The environmental situation in a world of rapid economic growth – conclusions and assessments

The combined effect of increased demands on biological resources, impact of climate change and deterioration in the quality of air, land and water may put enormous pressure on ecosystems in the next few decades. This might risk undermining the natural resource base for social development.

The special working group appointed by the Swedish Environmental Advisory Council has performed an analysis of the potential impact of economic growth on the state of the environment and we have focused our work on the use of above all biological resources in the longer term. Based on the analysis, we discuss possible ways of meeting future challenges and present ideas for initiatives that Sweden could take. The analysis extends over a broad field and deals with complex links that are difficult to assess and that are at times mutually reinforcing. There are currently no clear answers to many central questions.

Growth forecasts point to a three or fourfold increase in the global economy in the next fifty years. The study discusses what impact this might have on the demand for biological resources such as forest and agricultural products, freshwater and fish as well as the demand for energy and the impacts on the climate. Focus is on the overall pressure on the ecosystems.

The overall picture that emerges indicates that the problems anticipated are of such a magnitude and character that what is required is a veritable rethink in both national policy and international cooperation.

The situation is aggravated by the fact that many problems need to be dealt with in a global system that suffers from major institutional deficiencies at the multilateral level and often also at the national level. Weak or non-existent legislation and corruption prevent the long-term efficient use of natural resources and make short-term ruthless exploitation possible.

This, combined with an ever-increasing consumption of resources above all in the wealthier parts of the world, entails major challenges.

The anthropogenic era

The human imprint on the environment on a global scale is already so pronounced that the current era has been termed the anthropogenic era.

The most recent report from the Intergovernmental Panel on Climate Change, IPCC, shows that there is a consensus view about the fact that human activity has already had an impact on the climate. However, it is not the climate alone that is affected. The UN assessment of the condition of the ecosystems, the Millennium Ecosystem Assessment, indicates that 15 of the 24 examined benefits provided to Man by Nature, known as "ecosystem services", are decreasing or being used in an unsustainable way. The genetic resource base is decreasing rapidly. In certain regions the number of insects and birds has decreased to such an extent that it has an impact on pollination, which in turn has consequences on the supply of food.

Other services that have decreased are, for example, drinking water purification and quality, protection against natural disasters and waste degradation. The conclusion is that the capacity of ecosystems to produce biological resources and ecosystem services has been weakened. The report specifically points to the increasing threats to ecosystems caused by climate change and eutrophication, the loss of freshwater in dry regions and, as a consequence, the increased vulnerability of the populations of these regions, and the global fish crisis.

Studies of ecosystems indicate that many local and regional systems are becoming increasingly vulnerable. The resilience of the systems is decreasing. This means a weakened ability to recover and maintain quality if a system is subjected to a disturbance, such as a storm. Many studies show that there are thresholds and that crossing these may lead to the systems experiencing a regime shift. If this happens, an ecosystem may be transformed into a new, potentially less productive state. The collapse of several marine stocks of food fish demonstrates the consequences such regime shifts may have.

This weakening of ecosystems gives rise to questions such as: What happens to humans at the top of the food chain if the entire food web becomes depleted? Is there a risk of small gradual deteriorations in the capacity of ecosystems that will eventually result in irreversible effects on a larger scale? Does society have the capacity to cope with such changes? How can they be prevented and how do we ensure that our societies are prepared?

A dramatic increase in the demand for resources

The point of departure of the study is that world GDP will continue to grow rapidly. This has partly to do with continued growth in OECD nations, starting from an already high GDP level calculated per capita, and partly with a substantial expansion of the economies of many poor, heavily populated countries.

Decreasing poverty is a positive development that should be welcomed and recognised. Growth creates increased material resources in all societies, an increase in contacts within and between nations and the opportunity to make technical advances. If this is not combined with the sustainable management of ecosystems, which form the basis of economic development, negative impacts on social and economic welfare will eventually ensue.

The projections the Council has made point to major future challenges if the production and consumption trends, use of resources and impact on the environment continue as they have until now. Separate studies have been carried out on energy, forest raw material, freshwater and fish.

The studies have been carried out based on certain assumptions with regard to growth, enhancing efficiency over time and the development of consumption. If other assumptions are made, different results are achieved. The purpose of the studies is not to establish what will happen, but instead to raise questions regarding how things might develop if current trends continue, and above all to identify where trends need to be broken. We therefore call for further studies and continued analysis.

Fish and other marine resources

A fourth of the world's wild fish stocks are already outside safe biological limits and a further 50 per cent are in an acute need of more sustainable management. In the North Atlantic, stocks of the most important species of fish for consumption have decreased by 90 per cent since 1900. Illegal fishing is a major problem. A growing problem is fisheries at great depths in the open seas, and the use of destructive fishing methods, such as bottom trawling on underwater hills, which clear the seabed and destroy important spawning areas for fish. At the last meeting of the Convention on Biological Diversity, it was proposed that the UN should introduce a moratorium on bottom trawling in the deep seas, but the five states responsible for most of the fishing blocked the issue at the UN.

Fish consumption per capita has increased in the world and studies from the UN Food and Agriculture Organization (FAO) indicate that the trend is set to continue and that the demand for fish will increase by approximately 30 per cent in the next twenty years. This increase in demand will probably have to be met through fish farming since the catching of wild fish has stagnated and the trend is pointing downwards, even though new stocks have been discovered, fishing fleets have increased and greater depths are being fished. There is a risk that the scope of catching wild fish will have markedly decreased by the year 2050.

Freshwater

The pressure on freshwater resources is alarming in many areas around the world, leading to enormous environmental consequences and harsh competition between user categories in societies. Irrigation agriculture consumes most water, as much as 75 per cent, while industry stands for 20 per cent. Only 5 per cent is for household use.

The overuse of water has led to falling groundwater levels in many dry areas. In other areas intensive irrigation has resulted in the land suffering from salt contamination. There is a lack of data, but a rough estimate indicates that approximately 20 per cent of all irrigated land is exposed to salt contamination with major economic losses as a result. Biodiversity has decreased even more in freshwater systems than in the sea or on land. A clear example of

overuse is that some of the world's longest rivers no longer reach the sea for parts of the year.

The need for freshwater, which already is a scarce resource in many regions, may increase by 50 per cent globally as the population grows and incomes increase. When people become better off, their diets change and tend to contain more meat, which is water-demanding to produce. The change seems to be particularly strong in certain income brackets. Large parts of the population in growth economies will reach these income levels in the next few decades. Water use also seems to be rising in OECD countries that already have a high per capita consumption.

The freshwater study also indicates that there are ways of increasing water efficiency both at the production and the consumption stage. One way, for example, is to make more efficient use of rainwater, which could reduce the need for water in agricultural production by a quarter within 50 years. There are huge losses in the production to consumption chain. If the losses after harvest (via e.g. better storage) can be reduced in above all poor countries and the losses at later stages decrease in wealthy countries (by throwing away less food), it would be possible to reduce water consumption by about 15 per cent. There is thus a potential to meet an increase in the demand for freshwater for food by the mid-2000s without actually entailing a major increase in the use of freshwater. This requires, however, action and a change in behaviour.

Forestry

The forests of the world fulfil a number of non-commercial functions such as climate regulation, water flow regulation and erosion protection. Despite the fact that deforestation has been a matter of concern for decades, it is continuing at an alarming rate according to the FAO. The main reason is the need for agricultural land. Another reason is the growing problem of illegal logging. The reduction is fastest in the tropics, above all in Africa and South America. In Europe, Russia and China the planting of forests, restoration and natural afforestation have led to an increase in forest production. Deforestation is now estimated to be responsible for as much as 20 per cent of global CO_2 emissions.

There is also a gradual transformation of virgin forests into modified forests and plantations.

Scenarios of the demand for industrial timber for paper, sawn wood products and wood-based panels indicate that demand will more than double in the next fifty years. The consumption of paper will increase fourfold according to the scenario but the assumption is also that the recycling of paper will increase from the current 40 per cent to approximately 80 per cent.

The need for forest raw materials will increase dramatically both for industrial purposes as well as a source of energy. This may lead to a more intensive use of land and conflicts between different user interests, e.g. the need of land for agriculture, bioenergy production or conservation purposes.

Energy and the impact on the climate

The scenarios in our background report indicate that the demand for *energy* will increase threefold by the year 2050 (in line with the highest level scenarios in the reports of the Intergovernmental Panel on Climate Change, IPCC) and that this may lead to drastic increases in CO_2 *emissions* if we do not radically change our energy systems. Emissions are already about two - four times higher than what can be permitted in 50 to 100 years time if we are to achieve the EU goal of a maximum increase in temperature of two degrees. By the year 2050, societies will not only have to halve their emissions but also satisfy a much greater global demand for energy.

These types of scenarios point at a future with risks of substantial climate change and consequently great impacts on seawater levels, precipitation distribution, storms, food supply, access to water, biodiversity and much more. Vigorous measures must be taken in order to limit the increases in temperature. The most important areas are an efficient use of energy in all sectors, renewable sources of energy, avoiding deforestation, energy-efficient infrastructure and means of transport. Other important factors are choice of diet and energy efficiency in the food supply chain. Technology that will help resolve the problem exists but is not used to a sufficient extent. New incentives are required and knowledge must become more generally available.

Bioenergy, which may replace fossil energy sources and mitigate global warming, requires major land surfaces and a great deal of

water. In the background report to this memorandum, various scenarios are discussed with regard to the production of bioenergy. The conclusion is that even if an area corresponding to four to seven times the agricultural area of Europe were used, it would not be possible to meet more than 15-20 per cent of future global energy needs. Moreover, the water required would equal that of the entire food production system. It is also imperative to understand where these land surface areas would be available. Energy demand will increase substantially in growth economies like China and India, but in these countries the major part of the suitable arable land is already cultivated. It is primarily Africa and Latin America that still have large uncultivated land areas. However, there is a risk that an increase in cultivated biomass in these areas would have negative consequences on rain forest and biodiversity. One option currently being examined in India, for example, is whether it is possible to cultivate bioenergy on land that cannot be used for food production, i.e. "wastelands". This may, however, have a major negative impact on the poorest people since they are often dependent on this type of land for their survival.

Intensive cultivation often entails the use of pesticides and chemicals as well as the use of manure leading to eutrophication of surrounding waters. Monocultures lead to other risks such as erosion and salt contamination.

Total effects and risks of regime shifts

Unavoidable climate change during the next hundred years will cause more droughts in dry areas and more rain in rainy areas. The seas will become more acidic which will have an impact on marine organisms. It is important to understand the impact all this will have on the scope for increasing the production of food, forest raw material for industry, bioenergy and other crops such as cotton for the textiles industry. It is also important to understand how changes in biodiversity and the possibility of producing ecosystem services in turn may affect the climate in a mutually reinforcing process.

One example of how a mutually reinforcing process may affect important ecosystems is how the Amazonian rainforests risk being transformed into a savannah due to drought as a consequence of climate change combined with cultivation, grazing land and the felling of large trees that opens up the tree canopy so that the sunlight reaches the ground. Forests bind carbon and a gradual thinning-out and transformation into savannah will in turn have a greater impact on the climate.

There are several uncertainties in the climate change scenarios. These concern aspects such as feedbacks in the climate system that could not be fully incorporated into the models. A warmer climate will affect the carbon cycle, e.g. the capacity of both sea and land to absorb carbon dioxide will decrease and more carbon dioxide will escape into the atmosphere. When ice-sheets melt, less solar radiation will be reflected - a phenomenon known as the "albedo effect". Another uncertainty is future cloud formation and the current cooling effect of air pollutants (aerosols).

Another factor is that reduced permafrost may lead to methane gas emissions. There are also uncertainties surrounding the impact on large land-based ice-sheets on Greenland and in the Antarctic. The models have taken a certain amount of melting into account but do not consider the possibility of the ice breaking up and floating out to sea since too little is known about this phenomenon as yet.

The outcome may be more favourable than is deemed likely in the various scenarios but it may also be worse. The uncertainties are greater in the scenarios that predict major temperature rises - there is no experience on which to base expected feedbacks. There is a need for greater understanding of the consequences of different outcomes and better preparedness in the face of more negative outcomes.

Long global product chains and institutional shortcomings

The long product chains from raw material to final consumer in a globalised economy make it more difficult to gain an overview of the effects on the environment and on health at different stages and reduce the scope for individual countries to intervene. Growth economies have set up institutions for economic development but often lack sufficiently efficient institutions to limit environmental

effects. Countries like China and India are experiencing very serious problems with polluted water, rivers that no longer reach the sea and air that is so polluted that it causes several hundred thousand deaths every year. It is poor countries that are most vulnerable, countries that have not been able to establish institutions either to promote economic development or protect their environment.

Today raw materials and products move back and forth between the continents in our globalised world before the product finally reaches the shop-shelf for the final consumer. An example of this is fish caught in the North Atlantic that is transported to the Netherlands to be reloaded and sent to China where it is filleted, frozen and then transported to France where it is thawed, cut up and coated with breadcrumbs in order to be frozen as fish fingers and distributed to final consumers in for example Sweden.

China has increasingly become the "factory of the world", and exports everything from electronic goods to sports equipment and toys. Raw materials may originate from all the corners of the globe – metals from mines in Africa, forest raw material from neighbouring countries in South East Asia often illegally felled. It can be very difficult for a company that distributes a final product to trace the chain backwards and understand the environmental effects.

If things do not add up – what will the consequences be?

The scenarios give rise to the question how all this adds up? The main impression is that the ability of the biosphere to provide the services that humans demand today and in the future will be weakened. This confirms what has already been stated at the world summit in Johannesburg and what is now being dealt with in the Marrakech process – consumption and production patterns cannot be allowed to continue as they have until today.

According to economic forecasts, densely populated countries like China and India will have the largest economies by the year 2050. However, according to the same forecasts, the current industrial nations will at that time still have per capita incomes that are five times those in China and India and about 10 times those in Africa south of the Sahara.

It is impossible to accept the development indicated by our scenarios. Therefore the problem must be reformulated: is it possible to find a way to ensure that the interaction between humans and the environment functions so much better that we are able to continue to expand our welfare without weakening the biological supply base for future generations? Will we be able to enhance efficiency to the full extent required and develop new solutions quickly enough?

How can we meet these challenges?

We do not have any simple or ready-made answers. We are convinced that political intervention is needed. Previous experience also proves this. Certain environmental problems have been reduced as growth has increased, although not necessarily as a consequence of growth itself but as a result of political decisions and policy instruments.

The success stories that are usually highlighted are those that have been achieved as the result of national environmental efforts or of international cooperation between like-minded states. The challenges of today and tomorrow are of a much larger scale as regards both time and space. Yesterday's environmental problems were felt by the generation at that time, while the new problems need to be tackled bearing future generations in mind. The local environment is dependent on global events and vice versa. All local decisions regarding consumption, production, management and development; all choices made by every entrepreneur, municipality and citizen on a daily basis have, taken together, an impact of global proportions. We need to rethink our actions at all levels; from the local community to global institutions. Systemic changes within the areas of energy, transport, industry, agriculture, forestry, and town and community planning are required.

The scarcity of non-renewable resources such as minerals can often be managed on the market, where higher prices lead to improving efficiency and technological advancements.

Shared resources – the great seas with fish and other marine resources, lakes, rivers and streams, airflows and ecosystem services like pollination and water purification – do not have a price tag and must be managed so that they are not overexploited ("the tragedy of the commons" to use the language of economists). Rising prices

of biological resources may entail a more efficient use of for example water and a lower per capita consumption of for example meat. However, higher prices of resources such as forest and fish may instead lead to further exploitation and increased illegal extraction.

Some of the problems – the climate, state of the oceans, problems linked to the long global product chains – require international agreements and initiatives. However, the sluggishness of current structures and political systems means that it is uncertain whether these can be concluded quickly enough. A precondition for multilateral agreements is that the states that conclude them are legitimate and have regulations that are effective within their own territories. This is often not the case and in many cases it will take time before such preconditions evolve.

This is why other paths need to be explored in parallel. A continued analysis and discussion is needed with regard to what these routes might be and who should take the initiative. Perhaps we can learn something from previous civilisations. Many cultures through the course of history have been subject to major challenges due to changed preconditions in environmental and resource assets. Some have expired whilst others have found ways of moving on. In recent years, new literature has been published which analyses these courses of events. The ability to realise in time what the challenges are, to explore new paths and being prepared to rethink fundamental values appear to be factors that have been essential for the survival of these cultures. This points to the benefits of continued analysis and of thinking ahead to try to understand the holistic picture regarding the challenges, of encouraging various actors to be creative and test new ways as well as providing education and support to citizens to enable them to discuss and reflect over these issues.

How can Sweden contribute?

What can a small country like Sweden do to contribute to a process leading to a more sustainable use of resources? The challenges are so enormous that it may feel overwhelming and fraudulent to even put forward suggestions about what needs to be done and how Swedish policies can contribute. Both principles and long lists of proposals already exist in many other contexts without them

having had any real impact on unsustainable trends – it requires political will, as well as ability and strength, to carry out the proposals.

At the same time there are examples of problems that have been resolved – either completely or partially. Even if proposals may not immediately gain acceptance or have an impact, windows of opportunities may open and carefully considered strategies and proposals may find an audience. Experience also proves that persistent efforts, taking many small steps, may eventually bear fruit. Sweden might for example be able to take on a role of "think tank" and alliance forger in an open and creative dialogue on the challenges.

The analysis in our memorandum deals with three challenges:

- The demand for biological resources and the sustainable use of natural resources
- The climate challenge with a focus on energy efficiency
- Environmental challenges linked to long global product chains

The working group has produced a number of ideas which should be seen as examples of initiatives that the Swedish Government could take nationally, in bilateral cooperation or internationally.

A state needs to have measures of its own to ensure credibility internationally and we therefore emphasise the responsibility that Sweden and other industrial nations have when it comes to setting an example.

Some of the initiatives proposed by the working group in the memorandum can and should be taken immediately while others need further discussion and examination. We believe that a continued process is required through for example seminars with different actors, in order to produce ideas with regard to other possible initiatives and a more in-depth discussion. At the same time as we need to realise that there are problem areas without clear solutions, we also wish to emphasise the importance of making use of every available opportunity. There is no time to lose. Our assessment is that there are a number of potentially viable ways forward where the Government can take the initiative:

Put our own house in order and seek cooperation with growth economies

- Ensure the development of methods in Swedish forestry, agriculture and Swedish bioenergy cultivation that do not impoverish biodiversity or lead to chemical risks and eutrophication.
- Invest sustainably and methodically in energy efficiency measures in Swedish industry, housing and transport systems.
- Concentrate on town and community planning that is energy and transport-efficient.
- Allocate resources for continued environmental cooperation with growth economies like China and India when development assistance is phased out and initiate a cooperative dialogue on the sustainable use of natural resources and energy efficiency.

Strive for international agreements

- Support the reform and reinforcement of the international environmental regime.
- Take the initiative to a new world summit 2012 – a Rio +20 – that can evaluate developments holistically and create fresh momentum.
- Take the initiative for a continuation of the Millennium Ecosystem Assessment that should report in good time prior to the summit in 2012.
- Strive to reinforce the Convention on Biological Diversity.
- Turn Sweden and the EU into an international role model and continue to strive to ensure that the EU takes on a leading role in the climate negotiations.
- Work with like-minded countries to reach international agreements in order to stop the over-exploitation of wild fish resources and bottom trawling in the deep seas.
- Take the initiative, preferably in an alliance with like-minded states, to start an informal dialogue that can bridge credibility gaps between different countries and actors.

Mobilise the business sector and put the focus on sustainable trade

- Encourage and provide the business sector with incentives to exercise environmental concern (and take social responsibility) throughout the product chain; initiate such a process with Swedish companies and consider an international initiative for renewed and broadened cooperation with the business sector (Compact II) with more binding requirements.
- Stimulate certification systems, e.g. for the sustainable production of bioenergy.
- Strive to ensure that the standardisation bodies establish norms in their product standards that encourage greater energy-efficiency and sustainable production throughout the product chain.
- Strive for trade rules that support sustainable development.

Mobilise civil society

- Ensure that everyone receives education in sustainable development.
- Support NGOs that promote sustainable development and transparency in global value chains.
- Highlight the interaction between sustainable development, human rights and equality before the law.

Create the right economic incentives

- Do away with economic instruments that do not have the desired impact such as subsidies for fossil fuels and other non-sustainable types of energy as well as incentives for increased car-use.
- Promote international economic instruments to reduce the share of fossil energy through carbon dioxide taxes or trading in emission rights.

- Put a value on ecosystem services and produce methods for the evaluation of the development of the capital bases – natural capital, human capital and material capital.

Make the public sector a driver of sustainable development

- Ensure that public procurement takes account of environmental and social impact throughout the supply chain.
- Make the public sector the market bridge for non-toxic, energy-efficient systems and products, and for sustainably produced biological resources.

Invest in research on sustainable development

- Support research that contributes from a system perspective to the sustainable management of ecosystems and a sustainable use of natural resources.
- Support research on energy-efficient technology and renewable sources of energy.

There is a window...

The changes needed may seem insurmountable but history shows that surprises may arise. Preconditions may change quickly. There may be situations where a change in fundamental values generates political energy and creates conditions that make it necessary and attractive to make rapid changes within the business sector.

Experience of previous environment policy indicates that important success factors are: a consensus view among researchers; an insight into the problems among various other actors – citizens, politicians and the business sector - for which the media has an important role to play; leadership; and scope to develop technical and other solutions that are accepted by the actors who are to implement them.

Most of these factors are already in place today as regards the climate challenge. The IPCC's reports indicate substantial scientific consensus, considerable media attention is given to the issue and there is commitment among citizens. Technology exists

that can to a large extent reduce the use of energy in e.g. new buildings. It is possible to stimulate companies to develop fossil free technologies within industry and transport, and it is also possible to invest in infrastructure that does not encourage and necessitate increased car-use. There are growing markets for such systems and technologies.

Political initiatives are now required as well as responsive and proactive action within the business sector, which can help open the window.

Three platforms

We see three important contexts where the Swedish Government can make a difference.

The EU Presidency in 2009

We propose that the Swedish Presidency in the autumn of 2009 focuses on highlighting the global challenges. In order to prepare for this, we propose that Sweden immediately starts taking the initiative to, e.g.

- propose that the European Commission conducts studies and produces scenarios that can form a basis for international action and that can be presented by 2009,
- initiate dialogues with important actors within and outside the EU,
- invite (possibly together with other countries) important growth economies, e.g. the BRICS states (Brazil, Russia, India, China and South Africa) to an informal dialogue about the future challenges in which researchers and the business community can participate in order to find bridges and ways forward.

Important issues to press prior to and during the Presidency are:

- the climate issue during the next commitment period,
- monitoring the work carried out by the EU in the area of energy efficiency and taking additional initiatives that may

be required in order for the EU to forcefully promote sustainable innovations and investments in the area,

- monitoring the work carried out by the EU focused on the sustainable use of natural resources and taking initiative to promote sustainable agricultural practises and sustainable fisheries in the EU and internationally (special focus is required for bioenergy from plantations in developing countries),
- monitoring the EU work on chemicals.

Rio + 20

Sweden should also promote the holding of a new world summit in the year 2012 – a Rio + 20 (Stockholm + 40). A series of initiatives need to be taken immediately in international contexts in order to press the issue. The initiatives with regard to the Presidency and a possible dialogue with BRICS countries may also provide an input. The question may also be discussed during the Swedish EU Presidency.

The Swedish environmental quality objectives

The Swedish environmental quality objectives should also take the environmental impact in other countries caused by Swedish consumption into account and thus act as a role model for how global issues can be integrated at the national level. Sweden should strive to ensure that international environmental work adapts an environmental objective-oriented approach.

Conclusion

The economic and political world map will be redrawn during the next few decades. How this is done will have an impact on the possibility of tackling the environmental challenges. On the other hand, several major environmental problems will influence the scope for continued economic growth and the building of a world that is socially stable and that provides improved social conditions and welfare to an increasing number of people around the world.

The environment and resource issues are also linked to security policy issues. It is already noticeable how issues with regard to the supply of energy linked to the climate challenge have an impact on political alliances and the balance of power. It is not difficult to see the fork in the road ahead: either the international community will start cooperating on environment and resource issues or the fight over resources will intensify.