.5 Rare and endangered species



The Icelandic Institute of Natural History issues regular Red Lists, where species are categorized according to the threat of decline in population, and even local extinction. The graph depicts the number of several main groups in different Red List categories.

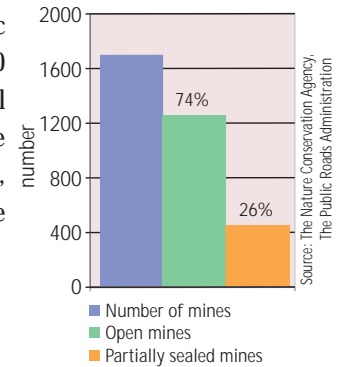


The Protection of Unique Geological Formations

8.1

Number of open mines

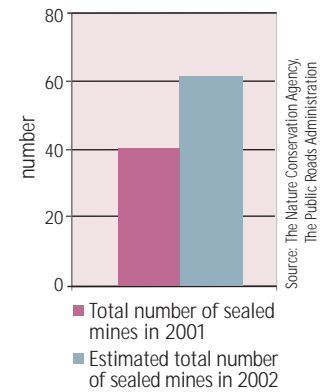
Open mines (mostly gravel and rock mines) are often visual scars on the Icelandic landscape. The Icelandic Roads Authority has listed 1250 open mines and about 450 partially sealed mines. It is estimated that this accounts for about 95% of the total number of mines in Iceland. It is unknown how many of these mines are still in active use. The Roads Authority, which is by far the biggest single user of gravel in Iceland, intends to seal many of its mines in the coming years, and ensure that new mines are quickly sealed.



8.2

Number of sealed mines per year

In the last two years the Icelandic Roads Authority has sealed about 40 old mines, and intends to seal about 20 more in 2002. A plan is on the drawing board for the sealing of all unused mines in the next 15 years.



Wilderness Conservation

9.1

a) Total area of wilderness areas and protected areas

b) Percentage of wilderness areas of the total area of Iceland



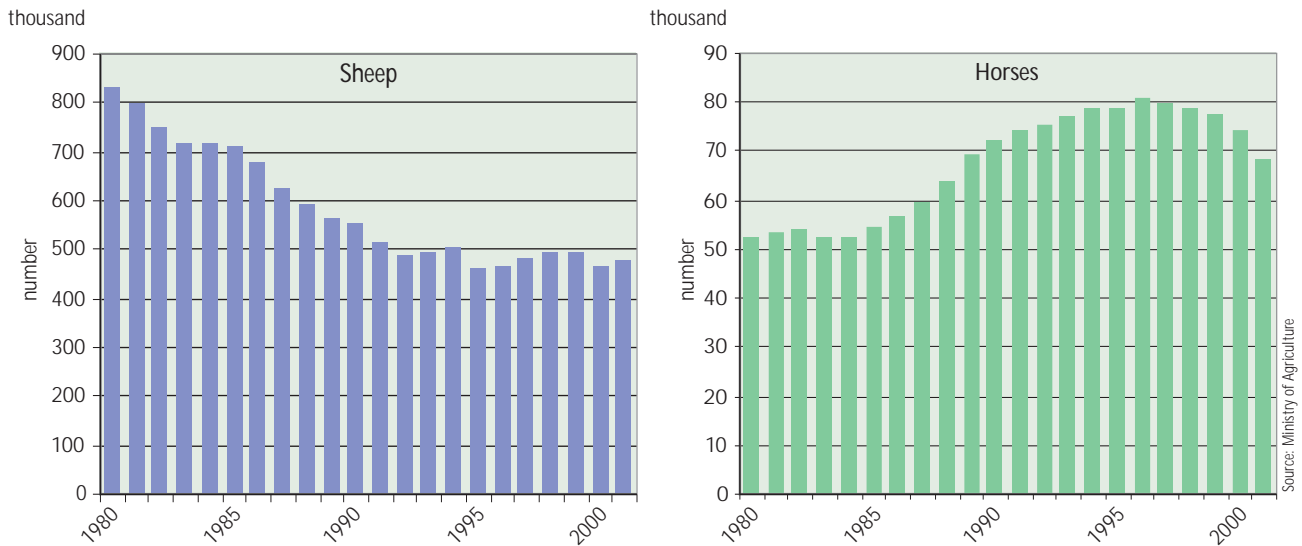
A total of 40,000 square kilometers of Iceland is considered to be wilderness, as the term is defined in the Nature Conservation Act. Thereof, 5,340 km², or about 13% of wilderness, are within protected areas. The concept of "wilderness" is new in Icelandic law. Regular up-dates of the mapping of wilderness areas is needed, so that the effect of new man-made structures on the size of these areas can be monitored.



Sustainable Use of Vegetation and Reclamation of Land

11.1

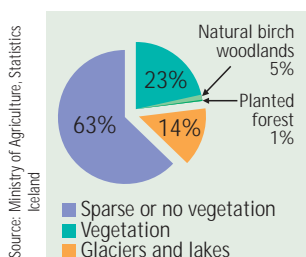
Total number of sheep and horses 1980–2001



Grazing is among the factors that affect the state of the land. Overgrazing can cause degradation of soil and vegetation. Even if the grazing stops it can take a long time for the land to recover. Grazing in Iceland is mostly from sheep and horses. The number of sheep continued to increase until mid-seventies of the last century but for the last twenty years the total number of sheep has been decreasing. In the year 2000 the number of sheep was down to 460,000 from the peak of 900,000 in the year 1977. This decrease has lessened the danger of overgrazing. The number of horses has increased during this same period although horses are still far fewer than sheep, or less than 100,000. The numbers do not tell the whole story, since horses are both heavier and their grazing habits can be damaging to the land. Another important factor is to look at which areas of land are chosen for grazing. Some work has been done in recent years to map out the state of the land in different areas and this information could be useful to manage grazing more efficiently. The number of sheep and horses grazing on land where soil degradation is problematic could be a useful future indicator.

11.2

a. Forest and woodlands as percentage of vegetated land in the year 2001



As seen in a previous graph (7.3), the area of vegetated land in Iceland, especially woodlands, has shrunk considerable since the time of settlement. About 14% of Iceland is glaciers and lakes, 63% contains sparse or no vegetation, and 23% is vegetated. Remnants of original birch woodlands cover around 5% of vegetated land (around 1.15% of the total area of Iceland) and planted forests around 1% of vegetated land (around 0.23% of total area of Iceland).

b. Total area of forests and woodlands in 2001

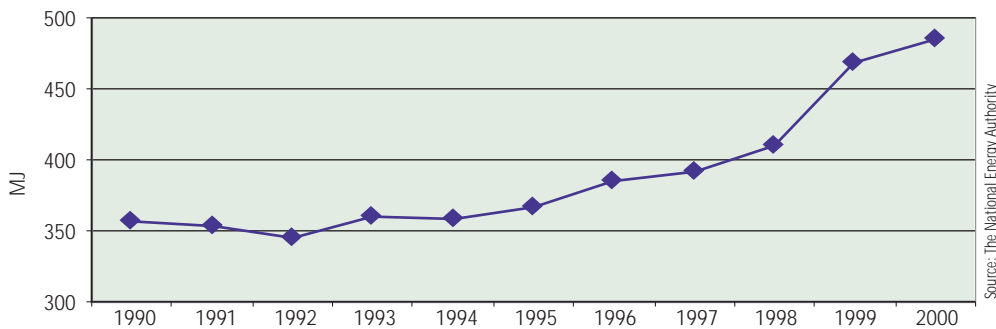
This graph shows the area of natural woodlands and planted forest in 2001. This area should slowly expand in the coming years, as government policy is to plant more forests.



Increased Utilization of Renewable Energy

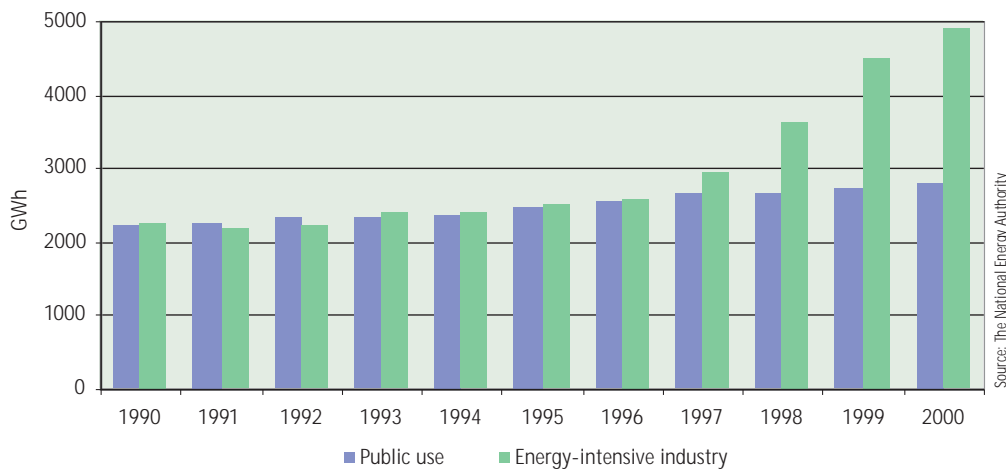
12.1

a. Total energy use per capita 1990–2000



Per capita energy use in Iceland is high compared with other industrial countries. A cool climate and sparse population calls for high energy use for heating and transport. Also, key industries, such as fisheries and metal smelting, are energy intensive.

b. Division of electricity between industry and public use 1990–2000

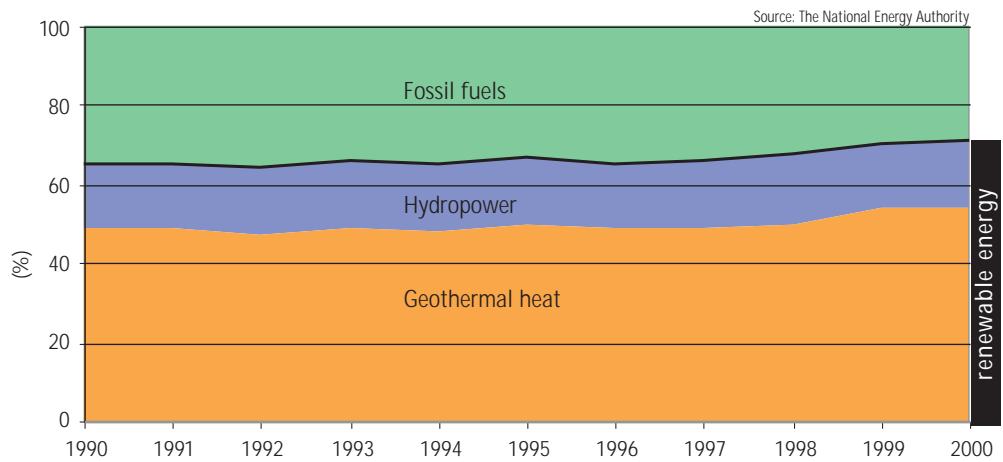


This graph shows that the increase in the use of electricity in the last decade is mostly due to an expansion of energy-intensive industry (metal smelting), not in increased public use of electricity.



12.2

Proportional division of energy 1990–2000

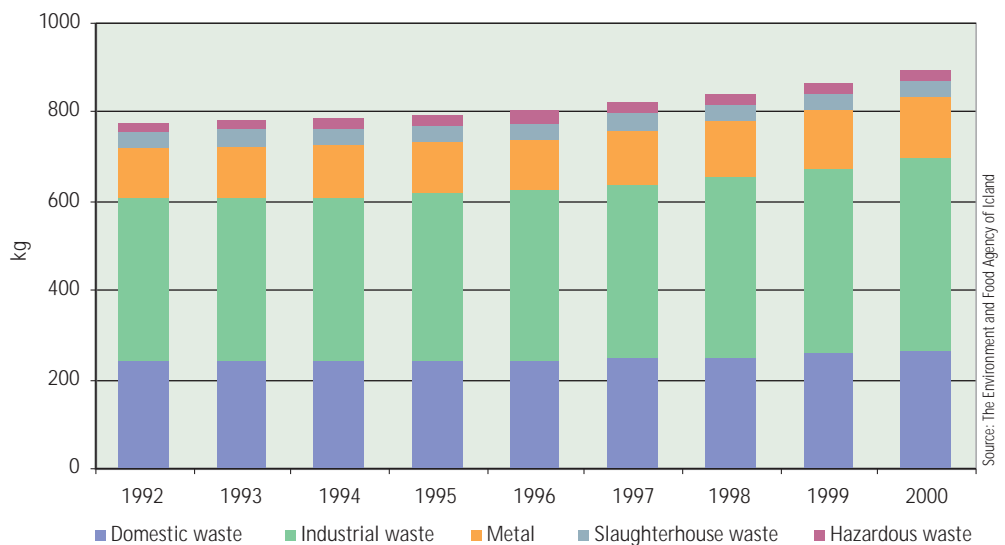


Iceland has ample reserves of renewable energy in the form of hydro and geothermal energy. Government policy is to increase the use of domestic energy sources, in real terms and proportional to imported fossil energy. The proportion of renewable energy in Iceland's total energy budget had reached 70% in 2000, which is the highest among industrialized countries.

Reduction and Improved Handling of Waste

13.1

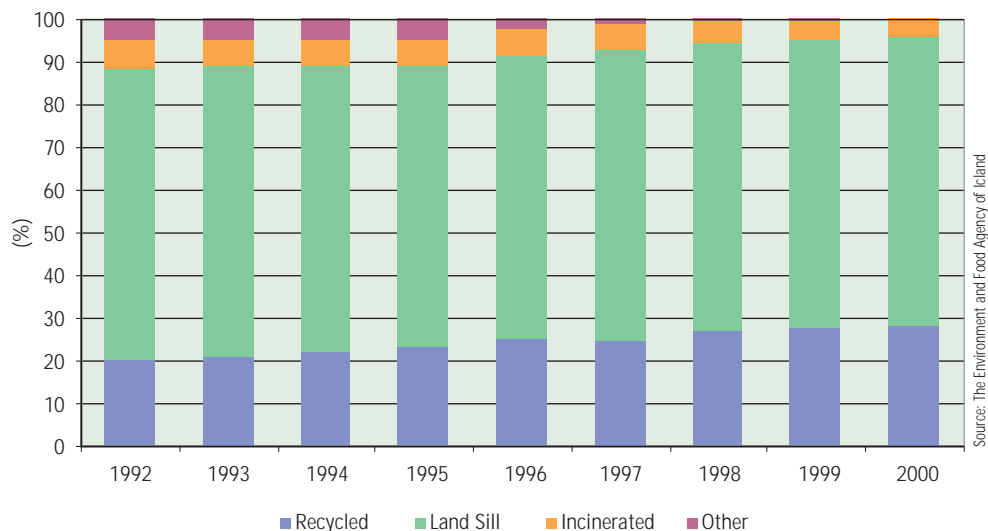
Total amount of waste per capita 1992–2000



The government goal of reducing waste per capita has not been reached in the last decade. To the contrary, per capita waste has steadily increased. The increase is greater among companies than households. Growing consumption seems to be the main explanation for this trend.

13.2

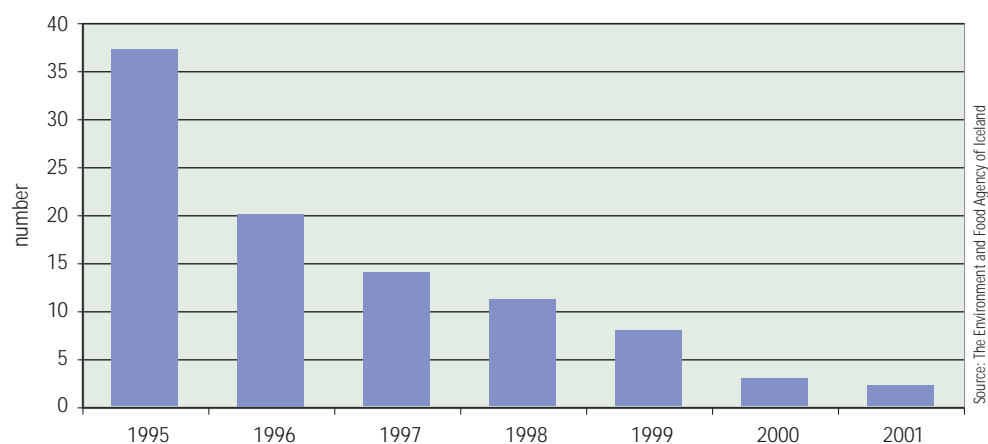
Proportion of waste recycled (including energy recovery), incinerated and put in landfills 1992–2002



The total production of waste is not the only statistic that matters with regard to waste. Safe disposal and effective recycling are government goals, where progress has been made in the last decade. The percentage of recycling has increased from around 20% in 1992 up to almost 30% in 2000. Less amount is incinerated today than in 1992. The amount of waste put in landfills has not changed much in the last decade, but the management of landfills has vastly improved in this period.

13.3

Number of locations with open pit burning 1995–2001

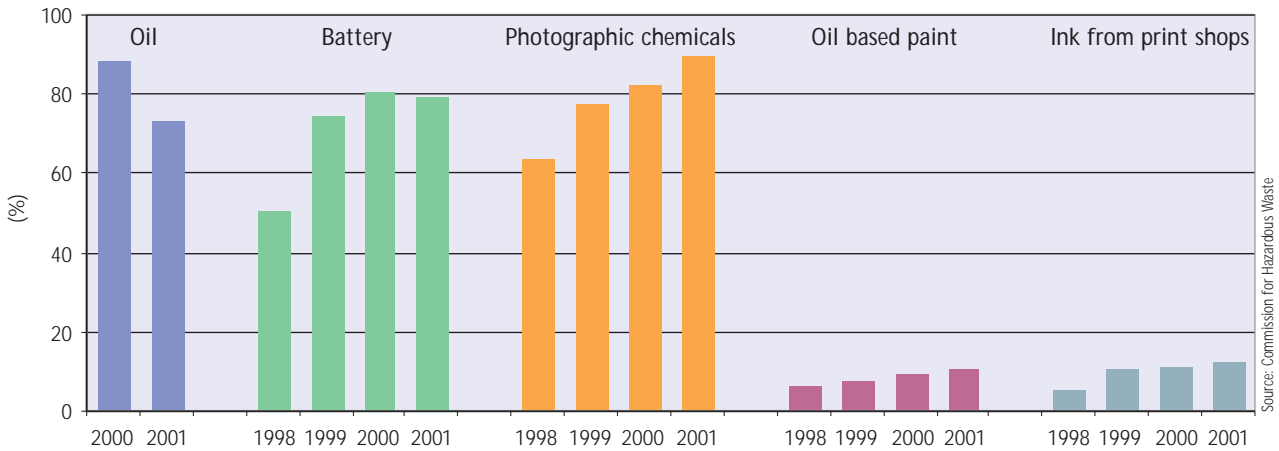


Open pit burning at low temperatures was a common method for waste disposal in Iceland until quite recently. Open pit burning is unsanitary and a visual pollution, and the low-temperature burning of waste can create hazardous chemical compounds, such as dioxins and furans. This form of waste disposal has gradually been phased out in recent years.



13.4

Reception of hazardous waste, percentage of retrieval

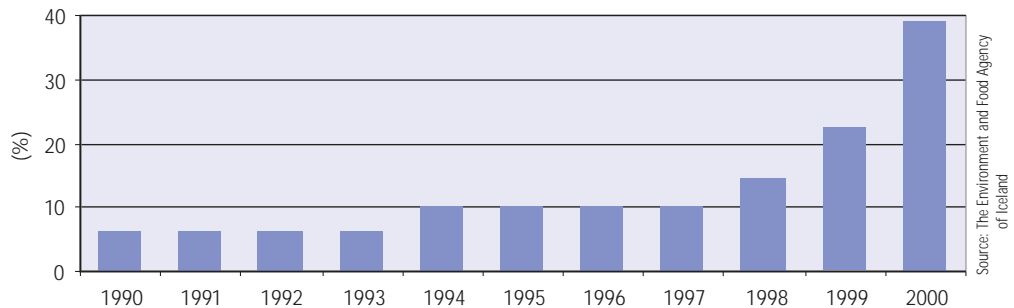


The generation of hazardous waste in Iceland is small, due to the small population and limited chemical industry. Due to the persistent nature of many pollutants, however, it is a government priority to halt all release of hazardous waste into the environment. To promote that goal, hazardous waste charges were introduced in a 1996 legislation, to finance and promote the collection and safe disposal of hazardous waste. Today, charges are collected from about ten different types of hazardous waste, some of which are represented in this graph. The collection rates are good for oil, batteries and photographic chemicals, but lower for oil-based paint and for ink from print shops. The collection rate for some other waste types is lower still. While there is room for improvement, the system is seen by the government to have been a success.

Clean Ocean

14.1

Percentage of inhabitants with waste water treatment 1990–2000

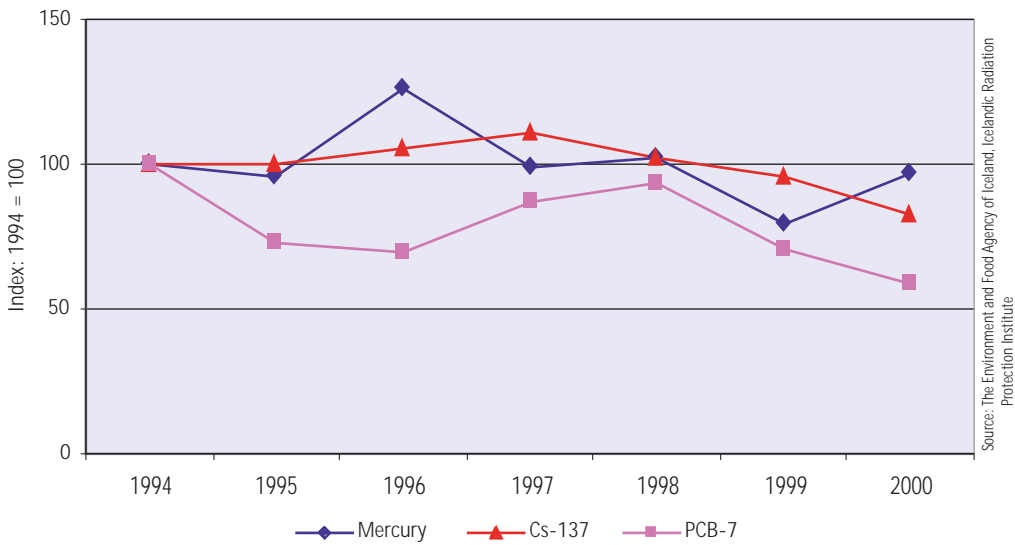


Ocean pollution from sewage in Iceland is minimal, due to the country's sparse population and strong ocean currents. Nevertheless, a ten-year programme for installing waste water treatment is now under way, with important steps taken in recent years, especially in the greater Reykjavik area. The proportion of inhabitants with sewage treatment has quadrupled in the last few years, from 10% in 1997 to almost 40% in 2000.



14.2

Concentration of PCB, mercury and Cs-137 in cod 1994–2000

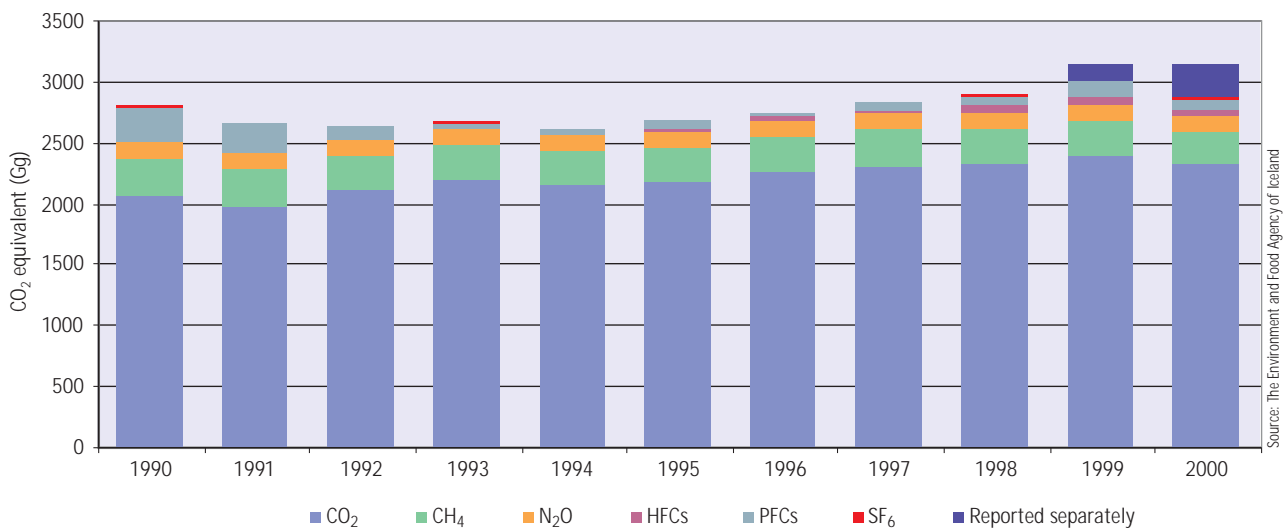


The three types of pollutants considered most hazardous regarding pollution of the oceans are persistent organic pollutants, heavy metals and radioactive substances. This graph shows the trend regarding selected pollutants from each of these groups in cod in Icelandic waters. PCB-7 is measured in cod liver, while mercury and Cs-137 are measured in cod flesh. It is difficult to assert a clear trend from the data, although it appears that the amount of these pollutants in Icelandic waters is declining rather than increasing. It should be born in mind that the strength of each of these pollutants is miniscule, and far below health and environmental standards.

Limitation of Climate Change

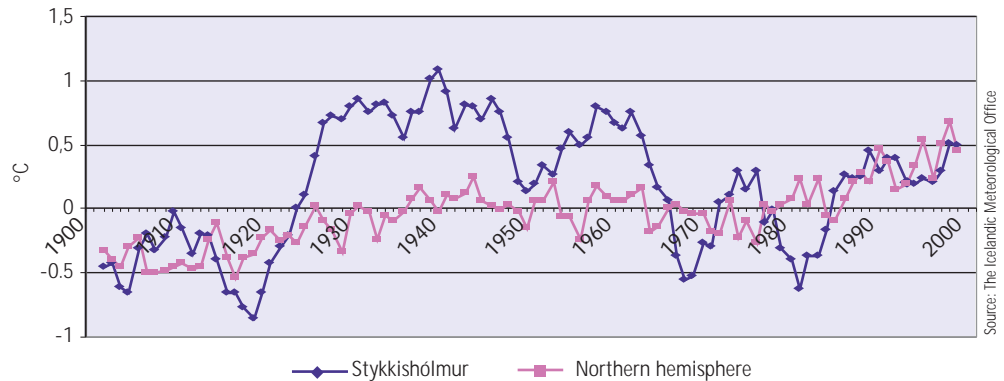
15.1

Total emission of 6 greenhouse gases (including carbon sequestration) 1990–2000



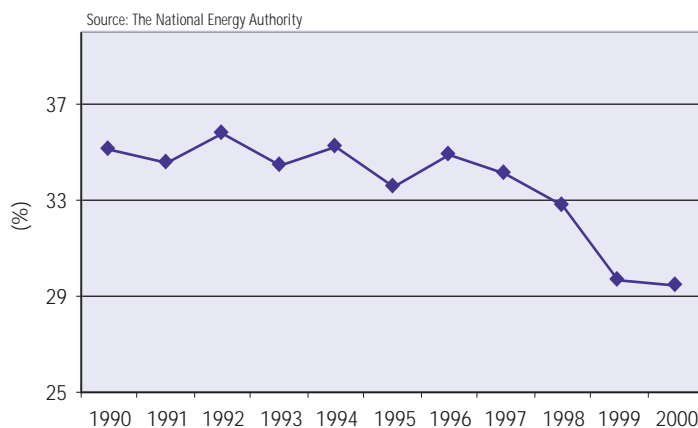
Carbon dioxide provides the bulk of greenhouse gas (GHG) emissions in Iceland. According to the Kyoto Protocol, the GHG emission shall not increase more than 10% from the level of emission in 1990, during the first commitment period, from 2008 to 2012. Carbon sequestration in vegetation can be subtracted from emissions, as is done in this graph. Industrial emissions of carbon dioxide from post-1990 industrial projects, using clean and renewable energy, is shown as a special category in this graph, as these emissions are reported separately and not included in national totals for Iceland according to a decision of the conference of the parties to the climate convention.

15.2 Variation of mean annual temperature in Stykkishólmur 1900–2000



The graph shows the deviation of the yearly mean temperature in Stykkishólmur in Western Iceland, compared to the annual average from 1960 to 1990. For comparison, the deviation from the annual mean for the entire northern hemisphere is also shown. The temperature oscillation is greater for a single station like Stykkishólmur than for the greater region, as is to be expected. The temperatures in Stykkishólmur is consistently higher than the hemisphere average from 1930 until the 1960s, but in the last decade the trend has been similar to the global trend of increased temperatures.

15.3 The use of fossil fuels as a percentage of total utilization 1990–2000

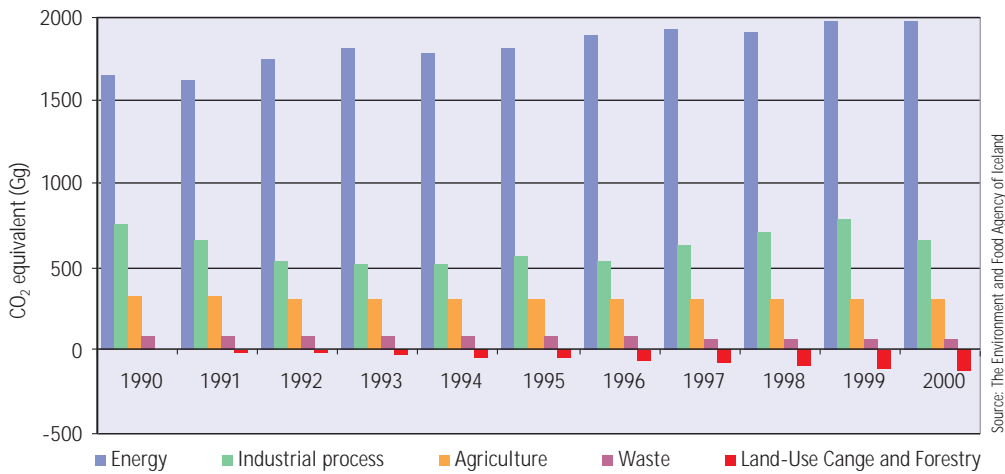


Using renewable energy sources such as hydro and geothermal energy instead of fossil fuels is an effective way to reduce emissions of GHGs. Some progress has been made in the last few years to increase to share of renewable energy sources in comparison to total use of energy. Should the plans of using hydrogen as an energy carrier in the transport sector materialize in the future, the share of fossil fuels in total energy use will decrease even further.



15.4

Emissions of GHGs divided by origin 1990–2000

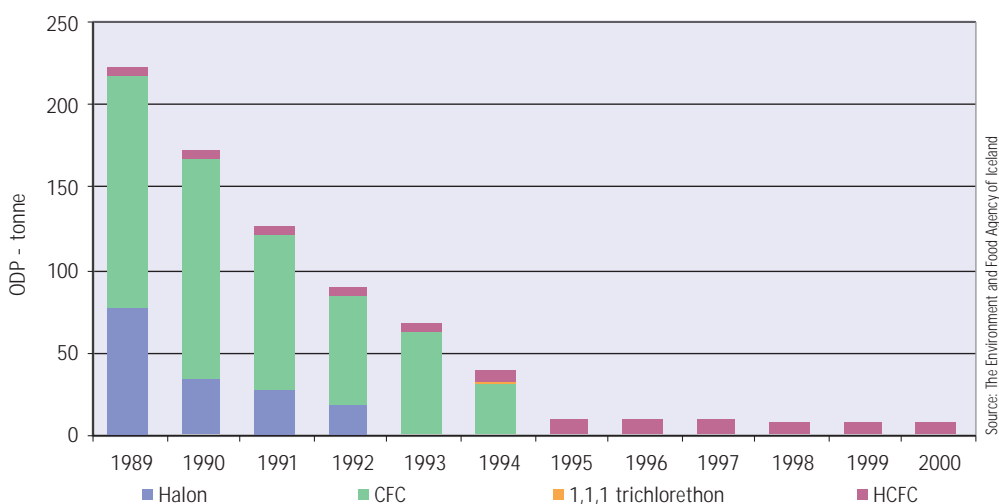


Burning of fossil fuels in the transportation and fisheries sectors is the main source of GHGs emissions in Iceland. Other sources of emissions include industrial processes, emissions from agriculture and methane from landfills. New carbon sinks, created through revegetation and afforestation, also count when calculating emission since the carbon absorbed by those sinks can be deducted from total emissions. Emissions from the generation of electricity are non-existent in Iceland.

Protection of the Ozone Layer

16.1

Import of ozone-depleting substances 1986–2000

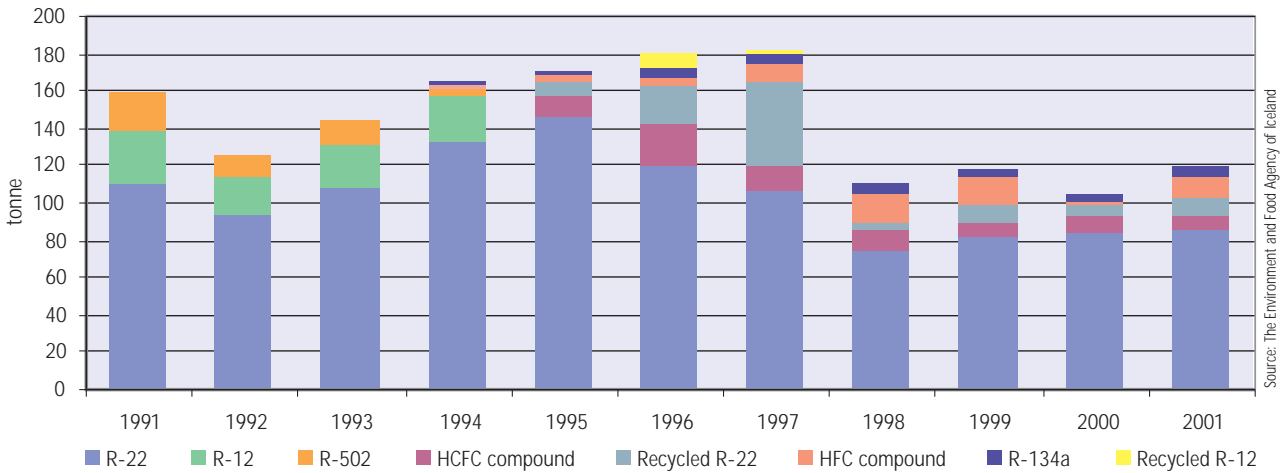


Iceland does not produce any ozone-depleting chemicals domestically. The importation is measured in so-called Ozone Depletion Potential-tons, taking into account each substance's effectiveness as well as volume. The importation of CFCs and halons has ceased, and the only ozone-depleting substances currently imported into Iceland are HCFCs.



16.2

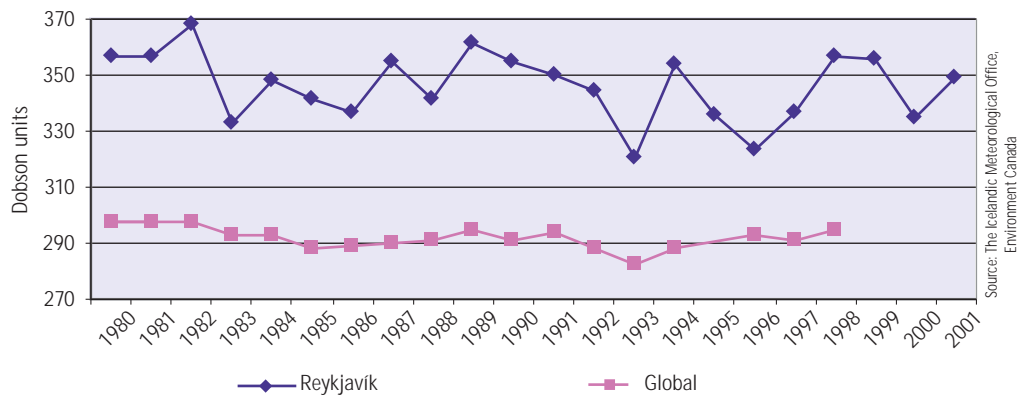
Import of ozone-depleting refrigerants (onboard vessels) 1990–2001



HCFCs are found for example in substances used for cooling, i.e. in fishing vessels. Iceland needs to decrease the use of these chemicals in the next years and cease them completely in 2015.

16.3

Thickness of the ozone layer over Reykjavik 1980–2000, in comparison to the average thickness of the ozone layer globally.



The ozone layer has continued to decay in recent years, despite the great decrease in use and release of ozone-depleting substances. This is due to the fact that it takes a long time for the substances to reach the stratosphere. It is believed that the depletion of the ozone layer will continue for some years, but then it will start to gradually recover. The annual mean for total stratospheric ozone over Iceland shows great fluctuation and no clear trend like the global average. The Icelandic Meteorological Office has measured total ozone continuously since 1957, which is among the longest such continuous observation record in the world.



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