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Compendium of data and indicators for sustainable development in Benin, Bhutan, Costa Rica and the Netherlands

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This investigation has been performed by order and for the account of the Foundation Ecooperation, within the framework of project 8007005, Development of multidisciplinary indicators for Sustainable Development in Benin, Bhutan, Costa Rica and the Netherlands.

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Abstract

In 1994, the Netherlands' Government signed three bilateral Sustainable Development Agreements with the Governments of Bhutan, Benin and Costa Rica. Initiatives taken within this framework resulted in a quadrilateral project with these four participating countries to develop indicators for sustainable development. This report presents a first overview of data on social, economic and environmental issues in the four countries, collected from reports by international and multilateral organisations (e.g. World Bank and World Resources Institute) and occasionally from national information sources. Many of the presented data could be regarded as potential indicators for sustainable development, although comparison of the four countries is still complicated due to 1) a lack of a comprehensive and universally accepted definition of sustainable development and 2) a lack of data and reliable data for certain issues. Quantitative data and indicators for issues such as human welfare or cultural aspects of sustainable development are almost non-existent. The comparison of data gives some insight in the similarities and differences between the four countries with regard to sustainable development issues, but better data collection, tuning of methodologies and indicator selection could improve this. This first attempt to relate the countries using more-or-less comparable indicators shows the progress of the Netherlands in realising sustainable development to be no more advanced than that of Benin, Bhutan and Costa Rica. The strategy for reaching this target, however, varies from country to country.

Preface

In 1994 the Government of the Netherlands signed three bilateral Sustainable Development Agreements with the Governments of Bhutan, Benin and Costa Rica. These agreements, based on reciprocity, equity and participation, are meant to develop new ways of North-South co-operation.

This report presents an overview of the data on a selected and limited number of social, economic and environmental issues in Benin, Bhutan, Costa Rica and the Netherlands for which data were found. The data were collected from reports by international and multilateral organisations (e.g. Work Bank and World Resources Institute) and occasionally some national information sources.

The report aims to:
- provide a first compendium of available data and indicators on the four countries.
- serve as a basis for discussion and a first attempt towards more comprehensive study on sustainable development within the project 'Development of multi-disciplinary indicators for Sustainable Development in Bhutan, Benin, Costa Rica and the Netherlands'.

The report should therefore not be interpreted as a mature assesmet of sustainable development in the four countries. Conclusions drawn in the report should be used with great care, because of limitations of data and the lack of a comprehensive and universally accepted definition of sustainable development. Chapter 2 shows that in the four countries different definition of sustainable development can be found. This report uses the concept as it has been used in Agenda 21 (UNCED, 1992 - Rio de Janeiro): the concepts refers to a potentially long-lasting balance between economic, environmental and social objectives.

The report is written by RIVM, as part of a long-term project to develop indicators for sustainable development. The project will consider the current environmental and economic situation of the countries and relations with culture, social aspects and perceptions concerning welfare and well-being. The differences between the four countries are considerable as described in this report.

An extract of this report has been published separately as 'Connect Four', in co-operation with the foundation Ecooperation.

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This report is a RIVM publication, anticipating similar exercises based on co-operation within the quadrilateral project 'Development of Indicators for Sustainable Development in Benin, Bhutan, Costa Rica and the Netherlands'. Valuable inputs have been received from our collaborating institutes in Benin, Bhutan and Costa Rica: the Agence Beninoise pour l'Environment, the Royal Institute of Management and the Observatorio del Desarollo. Most useful comments on draft chapters were also received from Henk van Schaik, Bert Bannink, Eric Drissen, Henk Hilderink and Jan Bakkes (all RIVM) and Marc Londo (Utrecht University). Saskia van Leeuwen, Debra van der Kooij and Ellen Boogards (RIVM) provided a substantial contribution to the final editing of the report.

Contents

Samenvatting

Het begrip duurzame ontwikkeling is vrij algemeen geaccepteerd als een hoofddoelstelling van milieu- en ontwikkelingsbeleid. Verschillende invullingen van dit begrip zijn echter mogelijk. In dit rapport wordt aangesloten bij een vrij brede invulling: duurzame ontwikkeling staat dan voor het nastreven van een potentieel langduring houdbare balans tussen economische, sociale en milieudoelstellingen. Uitgaande van deze defintie, en in het kader van de Duurzame Ontwikkelingsverdragen tussen Nederland en Bhutan, Benin en Costa Rica, geeft dit rapport een overzicht van geselecteerde data op het gebied van sociaal-culturele en demografische en economische onderwerpen met betrekking tot Benin, Bhutan, Costa Rica en Nederland. Deze data zijn verzameld uit diverse rapporten van internationale and multilaterale organisaties (b.v. de Wereldbank en World Resources Institute), hier en daar aangevuld met informatie uit nationale bronnen.

Veel van de getoonde data zouden beschouwd kunnen worden als potentiele indicatoren voor duurzame ontwikkeling (en worden als zodanig ook gebruik in de indicatorenlijst van de Commissie voor Duurzame Ontwikkeling). Vergelijking van de vier landen wordt echter gecompliceerd door enerzijds het ontbreken van een algemeen geaccepteerd denkraam en anderzijds door het ontbreken van data voor bepaalde onderwerpen, het ontbreken van betrouwbare data en het gebrek aan detail. Voor ingewikkelde onderwerpen zoals welzijn en culturele aspecten ontbreekt het bijna volledig aan kwantitatieve informatie. De mogelijkheid om op basis van de huidige informatie een geïntegreerd beeld met betrekking tot duurzame ontwikkeling in de vier landen te geven is beperkt. Desondanks is de huidige gegevensbasis wel voldoende om enig inzicht in de belangrijkste problemen, overeenkomsten en verschillen van de vier landen te verkrijgen. Verbeterde data verzameling, afstemming van methodologie, maar vooral ook onderlinge discussie zouden een verdergaande analyse mogelijk kunnen maken.

Uit het overzicht van demografische informatie blijkt dat in zowel Benin en Bhutan populatie groei momenteel sterk toeneemt. In Nederland is de hoge populatiedichtheid momenteel al een van de oorzaken van hoge milieudruk. Wat betreft de getoonde gegevens voor menselijke ontwikkeling lijken de vier landen verdeeld te kunnen worden in twee paren. Parameters zoals levensverwachting, hygiënische omstandigheden en het niveau van onderwijs zijn vergelijkbaar in Nederland en Costa Rica, het eerste paar, terwijl deze parameters voor Benin vergelijkbaar zijn met die in Bhutan, het tweede paar.

Met betrekking tot de economie zijn grote verschillen zichtbaar tussen de vier landen wat betreft gemiddeld inkomen, sectorale verdeling van de economie, economische groei en economische verwachtingen. Tegelijkertijd worden alle vier de landen geconfronteerd met globalisering en werkloosheid.

Nederland wordt van de vier landen het meest geconfronteerd met milieuproblemen zoals ruimteproblematiek, lucht en water verontreiniging - dit als gevolg van de hoge consumptie en productie van materialen en energie. In Benin is in de afgelopen decennia de vraag naar landbouwgrond sterk toegenomen. In het recente verleden zijn in Benin en ook in Costa Rica grote gebieden ontbost. In Bhutan zijn tot nu toe nauwelijks milieuproblemen, maar de druk op beschikbare ruimte voor menselijk gebruik (landbouw, stedelijke bebouwing) neemt wel

sterk toe tengevolge van bevolkingsgroei en economische groei. Costa Rica neemt wat betreft milieuproblematiek een positie in tussen Bhutan en Nederland.

De kapitaalsindicatoren recentelijk ontwikkeld door de Wereldbank zijn in staat de verschillende vormen van rijkdom in de vier landen te visualiseren. De economische waarde van infrastructuur en geproduceerde goederen (normaal beschouwd als beschikbaar kapitaal) vormt in alle vier de landen slechts een beperkt deel van het totale kapitaal. Bhutan en Nederland worden teruggevonden aan weerszijden van het 'kapitaalsspectrum': rijkdom in Bhutan bestaat bijna volledig uit natuurlijke hulpbronnen, en in Nederland voornamelijk uit menselijk kapitaal (kennis en arbeid).

Tenslotte dient te worden opgemerkt dat uit de verschillende gegevens uit dit rapport blijkt dat Nederland op de weg naar duurzame ontwikkeling (zoals hierboven gedefinieerd) niet verder gevorderd is dan Benin, Bhutan of Costa Rica. De strategie om een duurzamere vorm van ontwikkeling te bereiken zal zeer verschillend moeten zijn tussen deze vier landen.

Summary

Sustainable development has become a politically accepted concept, which calls for finding a potentially long-lasting balance between economic, environmental and social objectives. Within the context of the bilateral Sustainable Development Agreements,, this report overviews data collected on social, economic and environmental issues in Benin, Bhutan, Costa Rica and the Netherlands from reports by international and multilateral organisations (e.g. World Bank and World Resources Institute) and occasional national information sources.

Many of the data presented could be regarded as potential indicators for sustainable development, although comparison of the four countries is still complicated due to total lack of data for certain issues and lack of reliable data (especially for Benin and Bhutan) and detail. Available data and indicators for more complicated issues such as human welfare or the cultural side of sustainable development are almost non-existent. The report does not attempt to integrate all information into overall conclusions regarding sustainable development in the countries. Nevertheless, present data is able to present some insight in the comparison of the four countries with regard to sustainable development issues. Better data collection, tuning of methodologies and indicator selection could improve this.

From the overview of demographic information, population growth in both Benin and Bhutan can be seen to be currently accelerating. In the Netherlands, a high population density has already led to considerable environmental pressures. With respect to the selected data on human development, the four countries may be divided into two pairs. The parameters used for life expectancy, sanitation and hygienic conditions, and educational levels in the Netherlands are similar to those in Costa Rica, forming one pair, while these parameters in Benin are similar to those in Bhutan, forming the second pair.

Large economic differences in average income, sectoral shares, and economic growth and prospects are found between the four countries. However, all four countries are confronted with ongoing globalisation and the threat of unemployment.

The presented data shows that the Netherlands has to bow to several problems such as increasing intensity of the use of space, as well as soil and air and water pollution due to a high throughput of resources (e.g. energy, squandering, waste) and a high population density. In Benin, the pressures on land have increased strongly over the last decades. In this period, large areas in Benin, and also in Costa Rica, have been deforested and turned into agricultural land. Bhutan knows hardly any environmental pressures so far, although the pressure on available space for human exploitation (cultivation, urban areas) is increasing as a result of a high population and economic growth. Costa Rica holds a position between Bhutan and the Netherlands with regard to environmental pressures and problems.

The capital indicators recently developed by the World Bank allow visualisation of the different types of wealth in each of the four countries, where the economic value of assets produced is limited in weight. Bhutan and the Netherlands can be found at the opposite site of

the 'wealth-spectrum': wealth in Bhutan consists mainly of natural resources and in the Netherlands, of human resources.

Finally, with reference to the figures - but realising that no overall indicators are available at this stage - it should be noted that the overview show that the Netherlands' path to sustainable development is certainly not more advanced than Benin, Bhutan and Costa Rica. The strategy to reach sustainable development will be different from country to country.

1. Introduction

1.1 Data and indicators for Sustainable Development

Sustainable development has become a major policy objective at local, national, regional and global levels. This can be concluded from documents such as Agenda 21, national and local government environmental and/or sustainable development strategies, and numerous local initiatives. In general, the concept of sustainable development refers to integrated consideration of environmental protection on one hand, and issues such as population growth, social cohesion and economic development on the other. However, over the past years it has shown to be virtually impossible to agree on one, comprehensive definition (see e.g. Greef and de Vries, 1991; Rotmans and de Vries, 1997). In this report, a broad definition of sustainable development concept is used: the concept refers to finding a potentially long-lasting balance between economic, environmental and social objectives. Chapter 2 of this report pays more attention to the definition of this concept.

Attempts to formulate policies within the context of sustainable development are generally accompanied by a request for additional information. The purpose of this information can vary from identification of priority issues to awareness building and evaluation of policy options before and after implementation or enhancement of communication.

Obviously, for all kinds of decision-making, information is a key element. Since humans are only able to interpret a limited amount of information, indicators are used as a means to organise, synthesise and use information for a specific purpose. Indicators are not only used for professional decision-making, but also in everyday life, for instance, to assess whether one should wear a warm coat; here indicators can be a thermometer or the temperature indicated in the weather forecast.

For policy-making, indicators have two important purposes: (1) as a tool in the policy planning process and (2) as a tool for communication.

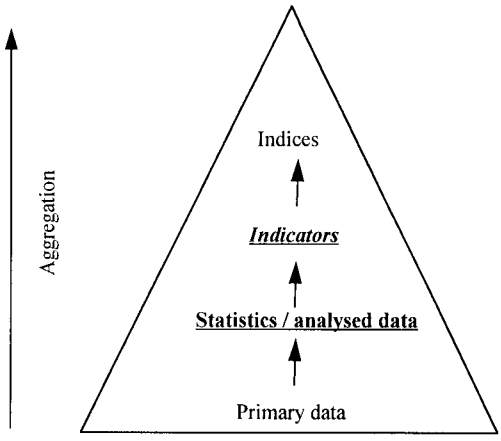
A formal definition of an indicator is a signal of some kind, which is typically measurable, and deemed important for making judgement about a certain system in the past, present or the future. One can identify three essential properties of indicators:

- They provide *simple, readily understandable* forms of information, especially in comparison with complex statistics or other kinds of data (Hammond et al., 1995).
- Indicators should have a *significance beyond their face value* (Bakkes et al., 1994).
- Indicators are *subjective*, which is not only the case with regard to interpretation, but also for selection and measurement. Since there are many world views and purposes for understanding complex systems, there are also many indicators (Balaton Group, 1996).

Indicators are thus distinct from statistics or primary data, especially in that '*they are more readily understandable*' and '*have a significance beyond their face value*'. As an example, the number of cars in a street is seen as single number raw data. However, when this number is 1) interpreted as an indication of traffic jams or air pollution - 2) measured according to some kind of standardised procedure and 3) related to a desired state, the number could

become an indicator. As such, indicators and highly aggregated indices[1] can be seen as forming the top of an information pyramid whose base is primary data derived from monitoring or analytical processes that refine such data (Figure 1.1).

Figure 1.1: Information pyramid



Source: Hammond et al., 1995

The focus in the report will be on the level of 'statistics / analysed data' (Figure 1.1) and in particular the data published by international organisations. The essential difference between data and indicators is that the information presented is not selected as (proposals for) indicators of sustainable development, but simply as an overview of the available information.

1.2 International data reports

Several international organisations - such as UNEP, UNDP, WB, WRI - publish data dealing with issues relevant for sustainable development in most countries in the world. The most important international reports used in this report are mentioned in Box 1.1.

The goal of each of these reports is to provide some form of accessible, and accurate information on selected issues. The reports try to allow for comparison by harmonising the data as much as possible.

Most of these publications have an additional goal. By providing the information, the organisation wishes to highlight a certain topic. In case of the World Resources-series for instance, the goal is explicitly given as ' .... *to improve management of natural resources and protection of the global environment'*. And the Human Development Report series are dedicated to *'... ending the mismeasure of human progress by economic growth alone'*.. to shift the paradigm *'... in favour of sustainable human development'*.

Obviously, the information presented in these reports could be a valuable input for the project 'Following the Path to Sustainable Development, Development of Sustainable Development Indicators for Benin, Bhutan, Costa Rica and the Netherlands'[2]. Therefore, this report will pay an extensive look at the information and data with respect to these four countries. The

[1] An index is here defined as the result of aggregating several indicators into one single piece of information.
[2] Short description of the project has been given in the preface.

reports used have been selected based on the fact that 1) they are widely used, 2) the information included is considered to be relevant within the context of the project (i.e. related to the subject of sustainable development) and 3) they were available. Several of the reports explicitly state that the information is given in the context of sustainable development (GAEA, World Resources, Human Development Report).

Box 1.1: The most important data sources in this report

- the 'World Resources'-series of WRI (1996),
- the Human Development Report of UNDP (1996),
- World Data 1995. World Bank Indicators on CD-ROM
  in combination with: Social Indicators of Development of World Bank, 1995
- Computerised Information Series, of FAO (1995).
- Global Approach to Environmental Analyses (GAEA) of World Bank (1995)

There are three major questions with respect to the information in these reports and the four country-project:

a) What do the reports tell about 'sustainable development' in the four countries (technical content)?
b) How relevant is the information in this report for the four country study (as considered by the persons included in the project) ?
c) How accurate is the information?

a. Technical content
With regard to technical content, this report especially focuses on similarities and dissimilarities of the four countries with regard available data and selected issues.

b. Relevance and coverage within the context of the four country study
Unfortunately, the limits of 'what is measurable' or 'what is available' do often not coincide with the information that is required. As a consequence, selection of data is generally a compromise between different criteria. The process of improving the relevance of the information can be a process of trial and error, in which studies asking for certain information finally stimulate others to find a way to produce this information.

It should be noted that what can be highly relevant information in one culture, can be absolutely irrelevant in another (e.g. depending on definitions). At present, much of the indicator and data collection work has been done by organisations from industrialised countries. However, several issues are looked upon differently in other cultures and, in addition, simply other questions are raised (NEF, 1995).

As an example: the data published under the title 'communication profile' in the Human Development Report gives information on radios, televisions, books, telephone lines etc. This is relevant information with regard to communication in industrialised countries, and to some degree also in non-industrialised countries. However, there are also countries in which most of the communication is done by completely other means such as personal contact. In this case, the information included in the tables does not represent 'communication' but 'uncommon forms of information exchange'. Another example might

be the use of GDP to represent welfare: In non-industrialised countries many aspects of welfare are clearly not part of a formalised economy.

Finally, Bhutan has expressed irritation with respect to the Human Development Index (HDI). Bhutan always shows up as one of the least developed countries with respect to the Human Development. However, according to Bhutan, the index is leading to a wrong interpretation: The low score of Bhutan is mainly caused by GDP being one of the constituents of HDI.

Since this report has the purpose to be a compendium, a large number of different data have been included. Nevertheless, the authors have selected data based on (supposed) relevance to sustainable development.

c. Accuracy
The data included in the international reports are based on actual measurement, assessment, or modelling. Accuracy of the information - in particular for individual countries - is not always perfect. Some of the reports (e.g. UNDP, 1996) explicitly indicate that the data-systems were far from perfect, and that users should realise this.

A few of the problems with regard to accurateness of the data are:
- comparability/standardised methods
- lack of data/assessment
- out-of-data censuses
- (other sources of) error

Comparability/standardised methods: The reports make efforts to use standardised methods, but this is not always possible. Often, data based on different methods is reported in one table, sometimes with footnotes added. As a consequence, limitations remain with regard to coverage, consistency and comparability of data across time and countries. The use of the statistical data must be subject to a general understanding of these limitations.

Lack of data/assessment: For many of the non-industrialised countries, data is not so frequently available as for industrialised countries. Especially in case the issue is considered to be crucial, sometimes assessment methods are used to avoid as much as possible lack of data. These methods can include interpolation, modelling, and estimates by country offices, experts or international statistical bodies. The accuracy of such data is lower than actual measurement.

Out-of-date censuses are another source of weakness. Because of infrequent updating in the past, dramatic shifts and breaks in statistical series can occur when new data and methods are introduced.

Other causes of error: There can also be other causes of error. For instance, the population of Bhutan was until very recently thought to be about 1.4 million. This number was based on the combination of an old population census, assessment of population growth and a combination of these two figures by means of extrapolation. A new population census in 1990 discovered that the population in 1990 was not 1.4 million but only 600,000. Most of the international

data reports still mention the 1.4 million. As a consequence, all other related data in these reports - especially 'per capita' figures, could be inaccurate too.

1.3 Purposes of this report

The interrelated goals of this overview were to:

1. *provide an overview of some of the basic data found for the four countries.*
The data are taken mostly from international reports, with occasional use of additional (national) data sources. In providing this overview, the report relates the information to the three questions given in the previous section: a) Technical content, b) data relevance and coverage for the comparative study on sustainable development and c) data accuracy.

2. *produce a basis for discussion.*
Limitations were 1) reliance on international (secondary) data sources, 2) the choices made to select certain information and 3) the possible bias in using data by authors from just one of these countries (thus with a certain cultural background). However, as such the report can form the basis of discussion on the meaningfulness and organisation of indicators and especially for directing further progress. The authors hope that the report will stimulate debate and discussion. One should note that the development of indicators is a long and complex process. And even when a set of indicators can be agreed upon, this set should have the freedom to evolve. This report has also been compiled to illustrate in a practical sense some of the difficulties of this complicated process.

Due to limitations readers are strongly encouraged to be critical both about content and organisation of the information.

CSD indicator list
In an effort to help realise the second goal, we have tried to include many of the indicators from the working list of indicators of sustainable development from the Commission of Sustainable Development. Appendix A contains this working list and others included in this report.

Important limitations
Since the reliability and accuracy of data are not always perfect, we should keep in mind that the information presented in this report is taken completely from the sources mentioned, and so also bears the inaccuracies from these sources. Neither here nor in the related brochure, 'Connect Four', does one intend to propose indicators.

The report should be seen as a compendium of data and not as a full sustainable development assessment. Comparison of the four countries - and conclusion on problems within these countries - will the topic of further study within the project mentioned in the preface.

2. Conceptual framework of this report

2.1 Introduction

In order to interpret indicators and data, one needs to know the relationship between the presented information and the broader issue at stake. This is certainly the case for complex, comprehensive and value-based concepts such as sustainable development. Conceptual frameworks are used to assist in framing the variety of issues involved and providing an overview for considering the issues and associated interconnections in a systematic way. A conceptual framework also facilitates communication. However, to be effective such framework must be adequately described.

At the moment there is no universally accepted definition of sustainable development (see further in this chapter). Neither is there an universally accepted conceptual framework for sustainable development indicators.

This chapter does not intend to present an extensive and complete framework for sustainable development. Instead, it provides a very simple framework to frame the different types of information found in international reports. For this purpose, first, the concept of sustainable development is discussed. Next, two different frameworks used in this report are discussed. Finally, an overview of the contents of this report is given.

2.2 Sustainable development

2.2.1 Historic context

The concept of sustainable development evolved in response to the growing awareness of the potentially disruptive consequences of exponential population growth and economic expansion in a finite world. In 1987, the report by the UN World Commission on Environment and Development (the Brundtland commission) played a key role in promoting the concept of 'sustainable development' as a framework of international environmental policy making (WCED, 1987). The term 'sustainable development' - as used by this commission - intended to emphasise the links between environmental policy and social and economic development (including underdevelopment). Thus, the term did not only encompass nature conservancy and efficient resource management, but also social equality and access to resources.

In many countries (especially non-industrialised countries) non-sustainable activities can be both a cause and a result of poverty and lack of resources. In other countries (especially industrialised countries) material wealth - based on material-intensive life patterns - can be the cause of non-sustainability. In the past, industrialised countries were able to manage many environmental problems within acceptable bounds through a combination of technology, management and money. However, such 'solutions' sometimes merely shift the problem to an other place or time period. Moreover, the impacts of these activities are sometimes offset by a constant increase of human activity. The Brundtland report argued that a more integrated consideration of economic, social and environmental issues could reveal solutions that are effective, without causing adverse side-effects in other policy areas.

In the late 1980s and early 1990s, the introduction of the term 'sustainable development' was followed by numerous attempts to make the concept operational for decision making at the national and international level. An important milestone in this process was the United Nations Conference on Environment and Development (UNCED) in 1992 in Rio de Janeiro (Brazil). During this conference, governments from a very large number of countries adopted the concept as one of the leading principles of policy making.

2.2.2 Sustainable development is a value-based concept

Many attempts have been made (by both scientists and politicians) to further elaborate the broad definition of the Brundtland commission. However, it has shown to be virtually impossible to provide one, comprehensive definition[3]. In fact, the concept is strongly related to views on nature, culture or economy (e.g. de Greef and de Vries, 1991, Rotmans and de Vries, 1997, Zweers, 1995)[4]. Obviously, there is no unique design of a sustainable world: the choice and the degree to which certain features need to be sustained depend on the operating set of values. These values vary from place to place and over time.

In addition to different cultural interpretations, also the actual position of a country with respect to economic development, its environment or social organisation also determines how the concept of sustainable development is elaborated.

Nevertheless, the concept of sustainable development have shown to be powerful in communicating a certain policy direction (a guiding star). Despite their differences, most interpretations agree on several common attributes. Some are discussed in the next section.

2.2.3 Elements of sustainable development

The most widely used definition of sustainable development is that of the Brundtland commission (WCED, 1987):

"Sustainable development is a process of change in which the use of natural resources, the directions of investments, the orientation of technological developments, and institutional changes are all in harmony and to increase the present as well as future potential to meet the human needs and wishes for present as well as for future generations."

It is now often believed that the requirement to increase the potential to fulfil human needs can be interpreted as a requirement to minimally *maintain the total amount of capital - including environmental capital - that is used to create welfare and well-being* (e.g. Serageldin, 1996). Most interpretations agree on several common attributes:

[3] See e.g. Pezzey (1992) who cites a few dozens of published definitions of sustainable development concepts.
[4] Interesting in this sense is the use of the 'Cultural theory' of Thompson et al. (1990). Based on this theory, three totally different approaches (egalitarian, hierarchist and individualistic) to sustainable development have been described by Rotmans and De Vries (1997).

1. Sustainable development refers to the need of finding a balance between objectives in different policy areas, i.e. environmental and ecological objectives, social objectives, and economic objectives.
2. It has an inherent holistic character; including consideration of long-term effects and effects for different geographical scales (e.g. communities and countries);
3. The notion is related to distribution within countries (poor/rich), in geographic sense ('developed' and 'developing' countries) and in temporal sense (current and future generations).
4. It stresses that economic growth should not be seen as an end, but as a means to the fulfilment of human needs.

Attribute 1 and 2 refer to integrated consideration of various policy-areas. For simplicity often a distinction is made into three different, fundamental areas:
- *The economic domain of sustainable development*: The main question here is: Is the system (country, city etc.) able to sustain a certain material quality of life? Does the direct affluence generated by a certain activity outweigh possible negative effects?
- *The environmental domain of sustainable development*: The main question in this domain is: Is the system able to sustain a minimum required level of ecological/environmental quality or are there certain activities that have such environmental impacts that they are reducing the economic possibilities in the future or even leading to a widespread ecological collapse?
- *The social and human domain of sustainable development*: Questions that could be asked in this domain are: Is the system able to maintain its social structure or are there certain activities which prevent individuals from enjoying their affluence or that are even undermining the cultural and moral fabric of society? Are activities contributing to social welfare and equity?

Clearly there are strong interactions between these domains. The three different domains will be used to draw up a frame for this report in the next section.

'Capital approach'
Some authors further operationalised the concept of sustainable development by identifying capital stocks[5]. Serageldin and Steer (1993) and Ekins (1992) have put forward four principal capital stocks related to the three policy areas mentioned above: human capital, social capital, natural capital and human-made capital.

The recognition of these different capitals is also the basis of the definition of weak and strong sustainability. For *weak sustainability* the total capital stock should be at least maintained, without regard to the composition of the capital. This allows the substitution of natural capital for economic or social capital. This vision is popular among mainstream economists. For *strong sustainability*, the economic and social capital on the one hand, and nature capital on the other are considered to be complementary. This implies that for sustainable development the amount of ecological capital stock should be maintained. This vision is shared by many ecologists and ecological economists. The World Bank added a third category, that of *sensible sustainability* which takes the critical level into account, below

[5] The word 'capital' is this case does not necessary only refer to monetary elements, but to all elements that are able to accumulate and depreciate (stocks), such as environmental resources, biodiversity, knowledge and possibly even social cohesion.

which no type of capital must decrease. The total capital stock should be at least maintained and substitution is allowed, but only within certain limits (maintaining a minimum stock per category). However, scientific uncertainties and normative world views play an important role in estimating the critical levels. A precautionary approach seems to be justified in view of the uncertainties. The concept of 'Environmental Utility Space' as put forward by Weterings and Opschoor (1994) could be seen as an elaboration of the sensible sustainability concept.

For ecological capital in particular, Daly elaborated three further requirements for sustainability. These three requirements distinguish between 1) renewable resources, 2) non-renewable resources and 3) the assimilative capacity of the environment (Daly, 1991):

1. Rates of use of renewable resources do not exceed regeneration rates (in fact strong sustainability).
2. Rates of use of non-renewable resources do not exceed rates of development of renewable substitutes (weak or sensible sustainability).
3. Rates of pollution do not exceed assimilative capacities of the environment (strong sustainability).

2.2.4 Definitions of sustainable development

The interpretation of sustainable development can be totally different in each of the four countries discussed in this report. In Table 2.1 some selected definitions of sustainable development from each of the four countries are given. These definitions - although not fully comprehensive and not always formal governmental policy - might give an indication of the interpretation of sustainable development.

Table 2.1: Selected definitions of sustainable development

Benin	The Environmental Action Plan (PAE) aims to study the equilibrium between man and his environment within the perspective of sustainable development. This can be articulated by: (...) to better manage Benin's biological diversity heritage and to improve the standard of living of both rural and urban populations (ROB, 1991).
Bhutan	Sustainable development is a development path that will allow the country to meet the pressing needs of the people, particularly in terms of food, health care and education, without undermining the resource base of the economy. New industries, new agricultural markets, and new forestry products need to be carefully developed, with respect to their broader environmental ramifications. Sustainable development is a concept that is in harmony with the cultural and religious traditions of Bhutan, in particular a strong conservation ethic and respect for the natural world. It is therefore essential that the traditional culture is kept strong so that its values guide the sustainable development path (quotes from the Seventh Five-Year Plan, RGB, 1992).
Costa Rica	Costa Rica's current National Development Plan (94-98) is based on the concept of sustainable development, following the general principles of Agenda 21. Sustainable development requires to drive the economy through the path of sustainable development and justice, based upon the fundamental principle of a better quality of life for a maximum number of people and to guarantee that this improved quality of life will translate in permanent and increasing opportunities for all (Figueres, 1994).
Netherlands	It has become obvious that there are three variables that determine on the long run whether we are able to make society sustainable - not only in national but also in international sense. These are energy, biodiversity and space (de Boer, 1996).

2.3 Conceptual framework of this report

At the moment there is no single best method for framing information in the context of sustainable development. Moreover, all available methods still suffer from overlaps and cross-cutting issues. Realising these limitations, two frameworks have been selected to organise the information presented in this report:

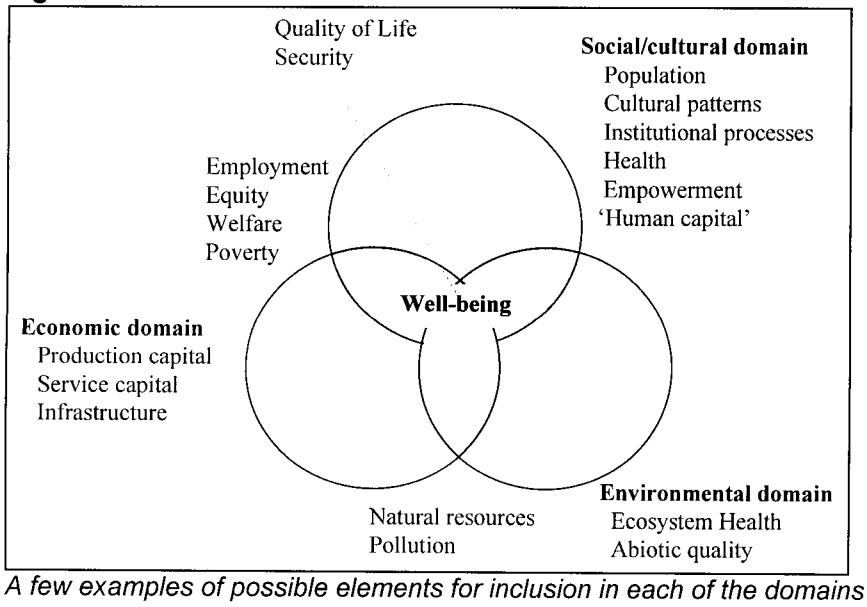
1. The three-domains framework
2. The causal Pressure - State - Impact - Response framework

Three different domains

Figure 2.1 shows three different (strongly interacting) subsystems relevant for sustainable development: the economic, social/human and ecological subsystems. This frame has already been the basis of more conceptual frameworks (Hardi, 1996). Sustainable development requires both the sustainability of each of the subsystems, but also a sustainable equilibrium between the subsystems.

1) *The social / human domain*: This domain includes all human beings and their social and cultural relations. These social and cultural relations (including governmental institutions) provide human societies with the means to sustain some kind of social cohesion and to deal with their natural environment.
2) *The economic domain*: The economic domain involves all elements related to the provision of scarce goods to humans.
3) *The environmental domain*: The environmental domain is about the stock of environmentally provided assets (such as soil, atmosphere, forests, water and wetlands).

Figure 2.1: The three domains

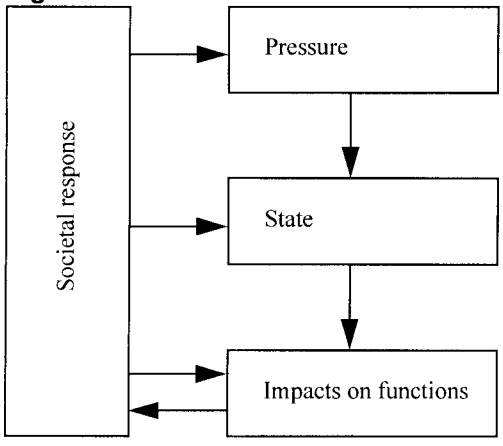


A few examples of possible elements for inclusion in each of the domains have been added.

In Figure 2.1 the domains deliberately overlap to show the interaction of the domains, but also to indicate that there are several cross-cutting issues that can not logically be placed in only one of the domains.

The causal Pressure - State - Impact - Response Framework
Several reports discussing the issue of sustainable development use of the Pressure - State - Impact - Response Framework (PSIR) to frame their indicators. This scheme is based on a simple causal relationship. Human beings exert certain **pressures** on the environmental, economic and socio-cultural systems. These pressures induce changes in the **state** or condition of the systems, leading to certain **impacts** on the environment, the economic and social system and to which society **responds** with policies and programs to prevent, mitigate or repair the damage.

Figure 2.2: The PSIR-scheme



Until now, the framework has been particularly helpful in environmental assessment with relatively clear causality chains. For instance for 'deforestation' 1) the state of the forest might be represented by the forested area, 2) pressures leading to changes in state could be logging and deposition of toxic substances, 3) the impacts of the changes could be the loss of biodiversity or marginalisation of local people, and 4) societal responses for instance reforestation and forest laws.

However, for sustainable development the simple linear relationship suggested in the scheme is sometimes not realistic. The actual world is more complex and dynamic as expressed in the simple causal relationship. Moreover, several elements could at the same time be pressure, impact or even societal response variable. In addition, many interactions are not sufficiently understood to be captured in the simple framework.

Cross-cutting issues
The three different domains mentioned above are used as basic organising scheme of this report. In addition, the PSIR scheme is used to identify causal relationships between different indicators. However, sometimes the labelling of issues seems to be arbitrary. There are two important reasons for this:

- More comprehensive issues (such as poverty, safety etc.) have dimensions in each of the different domains. Poverty, for instance, can be considered from an economic point of view (lack of scarce resources), social point of view (lack of equity, lack of participation) or even ecological point of view (insufficient access to scarce resources).
- Sometimes it is attractive to keep several elements of the PSIR scheme together. This often requires a combination of different domains: the cause of deforestation (ecological) is often an human activity such as logging (economic domain).

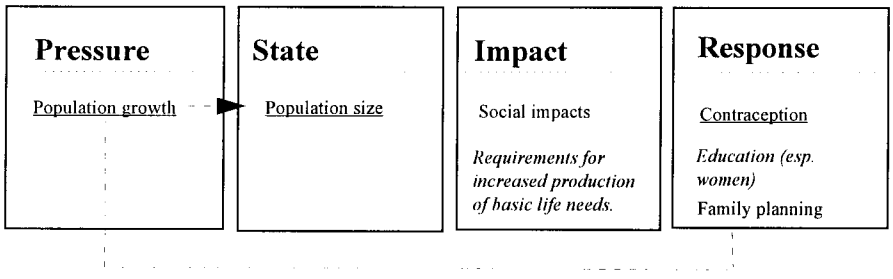
We have tried to be practical with the frameworks used: where issues could have been placed in different chapter, one chapter has been selected while in other chapters references are made.

2.4 Organisation of this report

This report is divided into three main parts: 1) Social / human domain, 2) Economic domain and 3) Ecological domain. The geographic context of the four countries is described in Appendix A.

Organisation of each chapter

All chapters start with an overview of the information presented in that chapter. This overview is provided by the PSIR scheme as indicated below. The purpose is to show the most important linkages between the different elements. Sometimes, in addition to the information included in the chapter, also other elements are shown in these figures.



For all elements the following indications has been used:

Element : Information is included in the chapter
Element : Important elements included in an other chapter
Element : Important elements not included in the report

Part 1: Social / cultural domain

3. Population and demographic trends

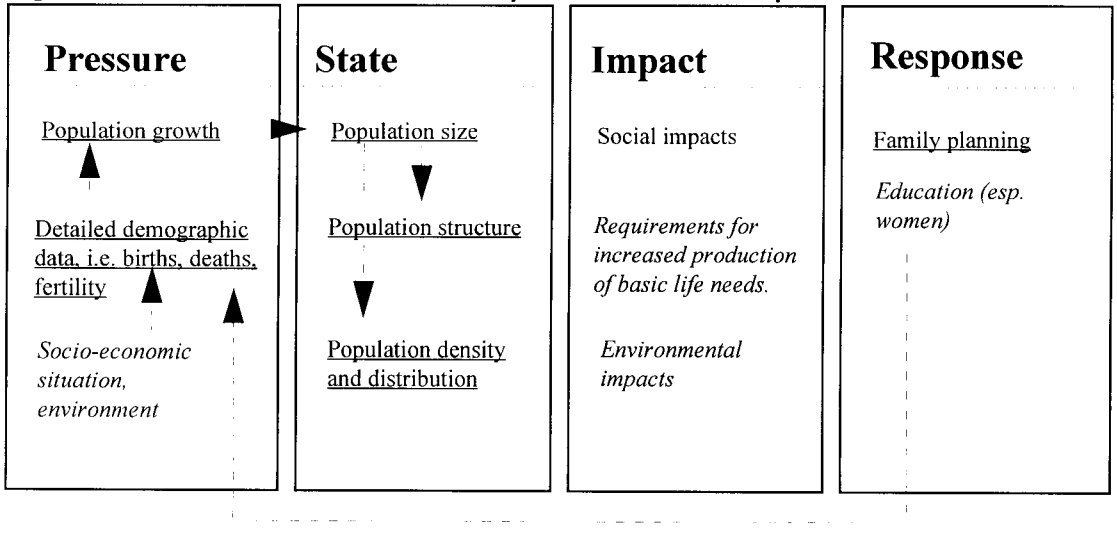
Agenda 21 identifies population growth as one possible cause of unsustainable development. Demographic statistics can provide insight in potential developments with regard to the size and structure of a population.

3.1 Introduction

The global population has grown strongly over the last century. In general, this growth has lead to an increase of required resources to provide basic life needs, such as water and food. Realising the carrying capacity of the world is not infinite, in 1996 the United Nations Conference on Population and Development (Cairo, 1996) concluded that for sustainable development a more mitigated growth is needed (Bakkes and van Woerden, 1997).

The information presented in this chapter can be structured within the PSIR-scheme as indicated in figure 3.1. The combination of birth and death rate determine actual population growth. The demographic state can be represented by population size, distribution and structure. Growth of population can have both social, economic and environmental impacts such as an additional need for basic materials etc. Finally, various response options are available, e.g. family planning and education.

Figure 3.1: Overview of the information presented in this chapter



Note: The purpose of this scheme is to show important linkages between the different parameters relevant for the issue and the data presented. For underlined parameters information is included in this chapter; for parameters in italic print information is included in other chapters. For parameters in normal print no information is included in this report.

3.2 Population and population growth

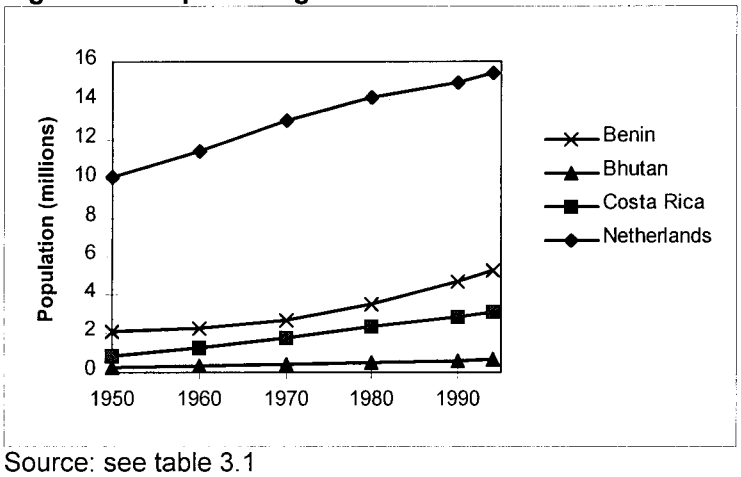
Table 3.1 shows the development of the population of the four countries in the period 1950-1994.

Table 3.1: Population size in the period 1950-1994

Population	*1950*	*1961*	*1970*	*1980*	*1990*	*1994*
Benin	2,046	2,237	2,693	3,459	4,633	5,246
Bhutan	285	332	395	481	600	675
Costa Rica	862	1,236	1,731	2,284	2,805	3,071
Netherlands	10,144	11,480	13,032	14,144	14,952	15,397
World	2,519,700	3,019,700	3,696,900	4,444,300	5,284,800	5,629,800

Source: WRI, 1996; World Bank, 1994a; World Bank, 1995a; Mideplan, 1996

Figure 3.2: Population growth



Source: see table 3.1

All countries have a growing population. The population size differs significantly between the four countries.

The inaccuracy of data can be illustrated by the fact that Bhutan's population was recently thought to be 1.4 million. However, a preliminary 1990 census showed that the country had only about 600,000 inhabitants. Nevertheless, all sources of global data (WRI, World Bank, FAO) still mention the 1.4 million. In table 3.1 and figure 3.2, the low 1990 population estimate for Bhutan was used. The estimates before 1990 were made by the authors of this report based on the trends in the faulty data of FAO and World Bank.

For Benin, a national report (ROB, 1991) gives population figures that slightly differ from the figures given in the table and figure above. The numbers for Costa Rica in 1990 and 1994 have been adapted according to national information (Mideplan, 1996). The population of Costa Rica in 1990 according to WRI (WRI, 1996) is 200,000 inhabitants higher.

Population density and distribution

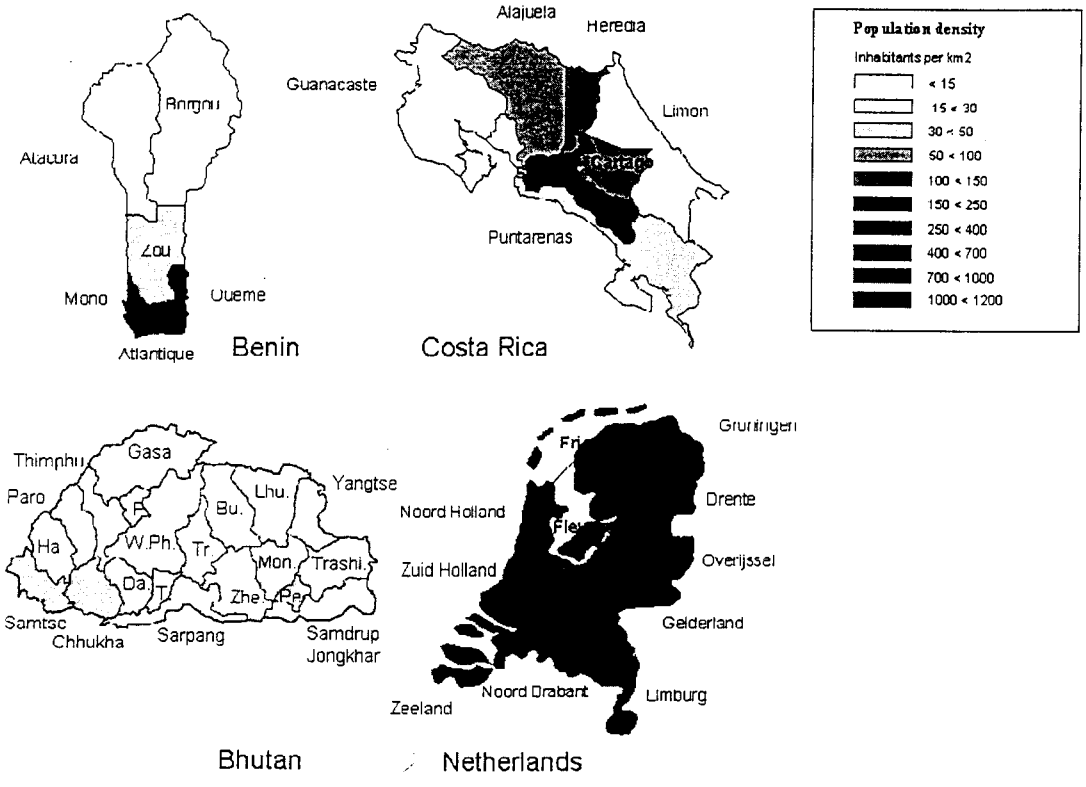
For pressure on the environment, population density is a relevant indicator. Table 3.2 gives the calculated population density in 1994 indicating that the Netherlands is by far the most crowded country. Bhutan has an extremely low population density. However, it should be noted that only 10% of the country is arable land. Also in the other three countries, inhabitants are not distributed evenly across the country as figure 3.3 shows (distribution per region).

Table 3.2: Population density

	Land area (000 ha)	*Pop.density. (inhabitants per km²)*
Bhutan	4700	14
Benin	11062	47
Costa Rica	5106	60
Netherlands	3392	454
World	13098404	43

Source: WRI, 1996; table above

Figure 3.3: Population density per region



Sources: Benin: ROB, 1991; Costa Rica: EdIN, 1995; Netherlands: CBS, 1996
Population in Benin is extremely unevenly distributed.

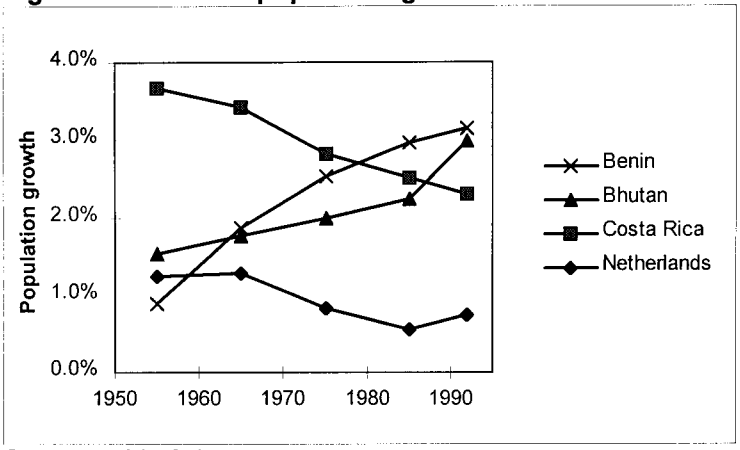
In the Netherlands the regional population density is between around 180 inhabitants per square kilometre (north and south west) and 1150 (Zuid Holland). Regional population density in Costa Rica is between 25 (Guanacaste and Limon) to 250 (San José). The population density in Benin is between the very scarcely populated savannahs in the North (15-20) to 350 in Altantique in the south of Benin. This means that the most densely populated area in Benin (the south) is comparable with the average density of the Netherlands (or the region Gelderland). This south of Benin also faces the highest population growth in Benin. The most crowded area in Costa Rica, San Jose, has a population density that is comparable to that of the region Groningen in the Netherlands. In Bhutan, highest population densities are found in the lower altitude, warmer south and central mid-mountain zone (95% of population) and concentrated in relatively low-sloping areas in river valleys. The lowest

regional population density in Bhutan is in Gasa (less than 1 inhabitant per square kilometre) and the highest in Samtse (50 inhabitants per square kilometer).

Population growth rates

The relative population growth rate are shown in figure 3.4. In the period 1950-1970, Costa Rica had by far the highest population growth rate of the four countries. Since then, this rate has been gradually decreasing. In Benin and Bhutan, growth rates increased over this period to about 3% p.a., i.e. twice the average world population growth[6]. The Netherlands has had a rather constant growth rate of about 0.6 % p.a. since 1970.

Figure 3.4: Relative population growth rates



Source: table 3.1

Population growth rate in Costa Rica is high but declining. Population growth rate in Bhutan and Benin is high and increasing

In absolute numbers, the Netherlands has had the highest growth rate of the four countries until 1980 (Table 3.3). In the period 1990-1994, the population of the Netherlands grew by about 450,000 people, which is lower than Benin (600,000), but higher than Costa Rica (300,000) and Bhutan (75,000).

Table 3.3: Total population increase between 1990-1994

	1990-1994 (000 inhabitants)
Benin	613
Bhutan	75
Costa Rica	312
Netherlands	445

Source: Table 3.1

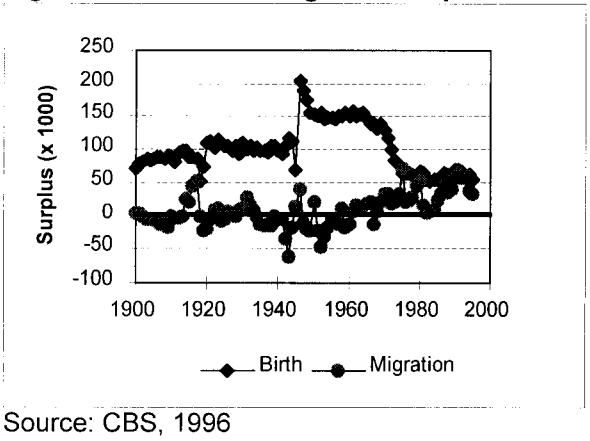
In absolute numbers, population growth is highest in Benin, closely followed by the Netherlands and Costa Rica.

Population increase can be caused by both a birth surplus or a migration surplus. The first is the difference between birth and death figures and the second the difference between immigration and emigration figures. Both surpluses are shown for the Netherlands in Figure 3.5.

[6] A population growth of 3% implies a doubling of the population every 23 years.

Population growth in the Netherlands has largely been the result of a net birth surplus. However, it is expected that there will be a net birth deficit in the near future. The second factor causing population growth - net migration surplus - became an important factor in the Netherlands after the 1960s, when people from especially Surinam, Antils, Turkey and Morocco emigrated to the Netherlands. The future trend with regard to the migration surplus is difficult to assess, but is expected to remain positive.

Figure 3.5: Birth and migration surplus for the Netherlands



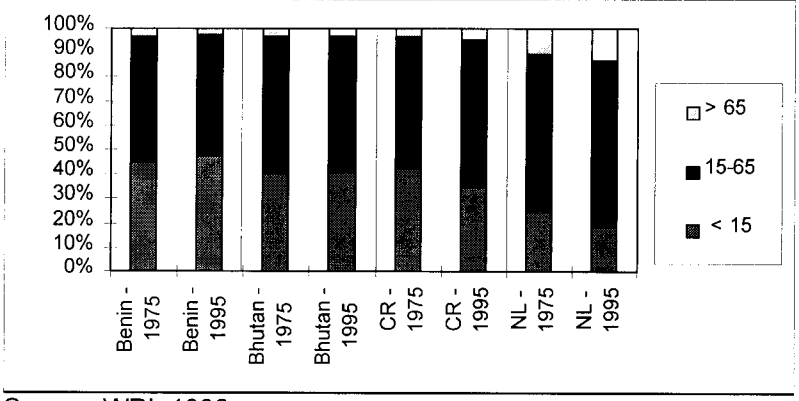
Source: CBS, 1996

A birth surplus has been the main cause for population growth in the Netherlands in the past. A migration surplus might be the main cause in the future.

3.3 Population profile

The population profile is relevant information, since both the very young and the elderly people often depend for their existence on the working population.

Figure 3.6: Age distribution in 1975 and 1995



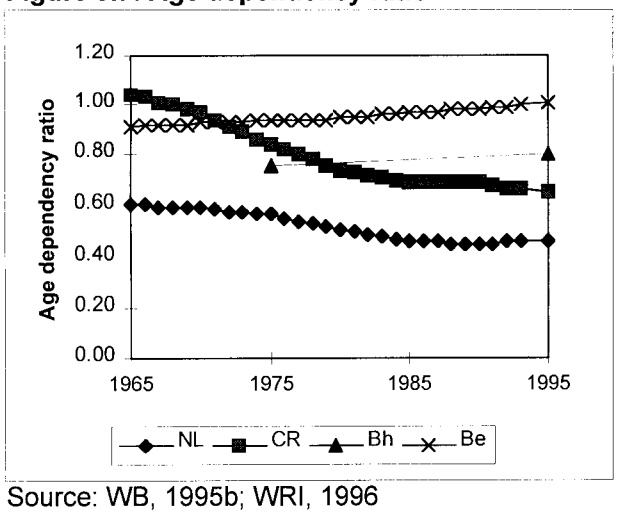
Source: WRI, 1996

Population of Benin, Bhutan and Costa Rica is very young.

Note: for Benin more detailed information is available (ROB, 1992)

The age distribution as shown in figure 3.6 is related to the life-expectancy and birth rates of the countries. Population in the world as a whole is slowly ageing (due to past levels of high fertility coupled to declining mortality rates). The ratio between the youngest plus oldest group divided by the middle group is the so-called 'age-dependency ratio'(ADR) shown in figure 3.7. The rationale behind this ratio is that both the group of children and elderly people are usually dependent for their subsistence on the working people in the middle age group.

Figure 3.7: Age dependency ratio



Source: WB, 1995b; WRI, 1996

The age dependency ratio rises thanks to an increasing share of young people (Benin, Bhutan) or elderly people (the Netherlands).

The ADRs of Costa Rica, Benin and Bhutan are relatively high as a result of the large share of young people. In the Netherlands ADR is much lower, and also it is much more determined by elderly people. The problem of a 'greying population' has been identified as a policy challenge in the Netherlands. As the next century approaches, more elderly people will be dependent on fewer people of working age to provide their care and security. Public provisions for pensions, health and community care will need to be financially supported by a relatively smaller percentage of the total population. Similar trends are not yet occurring in Benin and Bhutan, but - on the basis of current demographic trends (see next sections) can be expected within a few decades.

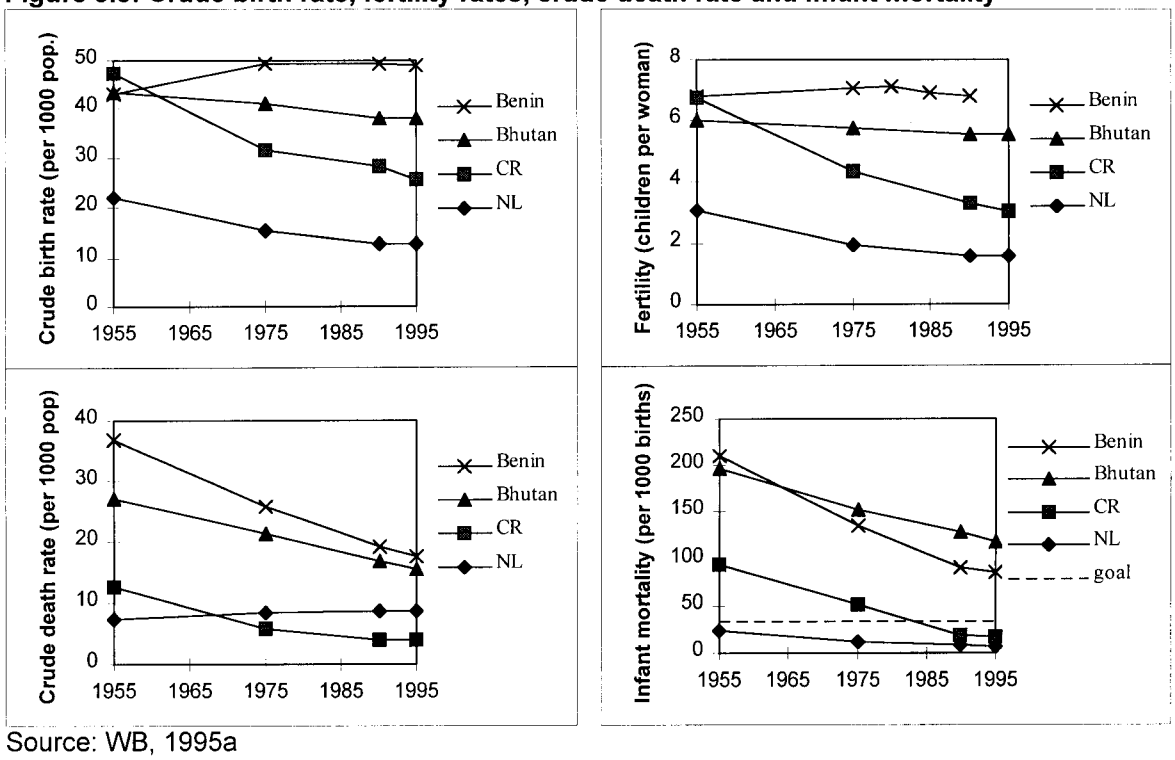
3.4 Detailed demographic data

Figure 3.8 shows more detailed demographic information: crude birth rate, total fertility rate, crude death rate and infant mortality rate. Most of these figures are strongly related to the issue of health discussed in the next chapter.

The trends occurring in figure 3.8 can be explained in terms of the population transition and the position of the four countries within this transition as discussed below.

On the basis of trends in several demographic parameters in many countries around the world the theory of the population transition (and related health transition) has been formulated (see also figure 3.9). In phase 1 of the transition, life expectancy is rather low, mainly as a result of many environment-related, communicable diseases and fertility-rates are high. As a result of advances in health care and medical knowledge and improvements in sanitation in phase 2, mortality rates decrease and consequently life expectancy rises. The result is a strongly growing population. Simultaneously, fertility rates go down. In stage 3 of the population transition, mortality and birth rates reach a new steady state, with finally an acceptable or zero population growth. In the figure 3.9 the position of the four countries have been indicated.

Figure 3.8: Crude birth rate, fertility rates, crude death rate and infant mortality



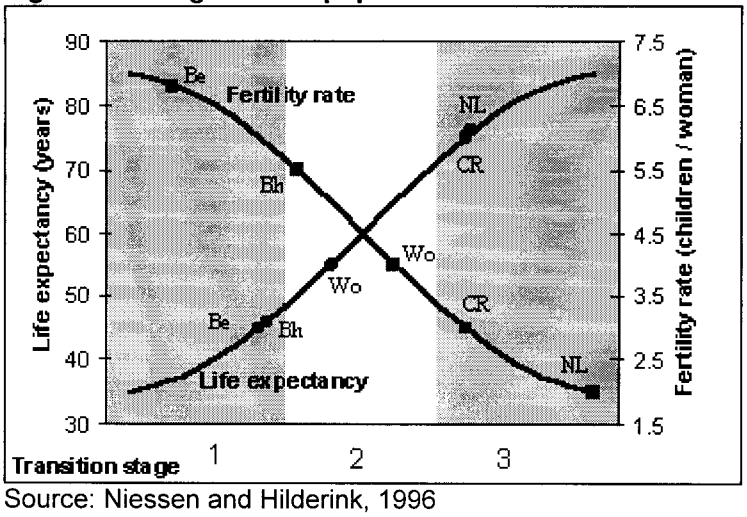
Source: WB, 1995a

Below the details of figure 3.8 are discussed.

Infant mortality

Advances in housing conditions, health care, medical knowledge and improvements in water supply and sanitation have resulted in a steady decline of infant mortality in all four countries. Nevertheless, the figures suggest that infant mortality in Bhutan is still very high. More recent figures suggest that in 1994 a reduction took place to 70 deaths per 1000 births (World Bank, 1994). Reduction of infant mortality strongly increases life expectancy, but at the same time helps building up demographic pressures, since often fertility rates decline much slower.

Figure 3.9: Stages of the population transition



Source: Niessen and Hilderink, 1996

The four countries are in different stages of the population transition.

Note: Wo indicates the global average in 1990. NL, CR, Bh and Be indicate the position of the Netherlands, Costa Rica, Bhutan and Benin.

Fertility rate and crude birth rate

Crude birth rate and total fertility rate are strongly related and show the same trends in figure 3.8. A critical point of demographic stability is the point at which the fertility rate drops below the replacement level of two children per woman. The Netherlands (and most developed countries) are already below the critical level, and Costa Rica seems to be approaching it. Reaching the 'replacement level' does not mean that population levels off immediately. Countries with large numbers of young couples, i.e. couples in their reproductive years will continue to grow for some time. The drop in fertility rate in Costa Rica in the period 1955-1995 has been quite dramatic, indicating that Costa Rica is reaching the end of the population transition.

Crude death rate

In Bhutan, Benin and Costa Rica crude death rate is decreasing. This is attributed to improved heath care and sanitation. In contrast, in recent years crude death rate in the Netherlands is slowly increasing due to ageing of the population.

3.5 Response options

There are various options available to respond to a rapidly growing population, e.g.:

- family planning programmes (including promotion of desire for small families)
- improved education (of especially women),
- promotion of the use of contraception
- attention to old age security
- population distribution policies (regional development)

There is not much data available on many of these response options. Education, sanitation and health care are discussed in the next chapter. There is some scarce data on contraceptive prevalence as shown below.

Table 3.4: Contraceptive prevalence (all methods)

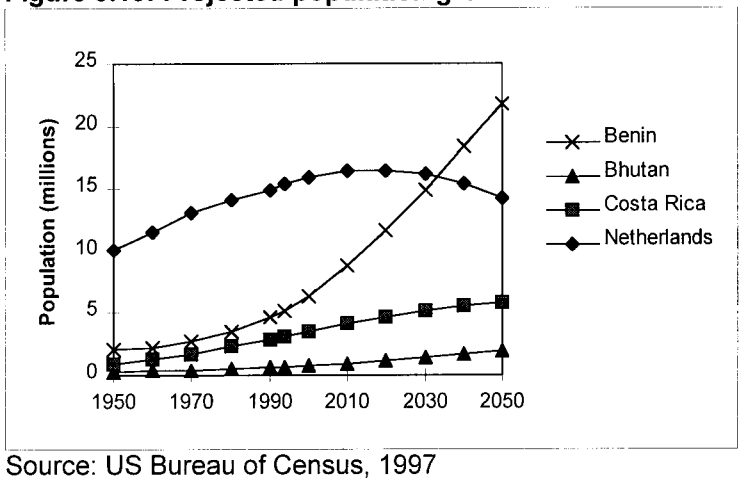
Country	*Contraceptive prevalence*				
	USBC				UNDP
	1982	1976/77	1985/1986	1992/93	1993
Benin	27				9
Bhutan					
Costa Rica	65	68	66	75	75
Netherlands	77	75	76	74	80

Source: US Bureau of Census, 1997; UNDP, 1996

3.6 Future population growth

Based on the current status of the data discussed in the chapter statistical population offices are able to project future trends with respect to population growth. Figure 3.10 gives the projected population trends for each of the four countries.

Figure 3.10: Projected population growth



Source: US Bureau of Census, 1997

After 2030 the population of Benin is projected to be larger than the population of the Netherlands

Figure 3.10 gives the projected size of the population, which not necessarily will come true - especially not if policies with respect to population growth are tightened. According to the data the population of Benin will be larger than the Dutch population in 2030. The population of the latter will start to decline after 2020. Over the whole period population growth of Bhutan will remain relatively high, while the population of Costa Rica will almost stabilise after 2040.

3.7 Conclusions

The demographic statistics found in the international reports give a rather complete view of the issue. However, the accuracy of the information for Bhutan is questionable.

All four countries currently have a growing population. Bhutan and Benin are currently facing an accelerating population growth, which can easily result in increasing environmental pressures. In relative terms, population growth is much slower in the Netherlands. However, due to its larger size, population growth in absolute numbers is higher than in Costa Rica or Bhutan. Thus - in combination with the high consumption patterns, population growth in the Netherlands causes much greater increases in pressures on the global environment than in each of the other countries. In each of the four countries, population is unevenly distributed over the total area.

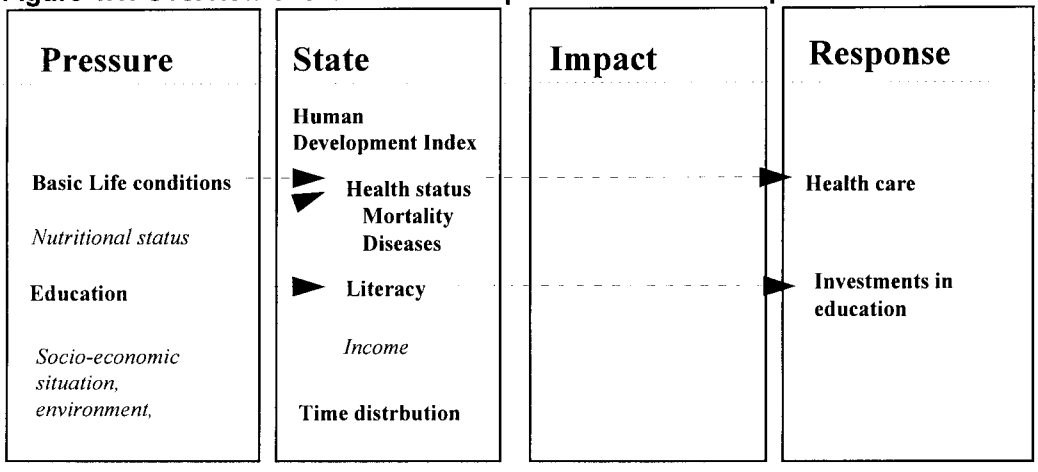
4. Human Development

The concept of human development (as used for instance by UNDP) emphasises human well-being as goal of development efforts. In this chapter, the term relates to the development of certain qualities attributed to individual human beings (i.e. health, education and time-distribution). In addition, the outcomes of the calculations of the Human Development Index is presented and discussed as an aggregated index.

4.1 Introduction

The capabilities of humans within a society are an essential part of the development concept. In terms of capital, one should think of abilities and skills of individual human beings and the ability of individuals to participate fully in society (health and nutrition). This brings the notion of human capital very near to the notion of human well-being. Here, we have decided to focus on health, education and time distribution. The nutritional status of the population is covered in the chapter on land and agriculture. Figure 4.1 shows the information covered in this chapter as part of the PSIR-scheme.

Figure 4.1: Overview of the information presented in this chapter



Note: The purpose of this scheme is to show important linkages between the different parameters relevant for the issue and the data presented. For underlined parameters information is included in this chapter; for parameters in italic print information is included in other chapters. For parameters in normal print no information is included in this report.

4.2 Health

Health of the population is an important aspect of human (sustainable) development. Changes in health are strongly related to the demographic transition discussed in the previous chapter; in fact one should speak of one transition determined by two components, the epidemiological transition and the fertility transition.

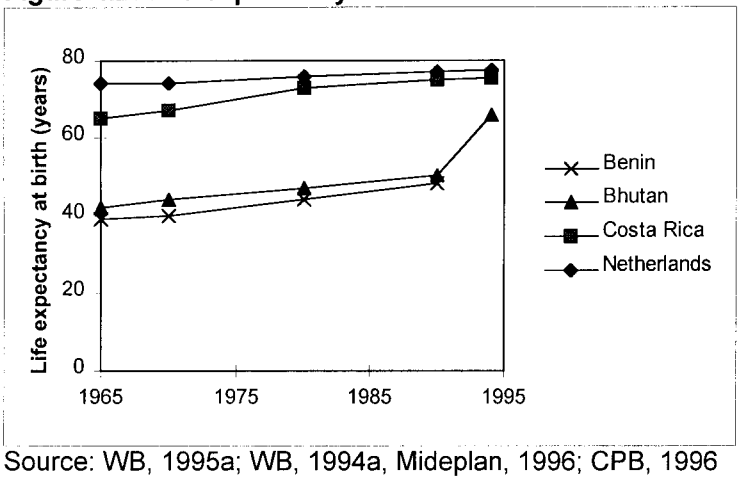
There are two types of widely accepted and available measures for comparison of the state of health of a population, which are average life-expectancy and mortality rates such as child mortality, infant mortality, crude death rates. In addition, there is some data available on a number of response- or pressure indicators for health. Nutritional status and food availability

are not included in this chapter, but in the agricultural chapters. The issue of health is also related to some environmental factors. In rural societies especially hygienic circumstances play important roles. In addition, health effects might be directly through pollution (e.g. lead, ozone) or indirectly as result of reduced agricultural output (but in general, these last factors are only small in comparison to other factors influencing health).

4.2.1. State of health: Life-expectancy and mortality rates

Life-expectancy
Increasing life-expectancy is an important overall indicator of improving health conditions.

Figure 4.2: Life-expectancy at birth



Source: WB, 1995a; WB, 1994a, Mideplan, 1996; CPB, 1996
Life-expectancy has been rising in all four countries, most strongest in Costa Rica, Bhutan and Benin. The four countries now cluster in two groups: Netherlands and Costa Rica; Benin and Bhutan.

Figure 4.2 shows that average life-expectancy at birth has been rising in the four countries in the period 1965-1990. Life-expectancy is highest in the Netherlands, but over the whole period Costa Rica has made most significant progress. People living in Costa Rica now have about the same life-expectancy as the Dutch. Life-expectancy in Bhutan and Benin is still much lower, but has been increasing most strongly in recent years.

Most of the sources publish comparable data on life-expectancy, but there are some exceptions. A study of the World Bank (1994a) on Bhutan mentions a relatively high life-expectancy at birth for 1994, which would suggest an enormous improvement in comparison to the other data (figure 4.2). However, WHO (1996) mentions that life-expectancy in Bhutan in 1992 was still only 48 years.

The significant increase in average life-expectancy in all of the four countries has been a result of advances in medical care, and improvements in hygienic conditions and food availability. World-wide the most important factor seems to be prevention of environment-related infectious diseases at young age due to improvement of the hygienic conditions. Vaccination is thought to have a relatively significant influence in low-income countries. Other factors determining increase in life expectancy are education and general welfare.

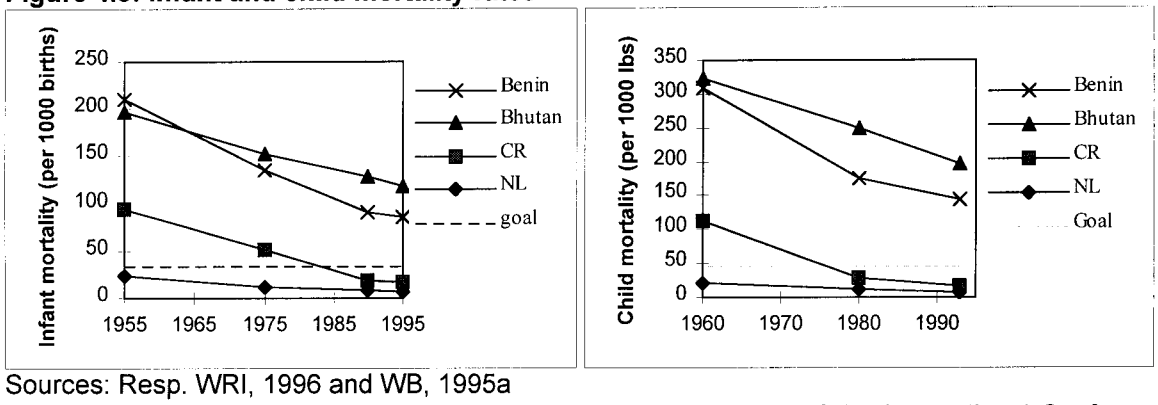
Greater longevity is projected for future years, especially in Bhutan and Benin, but also in the Netherlands and Costa Rica. In all four countries, women have a slightly higher life-expectancy than men.

The average life-expectancy does not indicate the period during which individuals can expect to live a healthy life. Progress is made by some institutes to develop a healthy life-expectancy indicator (e.g. Disability Adjusted Life-years Expectancy, DALY) which incorporates the disease processes as well.

Mortality rates

One of the most widely used indicators of health, the infant mortality rate, has been shown already in the previous chapter; in this chapter under-five mortality rate has been added. In addition, the causes of death in both industrialised and non-industrialised countries are compared.

Figure 4.3: Infant and child mortality rates



Sources: Resp. WRI, 1996 and WB, 1995a

Costa Rica and the Netherlands have already reached the goals of the International Conference on Population and Development. Bhutan and Benin have not.

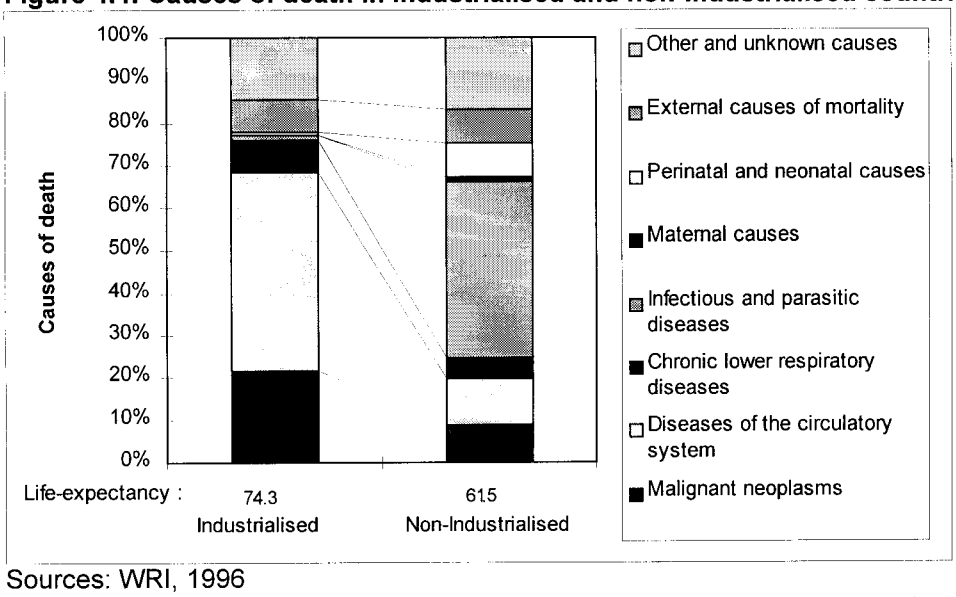
Figure 4.3 shows that both infant mortality (< 1 year) and child mortality (< 5 year) rates are strongly dropping, but that the actual value in Bhutan and Benin is still high. An other World Bank report (1995a) mentions for 1994 an infant mortality rate of 70 per 1000 life births. The reduction in Costa Rica over the period 1960-1993 has been significant. The International Conference on Population and Development (Cairo, 1996) concluded that countries should strive to reduce infant mortality in 2015 to less than 35 per 1000 life births and child mortality to less than 45 per 1000 life births, levels already reached in both Costa Rica and the Netherlands.

Causes of death

No sufficient data was available for all four countries. Therefore, figure 4.4 first shows the main categories of causes of death in both developed and developing countries.

Figure 4.4 shows that in industrialised countries chronic diseases, particularly related to old-age, have become the predominant cause of death. The last type of diseases are typically caused by endogenous and behavioural influences. In industrialised countries the main causes of death are diseases of the circulatory system (nearly 50%) and cancer (circa 20%). Infectious and parasitic diseases account for only 1 % of the deaths. However, in the non-industrialised world these types of diseases account for more than 40% of the total deaths.

Figure 4.4: Causes of death in industrialised and non-industrialised countries in 1993



Sources: WRI, 1996

The most important cause of death in industrialised countries are diseases of the circulatory system; in non-industrialised countries infectious and parasitic diseases.

Table 4.1: Incidence rate of various infectious and parasitic diseases

	Benin	*CR*	*NL*	*Bhutan*
	1989 (1/100,000)	1995 (1/100,000)	1994 (1/100,000)	1994 (1/100,000)
Malaria	4434	134	1.5	1827
Bronchio-pulmonary infection	832			
Diarrhoea	650	3206		
Amoebiasis	194			
Measles	145	6	2.0	
Bacillary dysentery	134		2.0	
Mumps	55		0.3	
Meningitis	53		2.8	
Whooping cough	35		3.5	
Tuberculosis	10	8	11.8	
AIDS	{6}	4	3.0	
Dengue		153		
Gonorrhoea		45	9.4	
Hepatitis		39	7.8	
Other intoxication		32		
Food intoxication		13	6.3	
Scabies			7.1	

Sources: Benin: ROB, 1991; Costa Rica: Mideplan, 1996; Netherlands : CPB, 1996; Bhutan: UNDP, 1996

Table 4.1 presents incidence rates of various infectious diseases in the four countries (for Bhutan only data on malaria was available). Table 4.1 shows that infectious and parasitic diseases are most common in Benin, followed by Costa Rica (no sufficient data is available for Bhutan, while in the Netherlands infectious and parasitic diseases have an incidence rate of less than 1/1000.

Table 4.1 shows incidence rates and not the health threat, in the Netherlands infectious and parasitic diseases are not only less common, but also less deadly as in Benin. A better comparison - which would also allow to include chronic diseases - would be comparison with respect to mortality or disability rates. For Benin data show that the major health problems are malaria, respiratory infections, diarrhoea and anaemia. In Bhutan, about 28% of the total treated health cases is related to exposure to air and water pollution. Of this 28%, 12.7% is diarrhoea and dysentery and 16% acute respiratory infections (WB, 1994a).

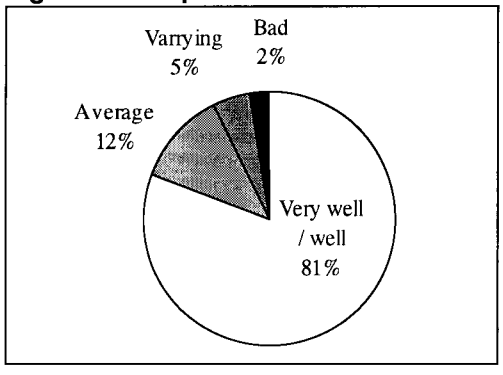
Table 4.2 shows two other types of data with regard to health status in the four countries. Maternal mortality rate in Bhutan is in the period 1980-1992 much higher than in the other three countries.

Table 4.2: Various data regarding health status

	Maternal mortality (1/100000 lb) 1980-1992	*Underweight children (< 5) % 1985-1995*
Benin	160 (400-800), [160-450]	(25), [11%]
Bhutan	1,310 [770]	38
Costa Rica	36 [30-40,1988-93]	6
Netherlands	10 [6, 1991-93]	[4, 1980]

Sources: WRI, 1996; UNDP, 1996, () Wolffers, 1996; [] WHO, 1996, {} ROB, 1991
Note: lb : live births

Figure 4.5: Experienced health in the Netherlands



Source: CPB, 1996
Most Dutch experience their health as well or even very well.

Finally, Figure 4.5 shows that most of the Dutch consider their own health as well or even very well.

4.2.2. Access to safe drinking water and sanitation

Health is strongly determined by the socio-economic situation and in particular basic life conditions, such as access to safe drinking water and sanitation[7].

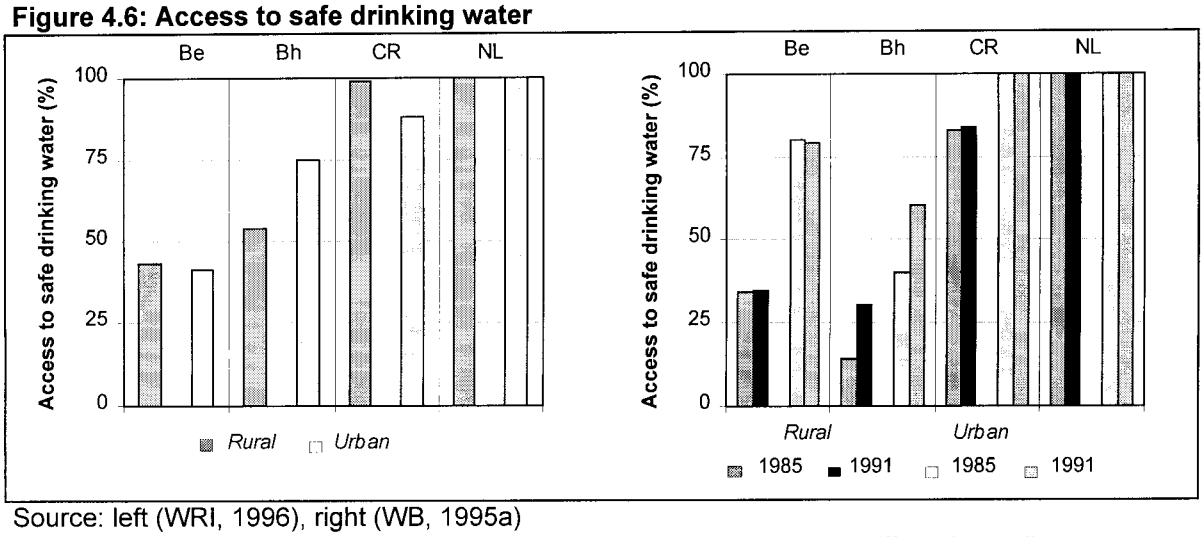
[7] The nutritional status is discussed in an other chapter.

Access to safe drinking water

Accessibility to safe drinking water is of fundamental importance to lowering the frequency of waterborne diseases. The Sustainable Development Indicator Programme of United Nations Commission on Sustainable Development names this indicator a good one for total human development because of its primary importance for life itself (DPCSD, 1996).

With reference to Figure 4.6, comparison of the data in the left and right figures shows great differences between the two sources, not only with regard to the total percentages but also to the relative status of rural and urban access to safe drinking water. The exact year of the WRI data is not known, which might be one cause for this difference. Another cause might difference in definition.

Figure 4.6: Access to safe drinking water



Source: left (WRI, 1996), right (WB, 1995a)

Access to safe drinking can still be improved in Benin and Bhutan. Data differs depending on source.

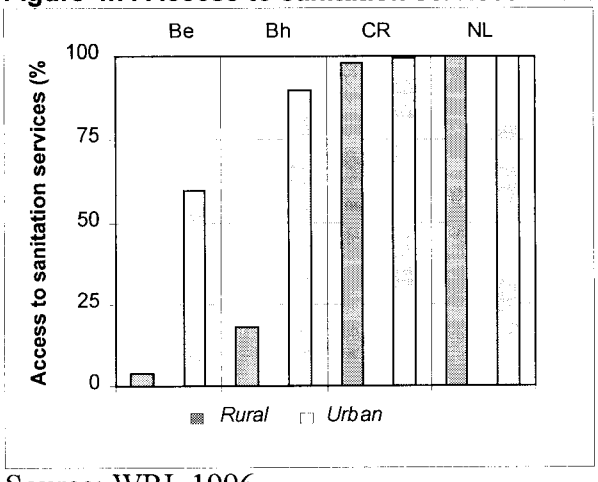
Note: Figure left shows access to safe drinking water in 1980-1995 according to WRI (left) and figure rights shows the access in 1985-1991 according to the World Bank (right)

According to both sources, access to safe drinking water in Costa Rica and the Netherlands is almost 100%. Although access to safe drinking water in Bhutan is limited, significant progress has been made in recent years. In rural areas in Benin, many people still lack access to water infrastructure due to the difficult terrain and lack of a complete road network. A more detailed report of the World Bank mentions that 54% of Benin's population has access to safe drinking water, where urban dwellers are twice as likely to have access to safe water as rural people (WB, 1994b).

Sanitation

The accessibility to adequate sewage disposal facilities is fundamental to decreasing the risk of diseases associated with conditions of hygiene. International targets for average accessibility to sanitation have been set at between 75% and 100% for the year 2000. Figure 4.7 shows significant differences in sanitation services between rural and urban areas, both in Benin and Bhutan. According to WRI data was the access to sanitation services in rural areas in the period 1980-1995 still far below the international target. It should be noted that - just as for access to safe drinking water - data for Benin and Bhutan differ, depending on the data source used. For instance, national data for Bhutan indicates that sanitation coverage in urban areas is 95% and in rural areas 70% (Karma Ura, 1997).

Figure 4.7: Access to sanitation services in the period 1980-1995



Source: WRI, 1996

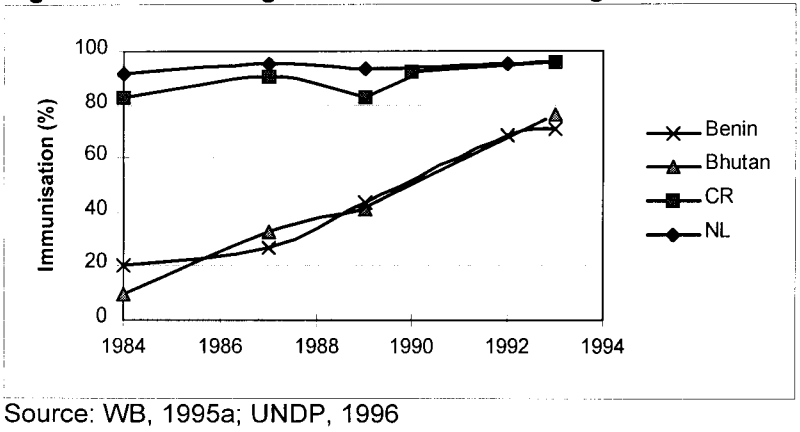
In Benin and Bhutan access to sanitation services is low, especially in rural areas

4.2.3. Health care

Immunisation against infectious diseases

Infectious diseases pose a major threat to human health. The provision of prevention programmes aimed at controlling these diseases and protecting vulnerable groups is therefore important.

Figure 4.8: Percentage of infants immunised against DTP and measles



Source: WB, 1995a; UNDP, 1996

Note: Infants are children < 1 year old.

Immunisation has (almost) reached the 90% goal of WHO in all of the four countries

As figure 4.8 indicates, the immunisation level in Bhutan and Benin has enormously improved over the last 10 years. The situation is now approaching that of Costa Rica and the Netherlands. The international target is to reach an immunisation rate of 90% in 2000.

Health care services

Several organisations provide information on health care services in the form of data on hospital beds, nurses and doctors. The different sources for table 4.3 and figure 4.9 include slightly different data.

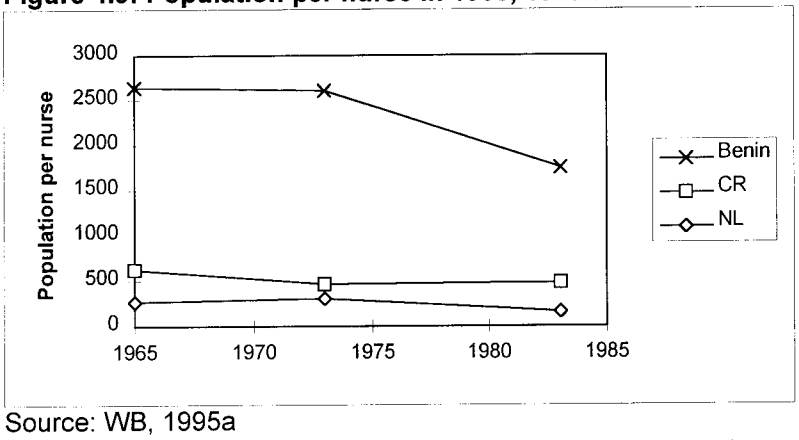
The differences between the four countries with regard to health services are large. Access to local health services (4th and 5th column) is an important parameter, since locally based programmes can often provide services more efficiently and more cost-effectively. In Benin, official policy is to increase the accessibility of health services for the poor and for rural people. However, at the moment the system is still centralised (WB, 1994b).

Table 4.3: Various data on health services

	Access to health services (%) 1985-1995	*Population per doctor 1988-1991*	*Population per nurse 1988-1991*	*Access to local health services % 1986-87*	*% 1991-93*
Benin	18	14286	3226	32	50
Bhutan	65	11111 {3822}	6667	50	90
Costa Rica	80	1136	2222	97	
Netherlands		398		100	

Source: First three columns UNPD, 1996; last two columns WHO, 1996; {} WB, 1994a;.

Figure 4.9: Population per nurse in 1965, 1973 and 1983



Source: WB, 1995a

In Costa Rica and The Netherlands there are much less people per nurse than in Benin.

Figure 4.9 shows a strong decline in the number of people per nurse in Benin between 1973 and 1983. The Netherlands and Costa Rica have a much lower figure: less than 200 and around 500 persons per nurse. UNDP publishes much higher figures for Benin and Costa Rica, indicating large uncertainties with respect to the actual data (UNDP, 1996).

Total national health expenditure

The size of the national health expenditures gives some impression of the priorities granted to health as compared to other sectors within the same country.

Table 4.4: National health expenditure compared to GNP/GDP

	National health expenditure		
	% GNP 1960	% GDP 1980s	% GDP 1990
Benin	1.5	3.95 (1985)	2.8
Bhutan			2.4
Costa Rica	3	4.70 (1980)	
Netherlands	4	7.70 (1985)	8.7

Source: WB, 1995a; UNDP, 1996

Note: GNP = Gross National Product; GDP = Gross Domestic Product

In the Netherlands health care expenditures strongly increased between 1960 and 1980. Since 1980, expenditures have been around 8% of GDP. Expenditures in Costa Rica and Benin are significantly lower.

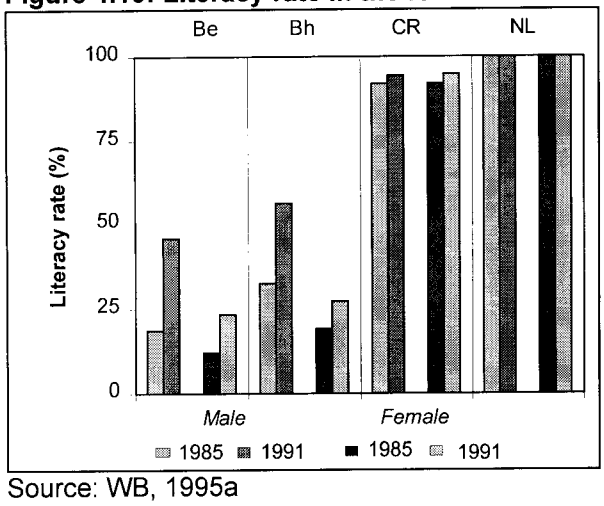
4.3 Education

Education is considered to be critical for human development, and thus for sustainable development.

4.3.1 Adult literacy rate

Adult literacy rate is the proportion of the adult population aged 15 years and over which is literate (sometimes different definitions are used for the term literate).

Figure 4.10: Literacy rate in the four countries



Source: WB, 1995a

There are large differences between Benin and Bhutan on one hand, and Costa Rica and the Netherlands on the other. In Benin and Bhutan male and female educational levels differ greatly.

Both in Costa Rica and the Netherlands adult literacy rate is near 100% (figure 4.10). In Bhutan and Benin literacy was in 1990 still below 40%. In Bhutan and Benin, there is a clear difference between male and female literacy rate.

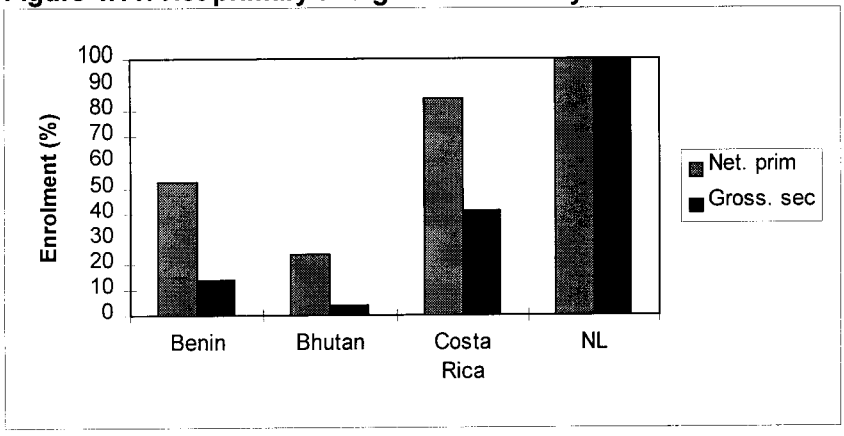
4.3.2 Enrolment rates

The enrolment rates indicate the percentage of a certain school-age group that actually participates in education. A distinction is made in gross and net enrolment rates: the first includes total school enrolment, including children of age groups other than the group used in the numerator (over-aged and under-aged students) and can therefore be higher than 100%. The seconds includes only participation of the specific age-group. In principle, the second indicator is more useful, but for the first, data is easier available.

Figure 4.11 indicates that net primary enrolment in the Netherlands is 100 %. In Costa Rica net primary enrolment is slightly lower (80%), followed by Benin (50%) and Bhutan (25%). It should be noted that the data might not include some of the local forms of education (e.g. religious education). Moreover, there are considerable significant differences between data sources among others caused by different assessment methods, reference years or different types of education included. For instance, both the World Bank and national data sources in

Bhutan mentions a primary enrolment rate of about 70% in Bhutan (WB, 1994; Chhewang Rinzin, 1997; Karma Ura, 1996) in the mid 1990s in contrast with the lower number that is shown in Figure 4.11.

Figure 4.11: Net primary and gross secondary enrolment rates in 1987



Source: WB, 1995a

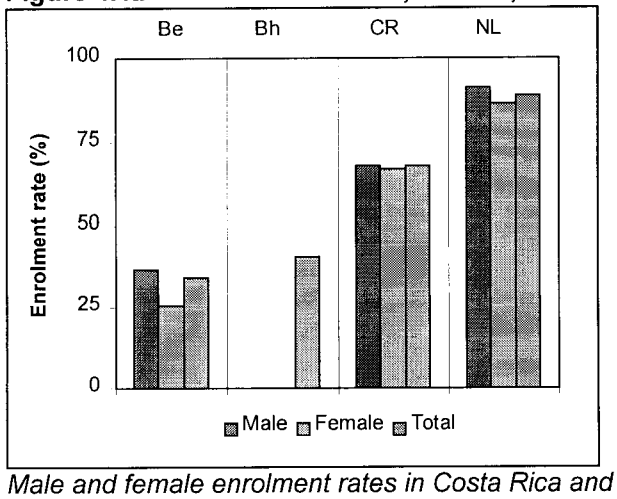
In Benin, Bhutan and Costa Rica secondary enrolment is much lower than primary enrolment.

Note: Net prim = net primary enrolment
Gross sec = gross secondary enrolment

The difference between primary and secondary enrolment is large for both Costa Rica, Benin and Bhutan and minimal for the Netherlands. It should be noted that the data might not include some of the local forms of education (e.g. religious education).

Figure 4.12, in addition, shows the combined first, second, and third level gross enrolment ratio as used by UNDP. Distinction is made between female and male students.

Figure 4.12: The combined first, second, and third level 1993 gross enrolment ratio



Male and female enrolment rates in Costa Rica and the Netherlands are almost equal.

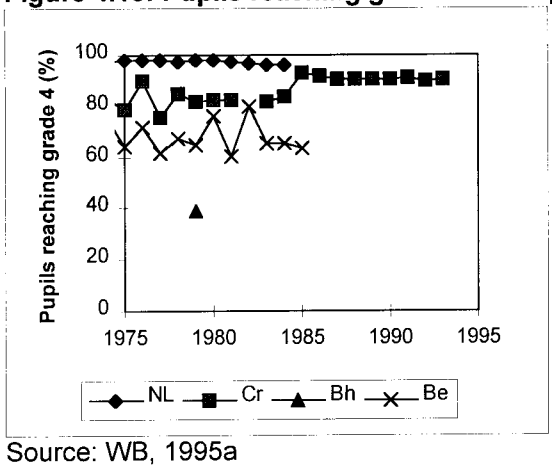
Source: UNDP, 1996

The same trends emerge in the previous figure. However, now almost no difference is visible between Benin and Bhutan. If the numbers in figure 4.12 are compared to those of other African countries, the level of education in Benin is concluded to be relatively low. Reasons might include distance from schools, school fees, the need for children to go out to work and

limited employment opportunities for school leavers. Cultural variables represent an extra obstacle for girls' education (WB, 1994b).

The last figure in this section shows the percentage of pupils reaching grade four according to World Bank data.

Figure 4.13: Pupils reaching grade 4 in the period 1975-1995



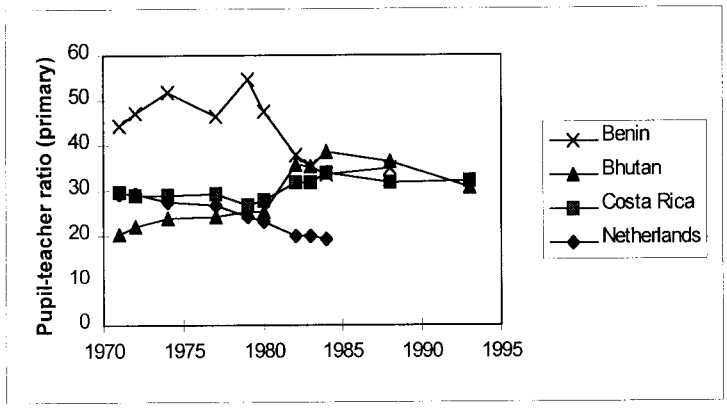
Source: WB, 1995a

The share of pupils reaching grade 4 is higher in Costa Rica and the Netherlands than in Bhutan and Benin.

4.3.3. Other data on education

Two other types of data were available with regard to education: first of all the pupil-teacher ratio and second the expenditures on education compared with GDP.

Figure 4.14: Pupil-teacher ratio



Source: WB, 1995a

The figure above shows available data on pupil-teacher ratio (he kind of education is not specified). The ratio was highest in Benin in the period 1970-1980 but decreased to a level around 30 pupils per teacher, similar to Bhutan and Costa Rica (the increase in these two countries might be the result of data-inaccuracies, unanticipated growth of pupils due to population growth or cut-backs). The Netherlands had a declining ratio in the period 1970-1985.

The table below shows the share of GDP devoted to education. Expenditures on education do not provide the full picture, since it does not show the efficiency with which these expenditures are used.

Table 4.5: Expenditures on education

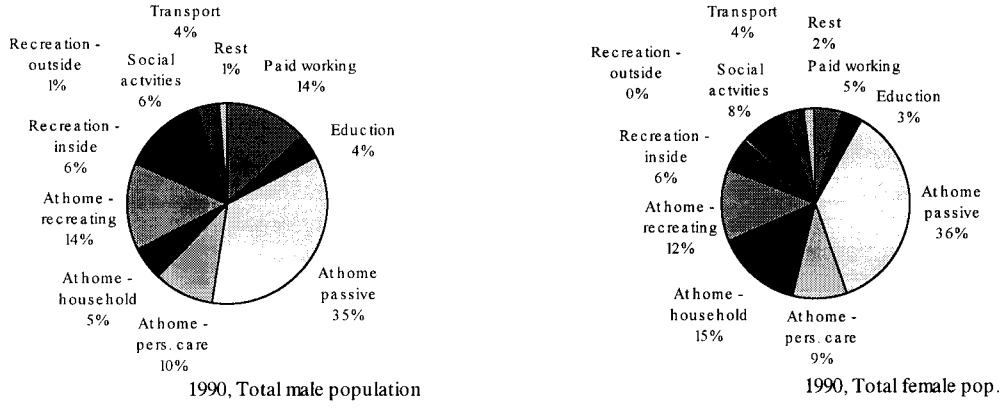
	Expenditure WB, 1995a % GDP		*Expenditure UNDP, 1996 % GNP*	
Benin	3.84	(1985)		(1992)
Bhutan	{4.5}	(1992)	{4.9}	(1992)
Costa Rica	5.60	(1980)	4.4	(1992)
Netherlands	5.59	(1985)	5.9	(1992)

Source: WB, 1995a; UNDP, 1996; except for {..}: WB, 1994a

4.4 Average time devoted to human activities (the Netherlands)

Time distribution of human activities might give relevant information on sustainable development, (it is one of the most valuable human resources). The concept of development is sometimes related to available time: by means of technology humans are able to reduce the time needed for primary life support activities and find time that can be used e.g. for social or religious activities.

Figure 4.15: Average time-distribution in the Netherlands in 1990



Note : Data is for one week in October. Categories are:

- Time spent at home. Four sub-categories:
  - passive : sleeping.
  - personal. care : eating, washing etc.
  - household : cleaning, time devoted to other members of the household (children).
  - recreating : reading, watching television.
- Recreation inside : going out (theatre, pub, eating out etc.), sports.
- Recreation outside : Walking, cycling as recreation.
- Social activities : Participation in social organisations (church, NGO, political organisation) and visiting friends.
- Transport : transport for all kind of activities.

Source: de Hart, 1995

Women in the Netherlands pay considerable more time to household work than men.

Only time distribution data were available for the Netherlands. Figure 4.15 shows the average time distribution for males and females in the Netherlands. A*verage* time distribution is

strongly related to other population data, such the share of children and the unemployment ratio. It includes time distribution of children, adults and elderly and of working and unemployed people. The numbers given for time distribution are percentages : 1% means almost two hour per week.

The largest share of time is devoted to sleeping (at home - passive). The other time categories spent at home are also relatively important in the Netherlands: personal care (including washing, eating etc.), household work (including child raising) and recreation at home (watching television, listening to radio or reading). Dutch females - on average - spend much more time than male on household work. Over the last decades, this situation is slowly becoming more equal. Dutch men spend about three times as much time on paid working than women. About 6-8 % of the time is spent on social activities as visiting friends and public participation. This last category is decreasing over time. For some societal categories (especially the working population) also 'free time' has been decreasing for some decades.

4.5 Human Development Index

The Human Development Index (HDI) published by UNDP (1996) is based on the average life-expectancy, average income, and a combination of literacy and enrolment. Often the position of a country with respect to this indicator in comparison to other countries is used as an indicator. The actual value of HDI - directly taken from the report - is not valid for comparing different years, since the different index scores are adjusted for every edition.

Table 4.6: International position for HDI and for GDP in two different years

	Report 1993			*Report 1996*		
	HDI-pos.	*index-value*	*GDP-pos.*	*HDI-pos.*	*index-value*	*GDP-pos.*
Benin	162	(.113)	145	154	(.327)	131
Bhutan	159	(.150)	163	159	(.307)	157
Costa Rica	42	(.852)	76	31	(.884)	54
Netherlands	9	(.970)	17	4	(.938)	32
Total countries included	173			174		

Source: UNDP, 1993; UNDP, 1996

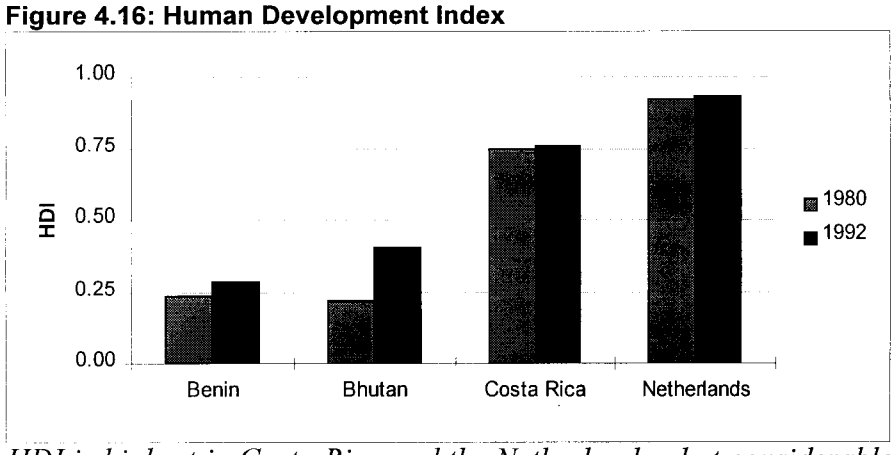
Note: The column GDP-HDI compares the international position of a country with respect to GDP and HDI.

Costa Rica and the Netherlands score very well on this Human Development Index

Both the Netherlands and Costa Rica score very well with respect to HDI: in terms of their absolute position, and their position for HDI compared to their position for GDP. Benin and Bhutan rank among the countries with the lowest HDI. Moreover, Benin has a low position for HDI in comparison to its GDP position.

It is possible to calculate HDI for 1980 and 1992 on the basis of the available data for each of the constituents (Figure 4.16). This figure shows that over this period, Benin and Bhutan have made the most significant progress with regard to HDI value.

Figure 4.16: Human Development Index



HDI is highest in Costa Rica and the Netherlands - but considerable progress has been made in Bhutan and Benin.
Source: various sources and own calculations

A few remarks can be made with respect to the conclusions above:
- Large uncertainties in data for Bhutan and Benin on the issues included in the HDI (life-expectancy, educational performance) have been shown. For Bhutan there are recent signs of improvement with respect to life-expectancy and educational indicators.
- The choices made on the composition of the HDI reflect a certain 'cultural-biased' idea on what human development is. It does not include all aspects that the Bhutanese call human development, such as spiritual development, care and general knowledge.

4.6 Conclusions

The data presented and discussed in this chapter have provided some information on the issue of human development. There are doubts with regard to the accuracy of the data for Bhutan and Benin.

Although not yet included, an approach based on healthy life expectancy seems to be a promising step forward as an indicator for human health.

On the basis of the information presented, clear differences between the countries are visible. Generally, the Netherlands and Costa Rica seem to be on a slightly higher level for the parameters selected. Educational and health parameters such as literacy rate and life-expectancy are relatively high in Costa Rica - especially in comparison with countries with a comparable average national income per capita. Bhutan and Benin seem to be more-or-less at the same stage of development with respect to life expectancy, improvement of hygienic conditions and educational parameters. There is still considerable potential for improvement. Although data is highly uncertain, there are signs that some progress with respect to several parameters, such as life expectancy and educational level, has been made in Bhutan in the last few years.

Cultural and religious parameters in relation to health and education rarely exist, but availability could influence the overall interpretation of human development in each of the countries.

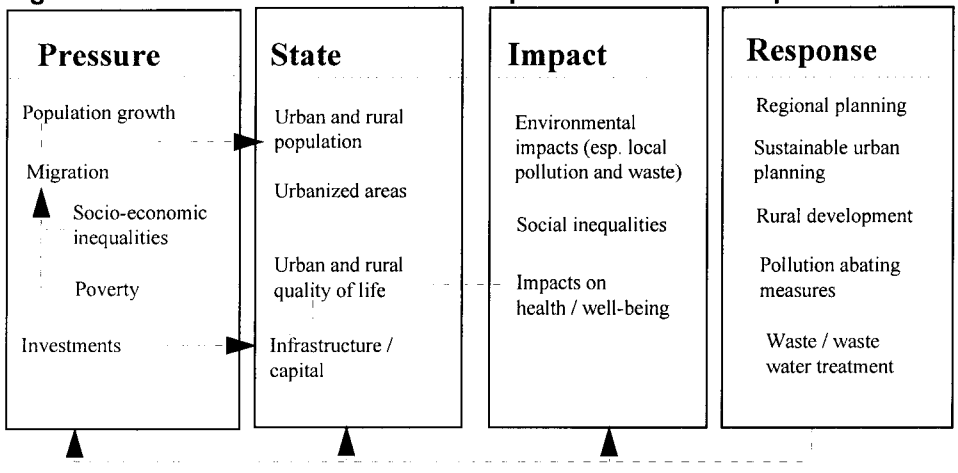
5. Urbanisation

In almost every country in the world the urban population is strongly increasing. On the one hand, urbanisation promises potential for economic development deriving from concentration of population, business and industries. On the other hand, urbanisation and especially fast urbanisation also introduces new specific urban problems, especially with regard to provision of food, housing, employment, infrastructure e.g. water supply, sanitation and waste collection, and urban quality. Moreover, large urban areas can pose significant environmental problems on the surrounding areas and often take productive agricultural land out of production.

5.1 Introduction

The figure below provides an overview of the information presented in this chapter. The information in this chapter focuses especially on the issue of urbanisation.

Figure 5.1: Overview of the information presented in this chapter



Note: The purpose of this scheme is to show important linkages between the different parameters relevant for the issue and the data presented. For underlined parameters information is included in this chapter; for parameters in italic print information is included in other chapters. For parameters in normal print no information is included in this report.

5.2. Urban and rural population

In all four countries, urban population grows considerably faster than rural population. The urban growth rates (see figure and table 5.1) in Costa Rica, Bhutan and Benin seem to be very high, but similar figures can be found for developed countries in the beginning of this century. The question mark in the table for Bhutan has been added to reflect the uncertainty of population data in general in Bhutan. It should be noted that the definition of urban population can differ slightly from country to country.

In 1975, 38% of the global population lived in urban areas. This share will probably rise to about 50% in 2000.

At the moment Bhutan is still largely rural (despite the fact that the urban population more than doubled in the last 20 years).

Table 5.1: Growth of urban population

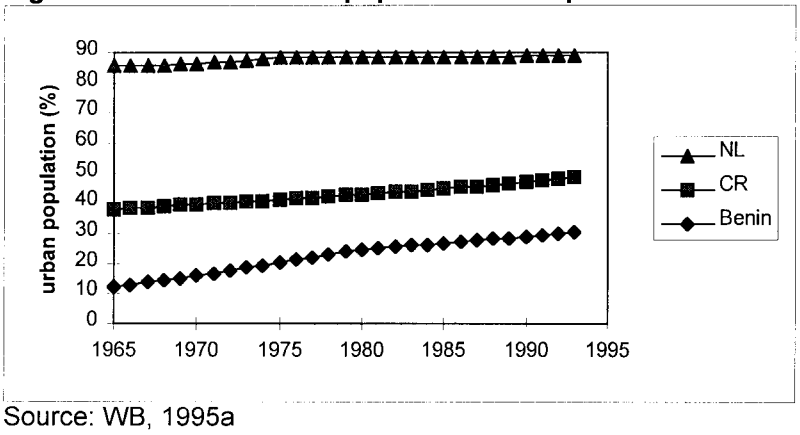
	Urban pop.(000)	*Urban population (percent)*			*1990-1995 growth rates (% p.a.)*	
	1995	1975	1995	2025	urban	rural
Benin	1,691	20	31	52	4.6	2.5
Bhutan	105 ?	3 ?	6 ?	9 ?	4.8	1.0
Costa Rica	1,702	41	50	69	3.5	1.4
Netherlands	13,801	88	89	93	0.8	0.2
World		38	45	61	2.5	0.8

Source: WRI, 1996

In Benin one-third of the population is urban and two-thirds are rural. However, urban growth rates are very high in Benin and with present growth figures it is expected that in 2025 over 50% of the population will be urban. The growth is strongly caused by rural-to-urban migration, especially to Cotonou, Parakou and Lokassa, which have growth figures of 4 - 8 %. One of the causes is population growth in rural areas as a result of which poverty has increases (land shortage). In some areas, one could even speak of a rural exodus (WB, 1994b).

In Costa Rica exactly half of the population is currently living in urban areas but this share is increasing. In the Netherlands about 90 % of the population is urban.

Figure 5.2: Share of urban population in the period 1965-1993



Source: WB, 1995a

Population in The Netherlands is mostly urban; The state of urban population in Costa Rica and Benin is rapidly increasing.

The rapid growth of population in urban areas and the rapid economic growth could intensify the problems of the urban environment. WRI (1996) pays special attention to the environmental impacts of cities and the quality of life (see also section 5.4)

5.3 Urban areas and megacities

No data is available with respect to the size of urbanised areas in the four countries. In comparison with the global situation, there are no megacities in the four countries. If nearby suburbs are included, the Netherlands have only two conglomerates larger than 750,000 inhabitants; Costa Rica one and the other two countries none (WRI, 1996). The city of Cotonou in Benin has about 650,000 inhabitants.

5.4. Impacts of urbanisation

Not much data on the situation in urban areas in the four countries is available. For the world as a whole WRI (1996) concluded that '*on average, urban dwellers have higher incomes and live healthier, easier lives than their rural counterparts. However, these advantages are not shared by all urban inhabitants. The urban social environment in developed countries - which includes factors such as violence and drug abuse - poses major threats to human health and productivity. In developing countries, urban areas often have huge populations living in poverty.*' But also rural life can have advantages and disadvantages. The rural population generally has a lower income and a lower access to all kind of infrastructure.

In general terms, the World Bank (WB, 1994b) describes that several factors in urban areas in Benin erode quality of life such as: air pollution, waste, health problems, employment and poverty, and inadequacy of basic infrastructure.

Air pollution
The quality of air in many cities is considerably worse than in rural areas. In the Netherlands, air quality standards in urban areas are regularly exceeded as a result of pollution caused by transportation, industry and energy production. Over the last decades, considerable progress has been made with regard to sulphur dioxide and lead. However, concentrations for carbon monoxide, nitrogen oxides, and aromates still exceed health standards on a regular basis. Incidents of summer and winter smog occur on average for about 15 days a year and two days a year, respectively. In the other three countries, air pollution seems to be limited to the main cities. In San José (Costa Rica) transport is one of the main causes of urban air pollution: resulting emissions of particulates and nitrogen oxides continue to increase. In Timphu (Bhutan) burning of fuel wood for heating and cooking creates visible air pollution (among other particulate matter). In Benin, in addition to direct emissions from transport and urban buildings, also unpaved roads might be an important cause of urban air pollution (dust).

Waste
Especially in Benin, problems are reported with waste disposal in urban areas. Waste disposal facilities in the main towns are almost non-existent and it is estimated that only about 20% of the household waste is officially collected. The remainder is mostly dumped at unauthorised garbage tips. A small part is recycled informally. It has been estimated that the urban waste production in Benin is about 400 g per person per day (ROB, 1992). In the Netherlands, waste production is much higher but - in general - effective collection schemes exist. On the other hand, here problems exist with processing collected waste (see also chapter 14)

Infrastructure
In general, infrastructure in urban areas is better than in rural areas. For access to safe drinking water and sanitation services this is shown in table 5.2. In Benin, also health services are reported to be better in urban areas than in rural areas. In fact, the World Bank mentions that a large number of doctors and teachers are holding administrative positions in main urban centres, in spite of a shortage in rural areas (WB, 1994b).

Table 5.2: Urban and rural access to safe drinking water and sanitation services[8]

	Access to safe drinking water		*Access to sanitation services*	
	Urban	*Rural*	*Urban*	*Rural*
Benin	41.0	43.0	60.0	4.0
Bhutan	75.0	54.0	89.6	17.9
Costa Rica	88	99	99.4	98.2
Netherlands	100.0	100.0	100.0	100.0

Source: WRI, 1996

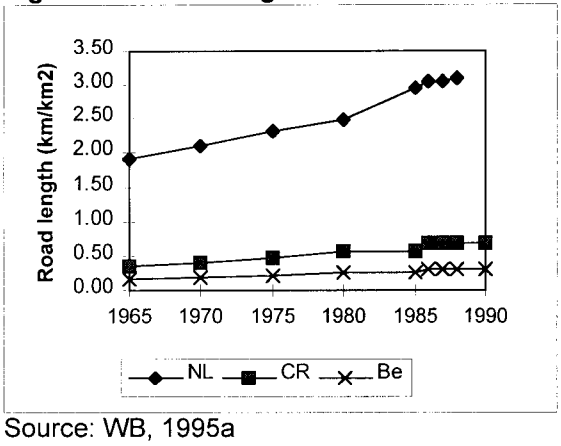
Housing / shelter

Rapid and uncontrolled urbanisation has resulted in Benin (esp. Cotonou) in urbanisation of areas which are unsuitable for construction because of regular flooding. In Bhutan another problem related to housing is reported: the use of fuel wood in unventilated houses causing a considerable amount of acute respiratory diseases (Flavin, 1991).

Roads

Figure 5.3 shows the length of roads versus the total surface of the country as given by the World Bank. The definition of road might not be equal for the three countries shown (for instance with respect to paved and non-paved roads). The road length might be related to total available infrastructure, but also to urbanisation, loss of wild areas, and pollution by traffic.

Figure 5.3: Road length



Source: WB, 1995a

Road length is highest in the Netherlands and increasing in all countries shown.

In all three countries road length is continuously increasing. The differences between the three countries are surprisingly small indicating some failure in the data - most probably related to different definitions. In Bhutan a report on road length suggests the ratio between length and total land surface could be around 0.08, so much lower than the other three countries. In Bhutan special attention should be paid to the issue of road development, since due to the steep slopes road development can lead to substantial environmental degradation, in particular deforestation and soil erosion.

[8] The same figures above have also been shown in a previous chapter on health. In that chapter also data from other sources were given that significantly differ from the WRI-data especially for Bhutan and Benin. In the World Bank data, urban quality is generally better than in the WRI-data.

Unemployment
Both in Benin and the Netherlands unemployment is an important issue in urban areas. Until recently, the social situation in the centre of the main cities of the Netherlands degraded: areas with high unemployment rates, relatively high crime rates, and related problems. This situation was related to the trend of 'suburbanisation', i.e. more wealthier people moved to towns surrounding the big cities. These processes appear to have slowed down. No data is available on poverty in urban areas in the four countries.

5.5 Response options

There are several possible response options available to deal with uncontrolled / unwanted urbanisation. These might include:

- regional planning
- sustainable, integrated urban planning
- rural development and poverty alleviation
- pollution abatement / air quality standards
- waste and waste water treatment

No data, however, was found on response options. Both in Benin and Costa Rica a lack of urban planning is reported as one of the causes of current urban problems (van Schaik, van Vuuren and de Kruijf, 1998; WB, 1994b).

5.6 Conclusions

There is some information available on the issue of urbanisation such as the size of the urban population and the size of the largest cities. Almost no information is available on air quality, waste production, safety or housing in rapidly urbanising areas in Benin, Bhutan and Costa Rica.

At the moment the Netherlands is strongly 'urbanised'. In Costa Rica and Benin urbanisation is a process that is currently occurring at high speed. In the Netherlands, specific problems are found in urban areas such as higher level of pollutants and specific policies for large urban areas are formulated. In Costa Rica, urbanisation is important in the Central Valley at the expense of productive agricultural areas. In the south of Benin, expansion of the large cities often occurs in areas not suitable for habitation (because of regular flooding). The scarce information suggests that fast urbanisation in Benin is causing some pressures on the quality of life and the environment.

6. Social, cultural and institutional factors

'Sustainable development' is strongly related to the way society is organised. The subject of this chapter - social, cultural and institutional factors of sustainable development - refers to some of those factors that provide human societies with the means to sustain social cohesion and also to deal with their natural environment. These include a common mutually shared acceptance of the subjects within the society with the forms of governance and a cultural identity and social behaviour which make a society more than the sum of the collection of the individuals. Without a sufficient degree of such identification - which can be the result of extreme inequity - social order is likely to collapse. For sustainable development, an analysis of the social and cultural factors should include the way a society perceives its own environment (e.g. ethics, religion, traditional (ecological) knowledge and social and political institutions).

There are still large methodological obstacles analysing this area of work, which makes a good discussion on the available information on this topic difficult. So far, these domains have not been fitted into methodological frameworks for analysis of sustainable development. Moreover, there are hardly quantitative indicators on social, cultural and institutional aspects in relation to an analysis of the sustainability of development. As a result, this chapter simply sketches some part of the cultural backgrounds of each of the four countries by giving information on its society, history and religion. In addition, attention is paid to participation, equity (in particular to gender equity) and finally to institutional development in the context of sustainable development. Topics that might be important but are not included are e.g. tolerance.

As a result of the lack of methodological frameworks, no overview figure is shown in this chapter.

6.1 History and religion

In the three tables below a summary is given of the main ethnic groups, religions and governmental systems in each of the four countries. The corresponding text includes a short description of the history, and important cultural elements of each of the four countries.

Table 6.1: Most important ethnic groups

Country	*Ethnic groups*
Benin	20-40 African ethnic tribes. The most important are the Fon and Adja (60%), the Yoruba-Nago (12%), the Batanou (9%), the Dendi (3%), the Ditamari (7%) and the Peul (6%).
Bhutan	Bhutanese 50%, ethnic Nepalese 35%, indigenous or migrant tribes 15%[9]
Costa Rica	White (including mestizo) 96%, black 2%, Indian 1%, Chinese 1%
Netherlands	Dutch 96%, Moroccans, Turks and others 4% (1988)

Source: CIA, 1996; ROB, 1991

In each country more than one ethnic group is present.

[9] In other sources sometimes different percentages for the three main groups are found.

Table 6.2: Most important religious groups

Country	*Religious groups*
Benin	70 % Traditional, 15 % Christianity, 15 % Islam
Bhutan	75 % Lamaistic Bhuddism, 25 % Indian/Nepalese Hinduism
Costa Rica	93 % Roman Catholic, 7 % Protestant
Netherlands	36 % Unaffiliated, 34 % Roman Catholic, 25 % Protestant, 3 % Muslim, 2% Other

Source: CIA, 1996

There are large religious differences both within and between the four countries.

Table 6.3: Governmental system

Country	*Governmental system*
Benin	Republic, democratic multi party system
Bhutan	Democratic monarchy, no parties; national assembly is chosen indirectly by local authorities (2/3) and by religious authorities and king (1/3).
Costa Rica	Republic, democratic multi party system
Netherlands	Constitutional monarchy, democratic multi party system

Source: CIA, 1996

Table 6.4: Average household size

Country	*Persons / household*	*Year*	*Source*
Benin	5.4	1979	WB, 1995b
Benin	6.6	1990	WB, 1994b
Costa Rica	5.6	1970	WB, 1995b
Costa Rica	4.4	1990	Mideplan, 1996
Netherlands	3.2	1971	WB, 1995b
Netherlands	2.4	1994	CPB, 1996

The average household size is smallest in the Netherlands

Benin

Between the 12th and the 19th century, five kingdoms - Allada, Abomey, Ouida, Nikki, and Porto-Novo - occupied the area that is now Benin. The kingdom of Abomey (or Dahomey) gradually consolidated its power and conquered neighbouring states. During the seventeenth century, the French and other European countries opened trade-posts in Benin and eventually Benin became a French colony. In 1960, Benin became independent, and after a period of political upheavals a centrally controlled government was installed based on Marxist Leninist ideology. At the end of the 1980s, the country ran into a complete crisis, as a result of which in 1990 the Marxist ideology was abolished as state philosophy and a multi party system (Republic) was installed.

Benin is a country of great diversity. Twenty to forty distinct socio-cultural groups live in Benin, many of them with their own language. With respect to religion, Christianity and Islam have been transposed upon a situation where animist traditions continue to persist. The major groups are the Fon and Adja peoples, the Yoruba-Nago, Batonou the Dendi, the Ditamari and the Peul. About 70% of the people of Benin live in the south and conflicts over land are starting to increase. The largest tribe in Benin are the Fon, and this group currently dominates the governmental institutions. Efforts are made to change this situation.

Most of people of Benin live in agricultural areas, where economy is based almost entirely on small family farms that produce little more than is needed by each family. Traditional relationships are in these areas very important. In the south, the cities are growing fast. The traditional family relations are less strong in the cities, which in case of poverty means that there is little social security.

Bhutan
Bhutan was founded in the sixteenth century. Until the beginning of the 20th century, Bhutan lacked a strong central authority and was isolated from the rest of the world. The history of modern Bhutan started with the installation of a centralised monarchy in 1907. However, until the 1960s Bhutan remained largely untouched by developments of the outside world. After this period, Bhutan started to aim for fundamental political reform and economic development on the basis of successive Five-Year plans. According to these plans, all steps are made carefully and impacts on the Bhutanese society are thoroughly considered. In fact, Bhutan is trying to adapt itself to 20th-century opportunities, while at the same time, maintaining pride in traditional culture.

There are six different ethnic groups in Bhutan. Most of the Bhutanese people are of Tibetan ancestry (the Bhote or Bhutia) and share a common heritage of Tibetan culture and religion. The Bhutia mainly live in northern and central Bhutan. Other ethnic groups are the Sharchogpas, the semi-nomadic Drogpas, and the Merak and Sakts. These groups share many cultural elements, and most of them are Mahayana Buddhists. The last ethnic group are the Nepalese Lhotshampas living in the southern part of Bhutan. Many of the Nepalese have settled in Bhutan during the beginning of the century, encouraged by a settlement policy of the British, and immigration continued throughout the century. In some areas the Nepalese settlers now even have a majority. Culturally there are strong differences with the other ethnic groups: e.g. their religion is Hinduism and their chief language is Nepali. Since the 1980s, tensions have developed between the Nepali settlers and the Bhutanese government.

The state religion of Bhutan is Mahayana Buddhism (approximately 75 percent of the people are Mahayana Buddhists). Buddhism serves as an important determinant of values and behaviour patterns in daily life of most Bhutanese. This includes an enormous respect for life in all its forms - human, animal and plant. As example of this is the 1959 Forest Act, one of the first laws of Bhutan. Among other aspects of forest management, it states that minimally 60 % of the country should be covered by forest (at present this is between 55 - 70 %) (World Bank, 1994).

In Bhutan, the king is head of state. All laws have to be approved by parliament. Members of Parliament are via dzongkags (district) elections indirectly chosen by the people (50 % of members) , and partly (the other 50 %) nominated by the king. Since 1981, Bhutan tries to increase public participation, not via NGOs (as done in many other countries) but via a form of governmental decentralisation and dialogue.

Costa Rica
Several Indian tribes settled down in Costa Rica before 300 BC. The Chorotegas were the most important group of them. At the end of the sixteenth century, Costa Rica was conquered by the Spanish. However, lacking precious metals and supply of Indian labour, Costa Rica attracted only few Spanish colonists. In the 19th century, Costa Rica became independent of Spain but remained strongly oriented on exports to Europe and the United States. After a

period of public unrest, in 1948 a military junta, headed by Figueres, installed the Second Republic based on a multi-party system.

The inhabitants of Costa Rica are almost all descendants of the Spanish. Only 1 % of the country is Indian. Other minorities are black (2%) and Chinese (1%). The most important religions in Costa Rica are the Roman-Catholic and Protestant churches.

Costa Rica differs politically and socially from most of its Latin American neighbours. Wealth is more evenly divided and far more is spent on education than on support for the military. The government strongly supported the peace process in Middle America, for which president Arias in 1987 received the Nobel-price. Sustainable development and environmental protection are at the moment important policy topics in Costa Rica.

The Netherlands
Several Germanic tribes settled in the Netherlands during the first Millennium. Culturally the Dutch have been strongly influenced by other European cultures. The Netherlands declared itself an independent state in 1572, during a war against the Spanish from 1568-1648. Since the 19th century the Netherlands is a constitutional kingdom with a multi-party system.

During its history, many foreigners have settled in the country. In the 20th century, hundred-thousands of people from the former colonies Indonesia and Surinam people moved to the Netherlands. In addition, a large group of foreign workers- mainly Turks and Moroccans - have remained as permanent residents.

The Netherlands may be described as a highly consensus-based community with a planning tradition for a wide range of aspects of society. A typical Dutch feature is the long tradition of government consultation of various groups in society. Current practice in the field of environmental policy making continues and strengthens this habit (OECD, 1995).

The influence of Christianity on the Dutch culture is strong, despite the fact that most Dutch have become 'unaffiliated'. Within the Christian approach to nature, in general, humans are not considered to be part of and subject to nature, but are considered to have a stewardship position (Pojman, 1994): Humans are allowed to use nature for their development, but they are morally obliged not to destroy it. However, there is a range of other views with regard to nature present in the Dutch society (e.g. Pojman, 1994; Zweers, 1995).

6.2 Social expenditures and social security

The provision of social services such as education, health and social security is very different between the four countries. Table 6.5 shows the governmental expenditures on certain social services, expressed as share of GDP. In the 'welfare' economy of the Netherlands, social services are largely provided for by the government, and consequently form a large share of the governmental budget. However, in recent years the tendency exists to privatise several of these services. In Benin and Bhutan, these services are not primarily provided by the government, but by the (extended) family, community and various local associations. The World Bank (1994b) comments that 'while the persuasiveness and importance of these systems is certain, the system also has it limitation: their effectiveness is related to the means available to their members (and their generosity)'.

Consequently the table shows that the Dutch government spends the largest proportion of GDP on social services such as education, health, and social benefits, followed by Costa Rica. One should note that definitions and accuracy of the data might strongly differ between the four countries. It is noted that in Benin and Bhutan traditional extended family values and practises which includes taking care of the elderly by family members is prevalent.

Table 6.5: Public Expenditures on social services (as % of GDP)

	Benin 1989-1991 (% of GDP)	*Bhutan* 1989-1993 (% of GDP)	*Costa Rica* 1989-1992 (% of GDP)	*NL* 1992-1994 (% of GDP)
Education	5.4%	4.2%	3.7%	5.7%
Health	0.8%	2.1%	5.0%	8.9%
Urban development	0.7%	0.2%	2.0%	pm
Social security	0.3%	pm	5.2%	7.5%
Recreation, culture and religion	pm	pm	0.2%	0.8%

Source: Benin (WB, 1994b), Bhutan (WB, 1994a), Costa Rica (EdlN, 1995), Netherlands (CPB, 1996).
Overall, Dutch public expenditures on social services are highest

6.3 Participation

Participation of various groups in decision-making is considered to be an extremely important aspect of sustainable development (see Agenda 21, 1992). One reason is that sustainable development is (at least partly) based on social values and choices and to ensure that values and knowledge of different groups are included, participation of these groups is a necessary condition.

The actual form of participation can be totally different. In Bhutan, the government aims to increase participation by means of governmental decentralisation. An alternative form of participation, which has been successfully applied in many other countries around the world, is encouragement of NGOs and their participation in decision-making (e.g. the Netherlands and Costa Rica). Experience in these countries has shown that the strength of NGOs is especially determined by their network. In Benin a large number of NGOs have been developed and registered in recent years partly in response to external financing opportunities. However, since NGO development is new, their strength and especially co-ordination of their efforts still has to grow (Wolfers, 1996).

At the moment, no comparable data was found on the issue of participation.

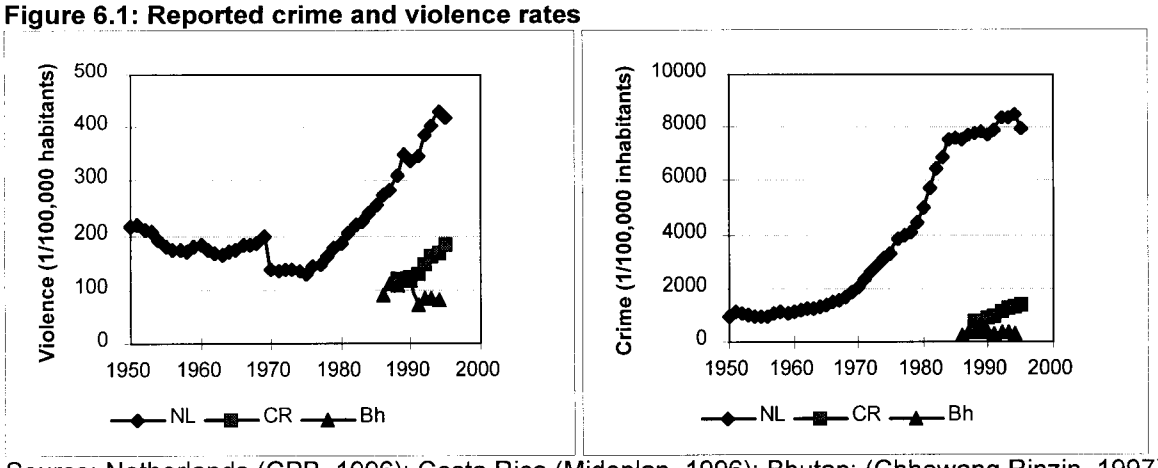
6.4 Other data on cultural and social issues

More data is available from the national statistical offices of the Netherlands and Costa Rica. Two topics have been selected: crime and visits to performed arts and museums.

Crime

Many people in the Netherlands will immediately think of crime when they are confronted with the word safety. Crime as an indicator could also be seen as some measure for social cohesion. Figure 6.1 presents only crime rates for the Netherlands, Costa Rica and Bhutan for Benin no data were available.

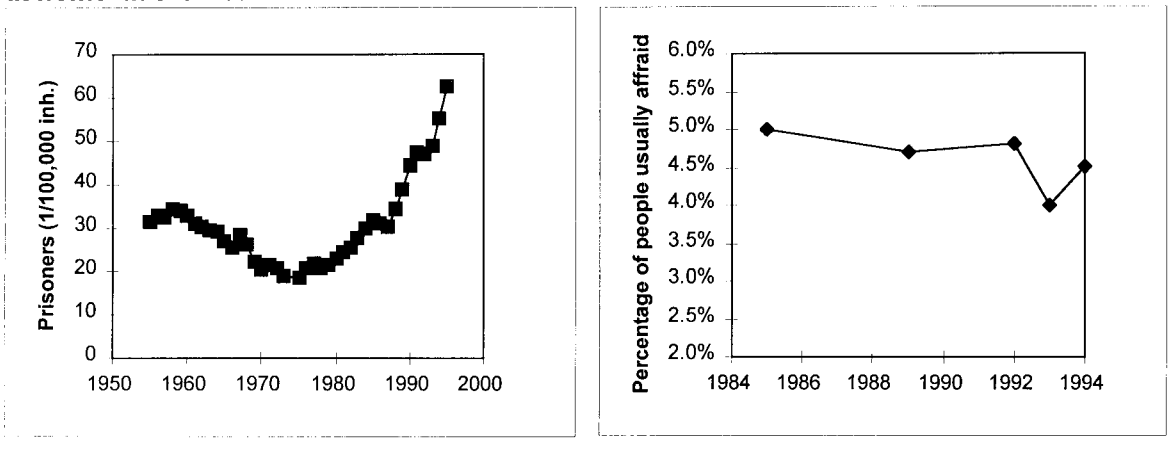
Figure 6.1: Reported crime and violence rates



Source: Netherlands (CPB, 1996); Costa Rica (Mideplan, 1996); Bhutan: (Chhewang Rinzin, 1997)
Reported crime rates in the Netherlands are much higher than in Costa Rica

Crime rates have increased considerably in the Netherlands and Costa Rica over the last decades. Total crime rates in the Netherlands seem to have stabilised during the early nineties. Normal crime rates in Bhutan are very low. It should be noted that when non-reported crime is included, estimates are much higher (in the Netherlands around 4/10 inhabitants for total crimes). The increase of crime rate is partly a result of a higher rate of registration of crimes.

Figure 6.2: Total amount of prisoners and percentage of people 'usually afraid during evenings at home' in the Netherlands.



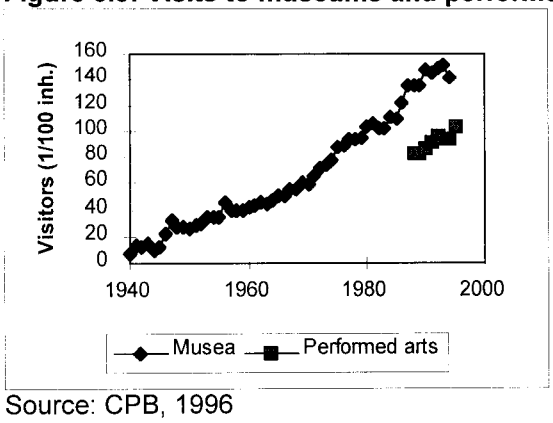
Source: CPB, 1996
Almost one per thousand inhabitants are in prison in the Netherlands.

Figure 6.2 (left) shows the total amount of prisoners in the Netherlands. Over the past two decades this number has increased to about 65/100,000 inhabitants. The growing amount of prisoners is largely the result of drugs and the growth of professional criminality. Figure 6.2 (right) shows that the percentage of people that are afraid during evenings at home has remained almost constant around 4-5% during the 1980s and 1990s.

Performed arts and museums

Figure 6.3 shows the total amount of people visiting two 'traditional' forms of social amusement: performed arts (music, theatre etc.) and museums visits per 100 inhabitants. The number of museums visits can also be regarded as an indication of interest in (past) culture.

Figure 6.3: Visits to museums and performed arts



Source: CPB, 1996

Visits to museums and performed arts per inhabitant are gradually increasing.

Over time, both museums visits and visits to performed arts have been increasing strongly, despite the availability of all kinds of new forms of social and non-social amusement (amusement parks, dancing's, pop concerts and television etc.). There is a tendency towards a 'sensorial' culture-experience (Metze, 1996). In their free-time, the Dutch search more-and-more for a large diversity of more intense stimuli. Aspects that are not included here, but might be related to cultural participation are religious and traditional activities.

6.5 Equity and gender equity

Two aspects of equity have been included in the economic sections: 1) equity between nations (in terms of development assistance, chapter 7), and 2) equity within a nation (in terms of income distribution, in chapter 9). In the chapter on urbanisation some attention was paid to the comparison of urban and rural quality of life. On the question of minorities not much data is available, except for the size of the major ethnic groups in each of the four countries which was shown earlier in this chapter. In this section only gender equity is discussed.

Gender equity

UNDP has made some indicators related to gender equity. The first index, the Gender Development Index is equal to the Human Development Index, but recalculated especially for women - called (GDI).

Table 6.6: Various data on women empowerment, data 1995 or latest available

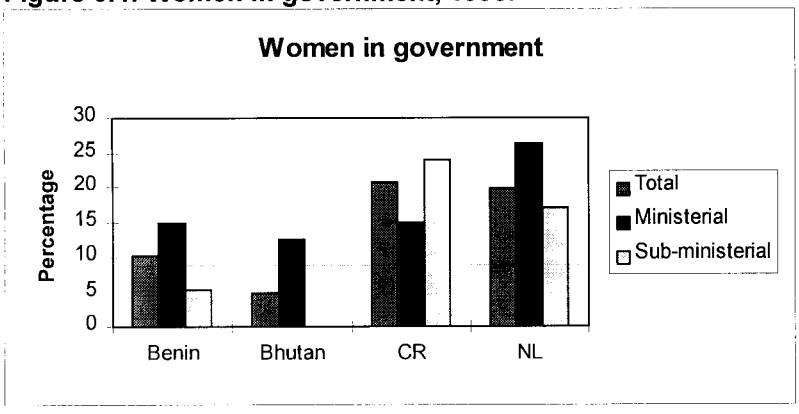
	Seats held in parliament (% women)	*Administrators and managers* (% women)	*Professional / technical workers* (% women)	*Total adult labour* (% women)	*Earned income* (% to women)
Benin				48	
Bhutan				39	
Costa Rica	14	21	45	28	26
Netherlands	28	15	44		33

Source: UNDP, 1996

In case of Benin, Costa Rica and the Netherlands (no data was available for Bhutan) the GDI is not only lower than the average HDI, but all three countries also score slightly worse than countries with comparable HDI. The data included in the second index, the Gender Empowerment Index, is shown in the table 6.6, in addition with data on the female share in the total labour force. Figure 6.4 shows the share of women in government in each of the four

countries. In each of the countries women have a lower participation rate in various jobs, in parliament, in government and in income earning jobs than man.

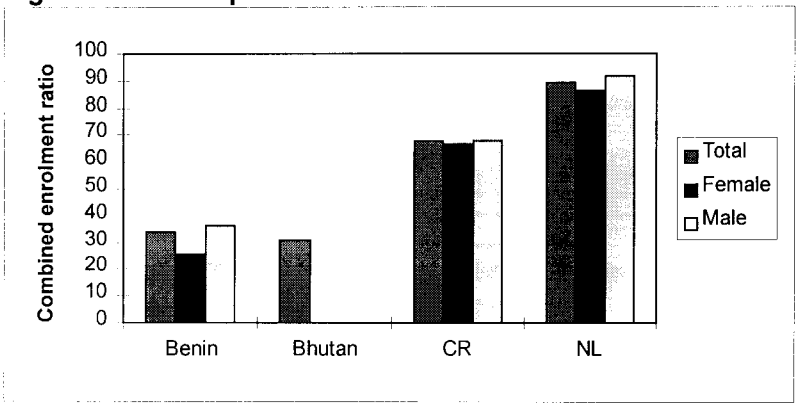
Figure 6.4: Women in government, 1995.



Source: UNDP, 1996
Note: the horizontal dotted line shows world average for total women in Government.
Percentage women in government is below 30% in each of the four countries

An important aspect of improving the position of women is a higher participation in education. Women education is not only important with respect to gender equity; it is also mentioned with respect to mitigating population growth.

Figure 6.5: Participation of women in education.



Source: UNDP, 1996
Participation of men is higher that that of women in all four countries.

Figure 6.5 shows that in Costa Rica and the Netherlands female participation in education is slightly lower than male participation. In Benin the difference is much greater, which has been discussed earlier in chapter 4. No data were available for Bhutan, but other reports indicate that also here there is some difference in participation.

Some argue that gender-indicators and indices as discussed above are strongly correlated with economic development of a country, and reflect a rather 'western way' of thinking. For the four countries currently a project has been started which has the intention to develop indicators that are more useful for comparing the four countries, with a totally different state of economic development and a different culture (Ecooperation, 1997).

6.6 Institutional development

Sustainable development and environmental protection are relatively new concepts. In many countries the institutions needed to achieve these goals still have to be developed. In their indicator-system, the DPCSD suggests several indicators that could be used for institutional development (UN.DPCSD, 1996). However, the DPCSD also admits that better indicators still need to be developed.

Communication profile

Communication is critical for all kinds of decision-making, thus also to support sustainable development. In table 6.7, three means of communication have been selected on which data could be found. No data was found on more traditional forms of communication. As a result, the data are less relevant for Bhutan and Benin: in these countries radio, telephone lines or books simply do not represent the main forms of communication. Some consider the modern 'telecommunication' such as radio and telephone to be relatively benign to the environment which is also the case for many of the traditional forms of communication. The number of radio and telephone lines per people is by far highest in the Netherlands, followed by Costa Rica and much lower for Benin and Bhutan.

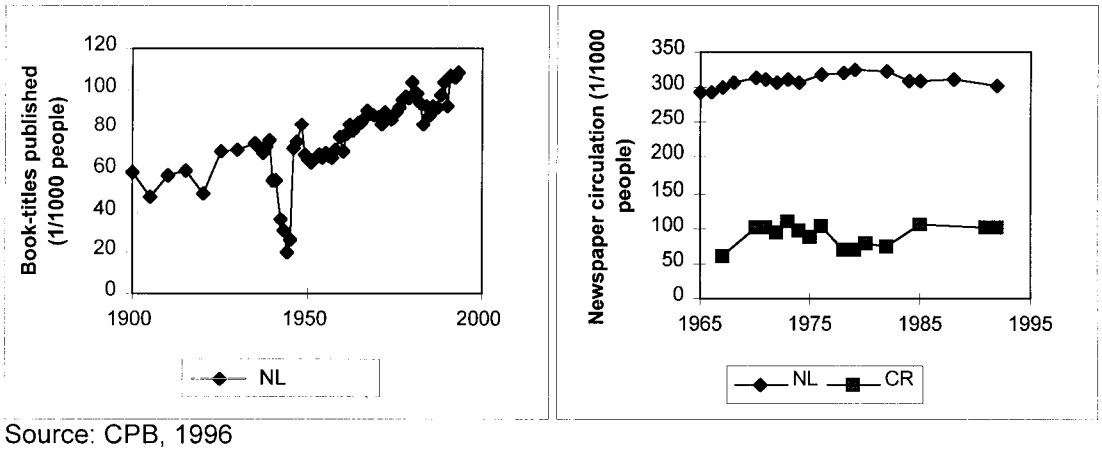
Table 6.7: Communication profile

	Radio (1/1000 people) 1992	*Main telephone lines (1/100 people)* 1991	*Book titles published (1/100000 people)* 1990-1992	*Traditional forms of communication*
Benin	90	0.3	13	pm
Bhutan	16	0.2		pm
Costa Rica	258	9.8	7	pm
Netherlands	907	47.7	78	pm

Source: UNDP, 1996

Data on communication is incomplete; modern communication techniques are most used in the Netherlands

Figure 6.6: Book titles published per capita in the Netherlands and newspaper circulation in Costa Rica and the Netherlands



Source: CPB, 1996

The differences between the three countries for book titles is less striking as with regard to the modern forms of communication. For the Netherlands, also data was available on the trend over time (Figure 6.6). Over the whole period, the number of book titles published per capita

has been slowly increasing only disturbed by external effects as the Second World War and economic crises.

The last type of information available is newspaper circulation, also shown in figure 6.5. Newspaper circulation in Costa Rica and the Netherlands is almost constant, circulation in the Netherlands is about three times higher.

Institutional framework for sustainable development
Decision-making for sustainable development and environmental protection requires new policy instruments and institutions. Some of these instruments are the formulation of sustainable development strategies, installation of a national council for sustainable development and the use environmental impact assessments. Table 6.8 gives the status of the use of these instruments.

Table 6.8: Instruments for sustainable development

	Benin	*Bhutan*	*CR*	*NL*
Sustainable development strategies	Nat. Envirnm. plan being developed	Sustainable Development chapter in Five-Year plan	Yes	Nat. Envirnm Plan Environment - Economy (1997)
National council for sustainable development	Yes	Yes - Nat. Env. Committee	Yes	Yes
Mandated Environmental Assessment	Yes, limited experience	Yes - limited experience	Yes, large amount of experience	Yes, large amount of experience

Source: various sources

The four countries all do very well on these points. One should note that Bhutan, Costa Rica and the Netherlands were among the first countries in the world formulating comprehensive sustainable development philosophies. In Benin, responses to promote sustainable development are more recent; environmental awareness has started to develop through the Environmental Action Plan preparation process, initiated in 1991.

In spite of the achievements in table 6.8, institutional development is still very important. In Bhutan for instance, there are still several constraints to environmental management with respect to: trained manpower, lack of data and research support, inadequate infrastructural facilities and inexperience (Flavin, 1991). At the same time, one should realise that Bhutan is a relatively environmentally sound country.

International co-operation
Ratification of global environmental agreements could be interpreted as the country's commitment to work towards sustainable production and consumption patterns on the basis of international co-operation and agreements. The agreements mentioned in table 6.9 above the horizontal line are selected by DPCSD to be part of their indicator 'ratification of global agreements'. A distinction has been made between full 'parties' of the agreement and the situation in which a country has 'signed but not ratified yet'

The Netherlands has signed most agreements of the four countries, followed closely by Costa Rica and (especially for the first group of agreements) Benin. Bhutan has signed the lowest number of agreements (several agreements are not really relevant for Bhutan). One should realise that the Netherlands also causes larger and more global environmental pressures than

the other SDA countries and is therefore 'morally' obliged to sign more of the agreements. But, ratification does not necessarily mean adherence or implementation.

Table 6.9: Signing and ratification of global environmental agreements

	Benin	*Bhutan*	*CR*	*NL*
• Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal				P
• Convention on Biological Diversity	P	S	P	P
• Framework Convention on Climate Change	P	S	P	P
• International Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa	S		S	S
• The Vienna Convention for the Protection of the Ozone Layer and its Montreal Protocol on Substances that deplete the Ozone Layer	P		P	P
• United Nations Convention on the Law of the Sea	S	S	P	S
• Convention on the Prevention of Marine Pollution by Dumping Wastes and Other Matter (London Convention)		NR	P	P
• Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques	P			P
• Convention on Wetlands of International Importance Especially as Waterfowl Habitat			P	P
• International Convention for the Regulation of Whaling		NR	P	P
• International Tropical Timber Agreement, 1994				
• Protocol 1978 Relating to the International Convention for the Prevention of Pollution From Ships (MARPOL)		NR		P
• Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space, and Under Water	P	P	P	P

Source: CIA, 1995
Note: P = Party
S = Signed, but not ratified (1995)
NR = Not relevant

Commitment to agreements on human rights could be interpreted as a sign of a country's commitment to co-operate internationally on the protection of human rights. Table 6.10 indicates that of the four countries only Bhutan has not signed the selected agreements.

Table 6.10: Signing and ratification of global agreements on human rights

	Benin	*Bhutan*	*CR*	*NL*
• International Covenant on Economic, Social and Cultural Rights	p		p	p
• International Covenant on Civil and Political Rights.	p		p	p
• Convention relating to the Status of Refugees plus its protocol	p		p	p
• Declaration against Torture	p		p	p

Source: Amnesty International, 1995
Note: P = Party
S = Signed, but not ratified (1995)
NR = Not relevant

6.7 Conclusions

There are few data available which allow comparison between countries on social, cultural and institutional issues. Data collection and interpretation for human well-being, social capital and culture are negatively influenced due to the absence of universal definitions for these concepts. Moreover, these issues are difficult to capture in a few quantitative indicators. It may be easier to characterise the status of a community in terms of pattern rather than a number (Bakkes, 1997). As a result in this chapter there are almost no data, apart from some anecdotal material.

The short historical overview of the four countries gives some indication of their different cultural backgrounds and different viewpoints on their natural environment. Especially the Bhutanese emphasise the importance of their Bhuddist cultural convictions on environmental protection.

In all four countries, there is more than one cultural group present. All four countries have included public participation into their decision-making systems (although very different).

The provision of social services such as education, health and social security is very different between the SDA countries. Since in the Netherlands, basic needs are at least partly provided by the state, overall Dutch public expenditures on social services are the highest of the four (in recent years more-and-more the provision of such needs is turned to the private sector). In Benin and Bhutan the (extended) family, community and various local associations are responsible for social services.

With respect to the issue of participation and equity, almost no data was found, despite the importance of these concepts. *Security* is considered to be a broad, but important issue, for human development. One aspect is crime. Crime rates have increased considerably in the Netherlands and Costa Rica over the last decades. Currently, reported crime rates in the Netherlands are much higher than in Costa Rica and Bhutan.

For each of the four countries, gender indicators as used by UNDP show that there are still important differences between access to education, societal participation and current employment positions between men and women.

As to institutional development, limited data is available. The available information on institutional development for environmental policy making shows that - on paper - the four countries are doing relatively well. Bhutan, Costa Rica and the Netherlands were among the first countries in the world to formulate sustainable development philosophies. In Benin, responses to promote sustainable development are more recent; environmental awareness has started to develop through the Environmental Action Plan preparation process initiated in 1991.

Each of the four countries has signed several multilateral environmental agreements. The Netherlands has signed the most agreements of the four countries, followed closely by Costa Rica and (especially for the first group of agreements) Benin. Bhutan has signed the least number of agreements (several agreements are not really relevant for Bhutan). The Netherlands also causes larger and more global environmental pressures than the other SDA countries, and could therefore be regarded as 'morally' obliged to sign more of the agreements. Ratification does not necessarily mean adherence or implementation.

Part 2: Economic domain

Chapter 7: Economy

Chapter 8: Wealth of Nations Estimates

Chapter 9: Poverty and income inequality

7. Economy

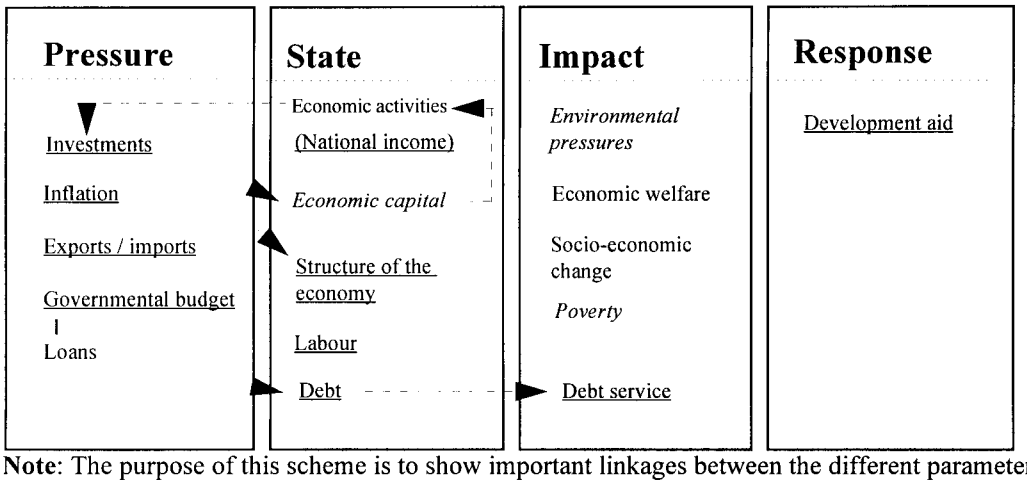
One of the objectives of sustainable development is to promote a sound economy in order to generate the resources to meet people's needs. These resources can also be used for the protection for human health and the natural environment. However, most economic activities - such as industrial production and transport - are at the same time important pressures on the environment.

7.1 Introduction

Basically, the economic domain involves all elements related to the provision of scarce goods (such as food, water but also money) to humans. With regard to sustainable development, the general goal in the economic domain is to ensure a decent material standard of living. In recent years, 'ecological economics' have increasingly paid attention to the role of environmental services and natural capital for this standard of living. In the next chapter we will focus on different forms of capitals, by discussing the estimates of the World Bank. In this chapter attention will be paid to 'more traditional' measures of the economic situation of a country. The topic of poverty is discussed in chapter 9.

The figure below provides an indication of the information covered in this chapter.

Figure 7.1: Overview of the information presented in this chapter



Note: The purpose of this scheme is to show important linkages between the different parameters relevant for the issue and the data presented. For underlined parameters information is included in this chapter; for parameters in italic print information is included in other chapters. For parameters in normal print no information is included in this report.

An important aspect of the economy is the small loop indicated in the upper left corner in the figure (the units of the items in this loop are not necessarily monetary). Investments can create capital to produce goods. These goods (here indicated as national income) can either be consumed (not indicated) or invested to produce new capital. Result of this loop is the provision of goods, in other words economic welfare.

7.2 The economy of the four countries

The basic structure of the economies of the four countries is very different. In short, the Netherlands has an affluent, service economy based on private ownership. In comparison with other European countries, the Netherlands has a large energy-intensive industrial sector (chemicals, metal industry). Bhutan has a rural economy based on agriculture and forestry. The small industrial sector is largely made up by large public sector companies, although in recent years Bhutan shifted to larger private Initiative. In Benin, the agricultural sector is the most important sector, generating a major share of the foreign exchange earnings. The industry sector is very small. Benin takes part in a World Bank structural adjustment plan since 1989. Costa Rica's per capita income places it at the higher end of middle-income countries. Over the last three decades, the service sector has been gradually expanding its share of GDP. In the early 1980s Costa Rica's economy plunged into strong recession, but stabilisation and adjustment efforts finally have reduced the major macro economic imbalances.

7.3 The national accounts indicators - GNP / GDP

National income

The most commonly used indicators for the size of a nation's economy are the Gross Domestic Product (GDP), i.e. the value of all marketed final goods and services produced within a country and Gross National Product, i.e. GDP plus net income earned in other countries[10]. The GDP figures given in table 7.1 are based on purchase power parity (ppp), which means that they have been corrected for differences in the actual value of currencies in countries compared to official exchange rates. The results of this correction is that GDPs of Benin and Bhutan and to a lesser extent also Costa Rica are significantly higher than suggested.

Table 7.1: GDP and GDP per capita

	GDP (ppp) 1992 mln US$	*GDP per capita (ppp) 1992 US $*
Bhutan	1,118	870- 1,800
Benin	5,948	1,245
Costa Rica	14,403	4,522
The Netherlands	263,549	17,373

Source: WRI, 1996

The level of GDP per capita is highest in the Netherlands

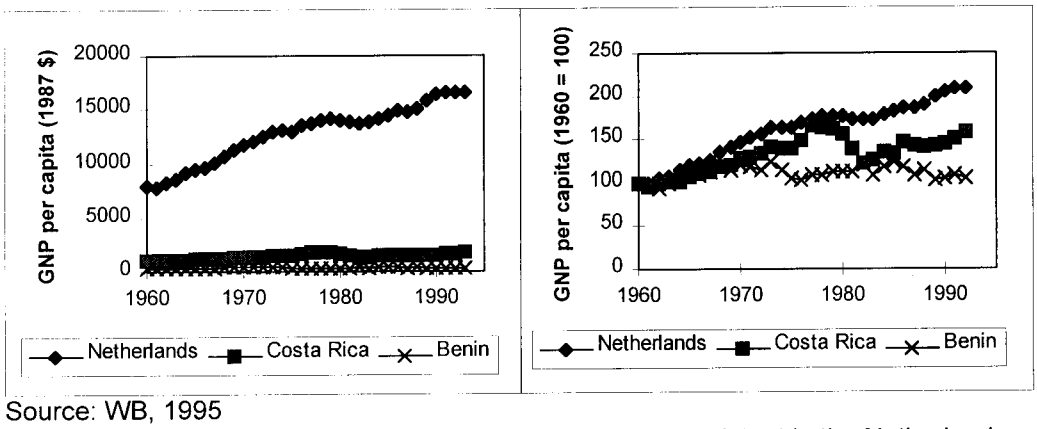
As mentioned in the footnote below, GDP underestimate the total size of the economies, especially in non-industrialised countries by not including activities such as subsistence farming. In Benin, the so-called informal economy is very large (van Schaik, van Vuuren and de Kruif, 1998).

[10] The 'per capita' figures of GDP and GNP are often used as measures of welfare, but their use for this purpose has been criticised. GDP and GNP do not include non-market activities and goods such as voluntary work, household activities and many functions of natural resources (see e.g. Daly and Cobb, 1989). Subsistence farming – an important activity in rural societies such as Benin and Bhutan – is not included in GDP and GNP. The figures can be used to compare the total volume of marketed goods and services or the average personal income on the basis of these goods.

The Netherlands' GDP per capita (based on purchase power parity) is about 4 times that of Costa Rica, and about 10 times that of Bhutan and Benin. The national accounts data for Bhutan are relatively uncertain. Non-ppp corrected data for Bhutan indicate a GDP per capita of 485 US$. In table 7.1, the GDP figures have been recalculated to deal with the overestimated population (reported per capita GDP-ppp was 870 1992 US$).

Figure 7.2 shows the level of GNP per capita since 1960 (both in actual numbers and as index). Over the last decades economic growth has been most consistent in the Netherlands. Costa Rica plunged into a very serious recession in the beginning of the 1980s and only in 1993 did the country reach again the same level as in the late 1970s. GNP per capita in Benin did not grow since 1960, partly as a result of a collapse in West African trade, but - according to the World Bank - also due to inefficiency and poor management of productive sectors dominated by the state. In 1989 the situation had become so serious that the government had to adopt a structural adjustment plan, with assistance of the World Bank and IMF.

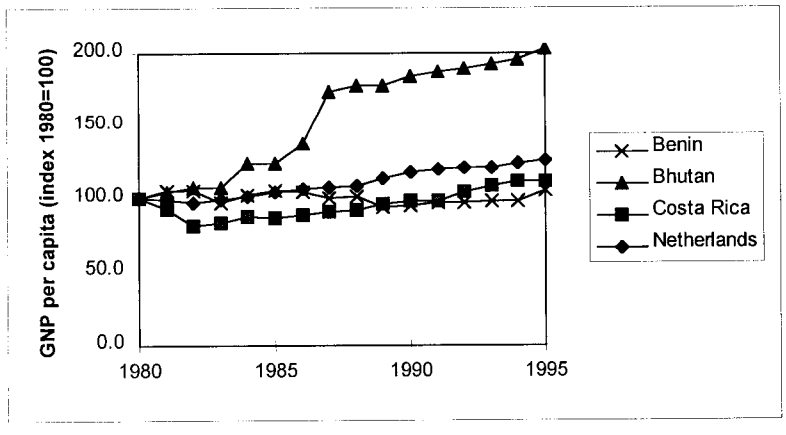
Figure 7.2: GNP per capita in the period 1960-1993



Source: WB, 1995

Over the last decades economic growth has been most consistent in the Netherlands

Figure 7.3: GNP per capita in the period 1980-1993 (1980 = 100)



Source: WB, 1997

Growth in the period 1980-1993 has been strongest in Bhutan

In Bhutan, (figure 7.3) GNP per capita has grown greatly, with a special inpetus in 1987, when a large hydropower station was put into action. The strong growth of the power and industrial

sectors has been the result of hefty governmental investments, based largely on donor support of the international community and revenues from electricity exports.

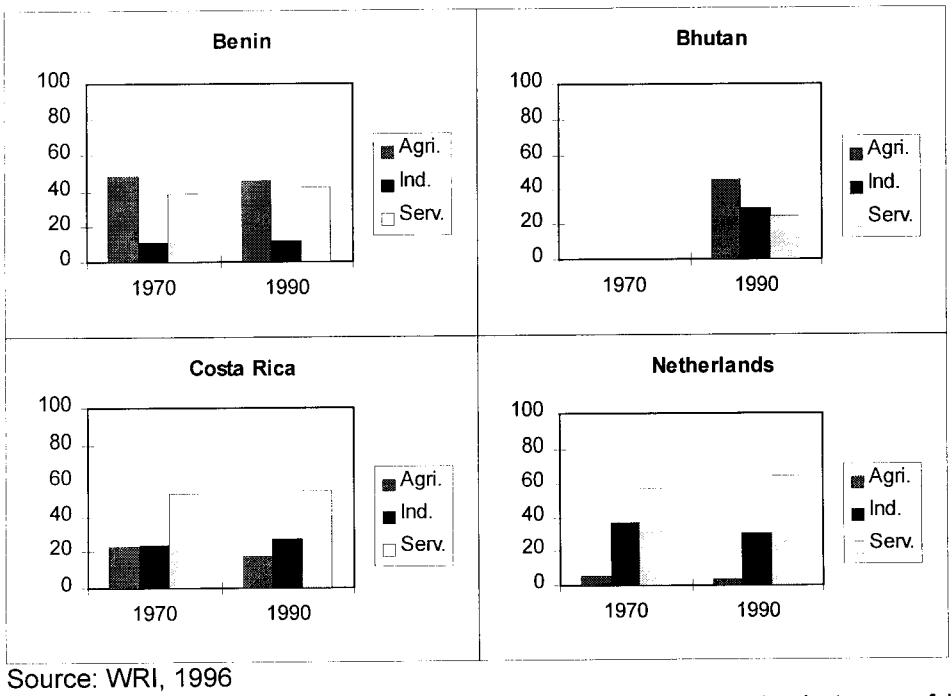
Structure of the economy

The structure of the economy - i.e. the relative size and activity of the various (sub)sectors of the economy - is not only important for the economy of the country, but also for the development of environmental problems. The sectors included in figure 7.4 are the agricultural sector, industry and services. Slightly alternative figures with respect to the size of these three sectors have been found in other sources (e.g. World Bank 1995a). For the Netherlands and Costa Rica more detailed data are available (Mideplan, 1996; CPB, 1996).

Agricultural sector

The agricultural sector is the main pillar of the economy in Benin and Bhutan. The structure of the agricultural sector in these countries is mostly traditional: small subsistence farms produce food mainly intended for own consumption. In Benin the sector also includes the cotton production, which is the main source of export (and thus generates foreign currency) and the 'engine' of economic growth over the past decade. However, due to the steady decline of the world cotton prices, conflicts over land, and environmental problems associated with cotton production, the cotton sector cannot be expected to play such a role in the future.

Figure 7.4: The share in GDP of industrial, agricultural and services sectors



Source: WRI, 1996

In Benin and Bhutan the agricultural sector is the largest sector in terms of its share in income; in Costa Rica and the Netherlands the service sector is the largest.

Note: Agri : Agriculture; Ind : Industry; Serv. : Services.

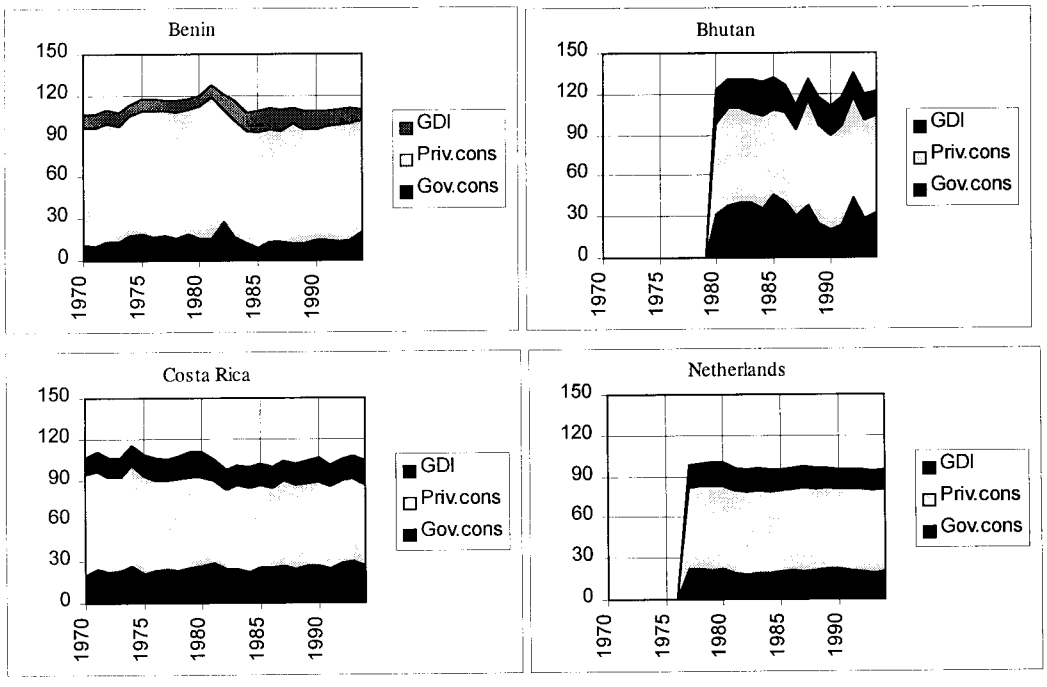
In the Netherlands, the agricultural sector is small in terms of its share in national income. In contradiction with the situation in Benin and Bhutan, agriculture is concentrated in large farms producing food for the national and international market. The situation in Costa Rica is in between these two extremes. Similar to Benin, the agricultural sector in both Costa Rica and the Netherlands has an important role in export.

The industrial sector
In terms of share in national income, the industrial sector is an important sector in Bhutan, Costa Rica and the Netherlands (between 20-30% of national income). In Bhutan the sector (in particular energy production) has been growing strongly during the last decade. In Costa Rica the industrial sector is growing slowly, while in the Netherlands the share of the industrial sector in national income is currently declining. The small industrial sector in Benin mainly consists of a small off-shore petroleum industry.

Services
Benin has a large service sector, mainly consisting of dynamic and informal commercial activities. The 'informal economy' includes two main activities: micro-enterprises (restaurants, street vendors, transport) and cross border trade with Nigeria. The transport and the trade sector in Benin are relatively large due to Benin's favourable geographic position. In the Netherlands, the same trend as in most western economies can be observed: a decline of the traditional heavy industry and a strong growth of the service sector (now accounting for more than 60% of national income). The service sector in Costa Rica accounts for more than 50% of national income and its share is still growing. Bhutan has a relatively small service sector.

Breakdown of national Income into expenditures
GDP can also be broken down into types of expenditures. In the figure 7.5, investment (gross domestic investments or GDI), private consumption and governmental consumption are shown.

Figure 7.5: Breakdown of GDP in types of expenditure

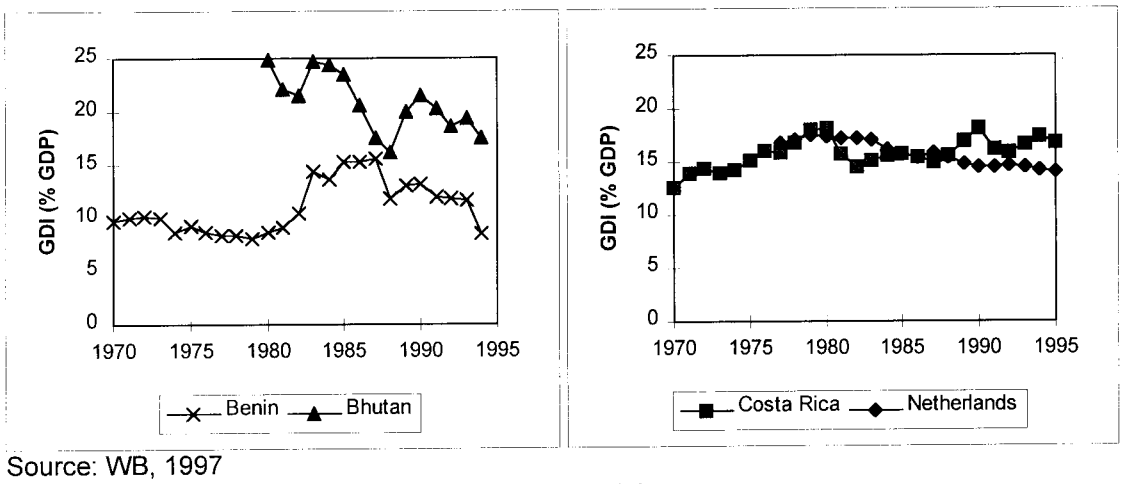


Source: WB, 1997
Note: GDI = Gross Domestic Investments; Priv. cons = Private consumption; Gov. cons = Governmental consumption.

The total of the three items included in figure 7.5 can be higher than GDP as a result of trade (as is the case for Benin and Bhutan). This, however, implies a strongly negative trade balance. Private consumption as share of GDP has been increasing in the Netherlands, but decreasing in Costa Rica. Governmental consumption is highest in Bhutan, followed by Costa Rica and the Netherlands. More detailed figures on governmental expenditures can be found in chapter 6.

The investments as share of GDP are redrawn in the figure 7.6. The figure shows that the share of investments is slowly declining in the Netherlands (as private consumption is increasing). The share of investments in Bhutan has been relatively high, indicating the large investments in e.g. infrastructure and sanitation made in Bhutan. The share of investments in Costa Rica are slowly growing over the whole period. Investments in Benin are rather low in the 1970-1994 period.

Figure 7.6: Investments as a share of GDP



Source: WB, 1997

The share of investments in Bhutan was relatively high.

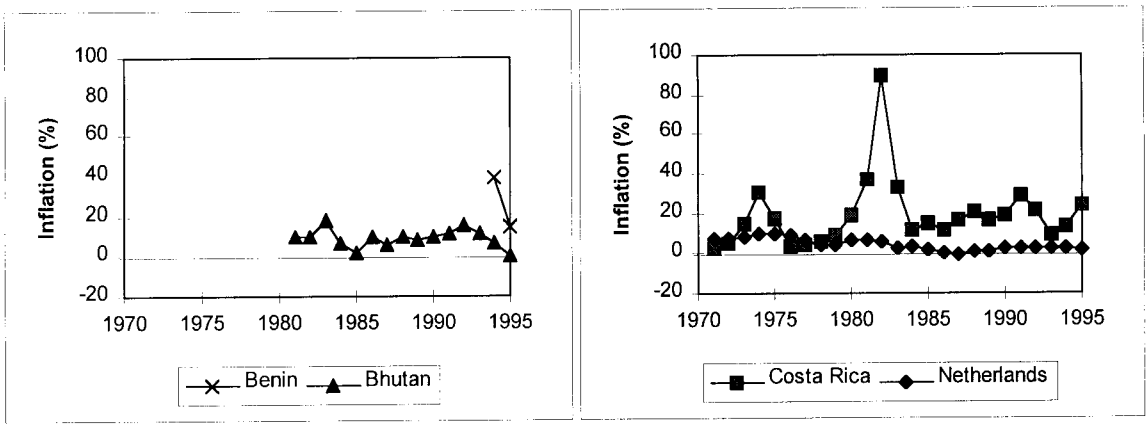
7.4 Other economic indicators

Inflation

Some economists argue that economies work most efficiently when inflation is low and stable. If inflation is rising persistently, it may indicate that the economy is overheating and that the rate of growth is therefore not sustainable. Moreover, it is possible that as a result of high inflation rate less attention is paid to the future.

The figures of UNDP (1996) and World Bank (1997) comply very well. The Netherlands has had a stable and low inflation rate over the whole period and since 1983 inflation has been permanently below 3%. The inflation rate in Costa Rica has been less stable and reached peaks in the mid 1970s, the early 1980s and the beginning of the 1990s. Inflation in Bhutan varies between 0 and 20%. For Benin not much data are available. Derived inflation rates suggest a high inflation during the early 1980s, followed by a period of lower inflation during the structural adjustment plan (WB, 1995).

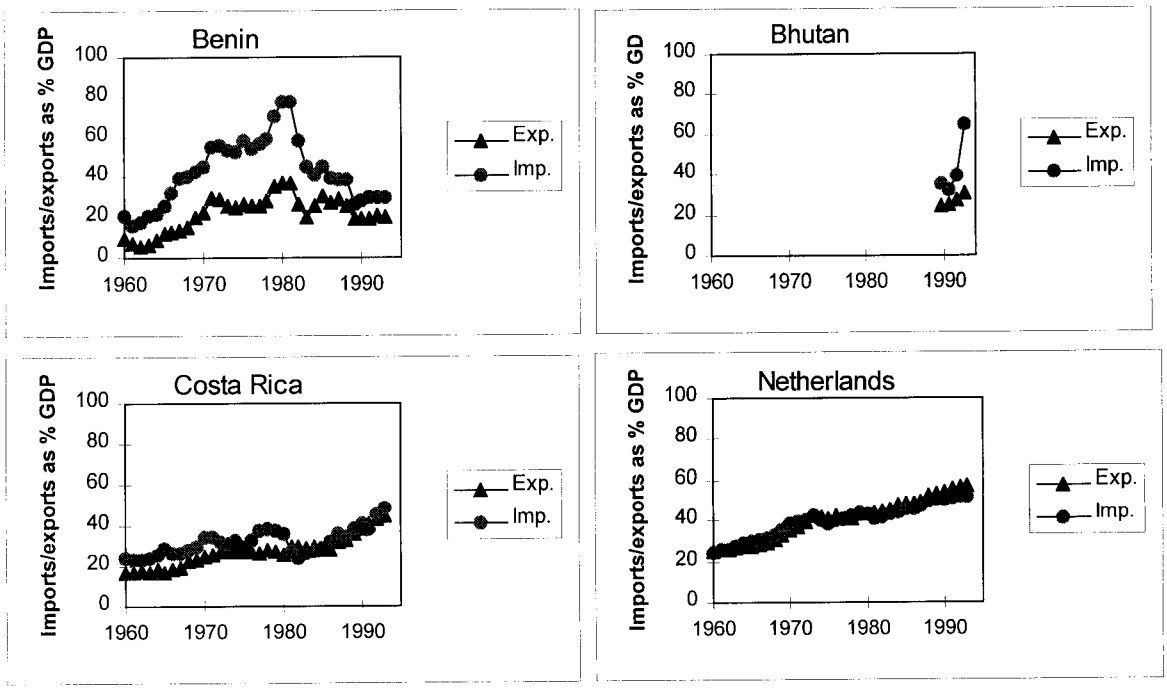
Figure 7.7: Inflation rates on GDP in the period 1960-1993



Source: WB, 1997
Inflation has been high in Costa Rica and very moderate in the Netherlands

Exports and Imports
The value of exports and imports of goods and (non-factor) services in comparison to GDP is used as a measure of the importance of international trade (and consequently the openness of a country).

Figure 7.8: The value of imports and exports as share of GDP



Source: WB, 1995
The importance of international trade generally increases

For Costa Rica and the Netherlands, the value of imports and exports compared to GDP has been slowly growing over the whole period and both now have a relatively open economy. For Benin the indicators show a more complex trend, which may be due to depreciation of the exchange rates and the change of economic system. For Bhutan, the scarce data available suggest an increase in the importance of international trade. The trend of increasing

international trade is visible for almost every country in the world, and can be related to the trends 'globalisation' and world-wide liberalisation of economies.

Figure 7.8 also shows that in the Netherlands the total value of exports has been higher than the total value of imports for more than a decade (a so-called positive trade balance). In the other three countries the opposite is the case (negative trade balance). A negative trade balance is not a problem in itself but can be a pressure because it may lead to a shortage of foreign currencies. Appendix C gives some information about the type of imports and exports of each of the countries. The main export product(s) of each country are mentioned in the table 7.2.

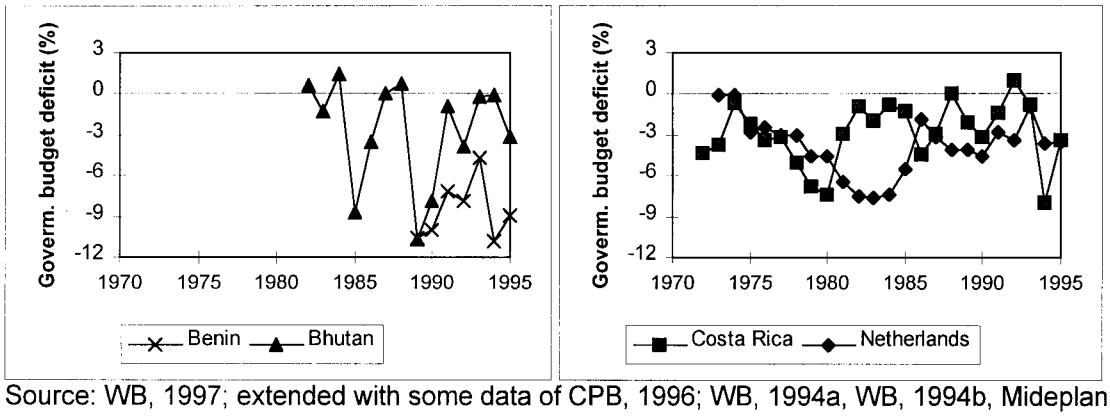
Table 7.2: Man export products

Country	*Main export products (goods only)*
Benin	1) Cotton
Bhutan	1) Electricity, 2) Wood and wood products
Costa Rica	1) Coffee, 2) Bananas
Netherlands	1) Equipment, 2) Agricultural products

The exports of both Benin, Bhutan and Costa Rica consists only of a limited amount of products, making these countries more vulnerable to changes in prices at the international markets. In case of the Netherlands, exports are much more diverse.

Overall public budget surplus
Figure 7.9 shows the overall budget surplus or deficit of the four governments. Many countries, including many western countries, have a huge public budget deficit.

Figure 7.9: Overall budget surplus or deficit (as % of GDP)



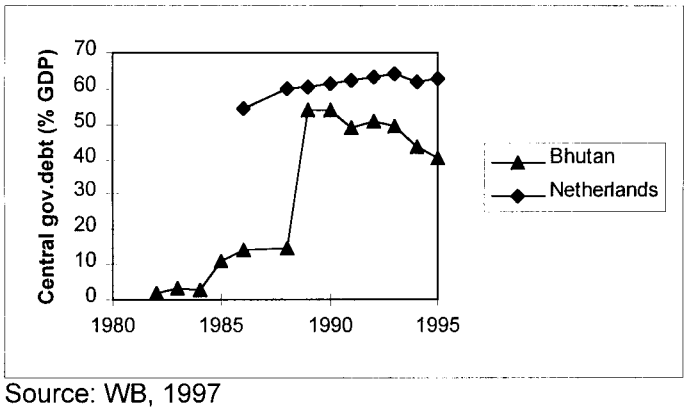
Source: WB, 1997; extended with some data of CPB, 1996; WB, 1994a, WB, 1994b, Mideplan, 1995
Public budget deficits very quite strongly

The figure shows that public budget deficits vary quite strongly over time (among others as result of politics and business cycles). The Dutch government has significantly reduced the public budget deficit in the period 1980 - 1995. Bhutan was able to balance public expenditures and incomes during the early nineties, but it is expected that it will grow in the future. The budget deficit in Benin is rather high: in the 1985-1989 period, it averaged -11% of GDP which is comparable to the deficit in the period shown in figure 7.9.

The consequence of a high budget deficit is the accumulation of public debt. Figure 7.10 shows public debt of the national government compared to GDP. In the Netherlands public

debt is equal to slightly more than 60% of GDP. Bhutan has started to build up public debt after the increase in public expenditures in the late 1990s.

Figure 7.10: Public debt of central government



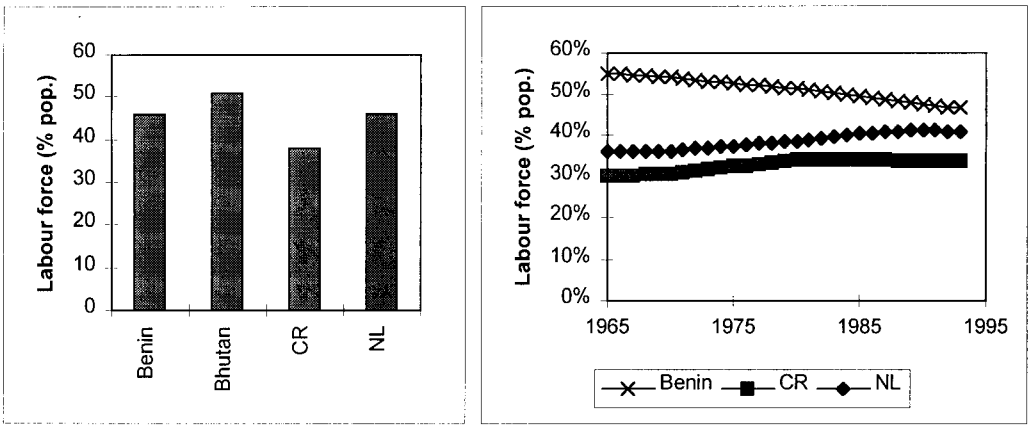
Source: WB, 1997

Public debt is higher in the Netherlands than in Bhutan

7.5 Labour

Figure 7.11 shows the labour force as share of the total population. Trends in these figures are among others related to labour participation, sectoral changes and demographic trends.

Figure 7.11: Labour force as share of the total population in 1990 and in the period 1965-1993

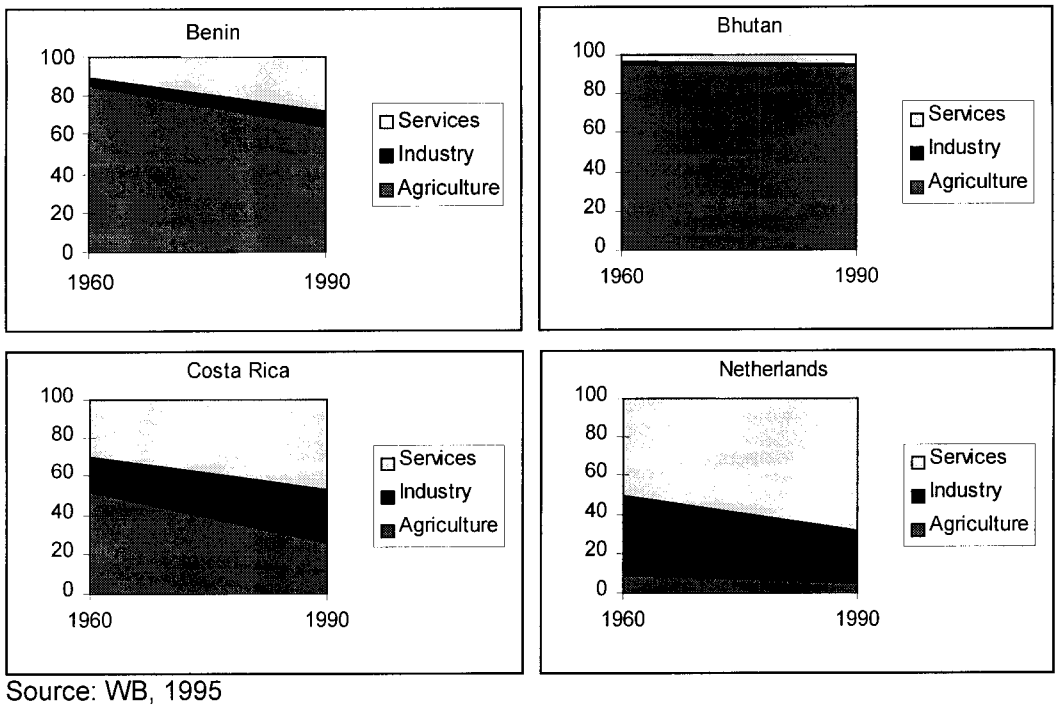


Source: left: UNDP, 1996; right: WB, 1995

The labour force as share of the total population in 1990 is highest in Bhutan and lowest in Costa Rica. Gender related information is available for Benin, Costa Rica and the Netherlands.

The four countries are very different with respect to distribution of as shown in Figure 7.12. The differences are related to economic priorities and the geographic situation, but can (at least partly) also be explained in terms of the 'economic transition'. This theory suggests that economies generally go through different stages: starting from a primarily agricultural-based society, a growing share of people will start to work in the industrial sector as a result of industrialisation. This stage is followed by a (final) stage in which most people work in the service sector.

Figure 7.12: Share of population working in the sectors services, industry and agriculture



Source: WB, 1995

The distribution of labour changes towards industry and services with increasing industrialisation and economic activity

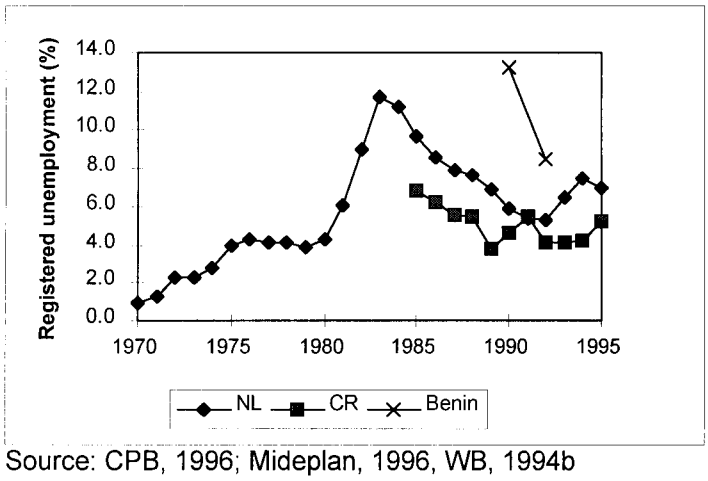
In the Netherlands more than 60% of the working population is currently working in the service sector while the population active in the agricultural and industrial sectors are declining in share. In Costa Rica the service sector also employs the largest share of the working population and here too its share continues to increase. In Benin the agricultural sector is the largest sector although its share is declining. The next sector in Benin is the service sector, which is relatively large due to the favourable trade position of Benin. About 85% of the working population of Bhutan is working in the agricultural sector.

Employment data are not only relevant with regard to securing a livelihood but also for active participation in society. Figure 7.13 shows the registered unemployment in the Netherlands, Costa Rica and Benin.

It should be noted that there are often severe problems with data availability and quality for data related to unemployment. Moreover, the figures do not always fully represent real non-employment: first of all the figures only include registered unemployment, and secondly, the figures do not include underemployment (being employed without sufficient meaningful work). Thirdly, the informal sector, and unpaid labour in e.g. households and the agricultural sector are often not captured in the data. Finally, different definitions are used to determine whether somebody is unemployment or not able to work.

During the 1990s, unemployment has been highest in Benin (partly due to the start-up of the first structural adjustment programme), followed by the Netherlands and Costa Rica. In Benin underemployment was - depending on the season - estimated up to 30% in 1994 (WB, 1994b). In Costa Rica total unemployment was estimated at around 10-11% in the period 1990-1995.

Figure 7.13: Registered unemployment



Source: CPB, 1996; Mideplan, 1996, WB, 1994b

A significant share of the population is unemployed in Benin, the Netherlands and Costa Rica (no data are available for Bhutan)

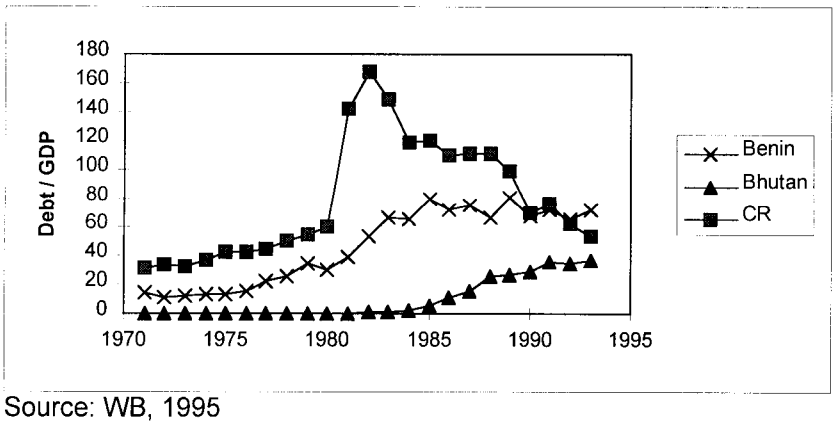
7.6 Foreign debt and development aid

7.6.1 Foreign debt and borrowing

Foreign debt compared to national income

The total amount of long-term foreign debt as a percentage of GDP is a measure of the degree of indebtedness. Debt can negatively effect economic growth, social development and poverty eradication. There is - however – no general definition of a reasonable debt, this will vary from country to country.

Figure 7.14: Total foreign debt compared to GDP in the period 1970-1993



Source: WB, 1995

Benin, Bhutan and Costa Rica have a considerable foreign debt

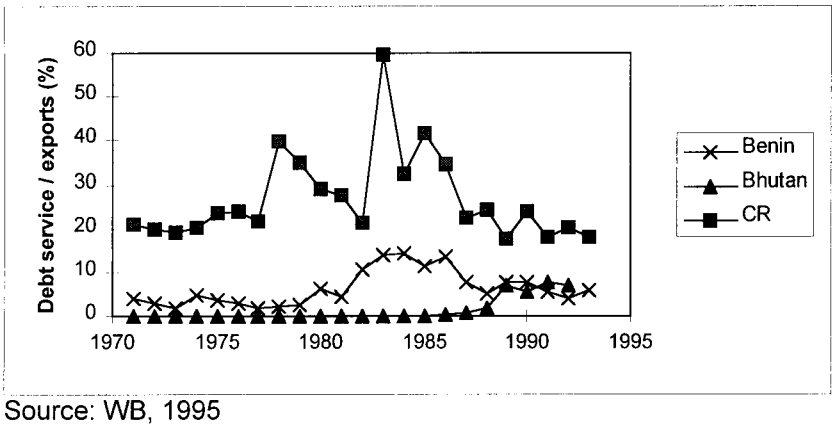
Costa Rica built up an enormous debt burden during the early 1980s. Since then the country has been able to slowly reduce this burden as result of agreements with its commercial creditors. Costa Rica's remaining debt is, however, still high and highly inflexible, reducing the scope for economic policies. Benin's debt has been increasing up to 1985. Since then, the

debt as share of GDP remained constant. Bhutan started to build up foreign debt only since the late 1980s. The Netherlands do not have an external debt.

Debt service in comparison to exports earnings

The debt-service/export-ratio measures the current cash flow on debt services, indicating the (short-term) economic burden of debt on the economy.

Figure 7.15: The total value of debt service compared to the total value of exports of goods and services



Source: WB, 1995

Debt services are highest in Costa Rica

The same trends emerge as in the previous figure. The main difference is that the relative position of Benin in 1993 in figure 7.15 is better than in figure 7.14.

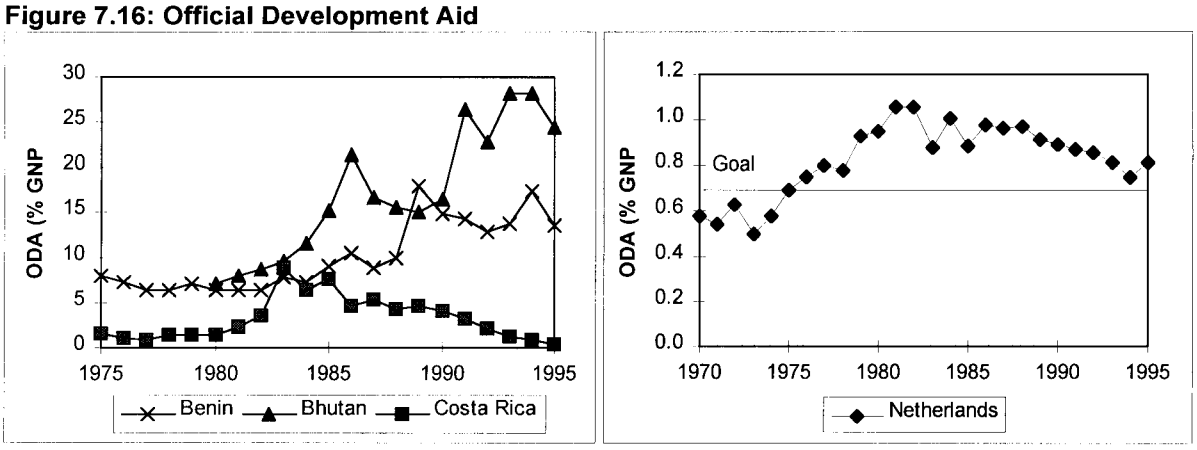
7.6.2 Official Development Assistance

In the last years, inequality across nations has increased, despite the fact that as a whole the world is become wealthier (RIVM, 1997b). Development assistance aims to invest in the future of less wealthy nations and to enable these countries to reduce the gap between the wealthy and poorer nations. In this way, development aid is strongly related to the equity component of sustainable development. Despite the promises made during the UNCED conference in Rio de Janeiro in 1992, official development assistance as a share of the GNP of donor countries has generally decreased in the period 1992-1995.

Figure 7.16 (left) shows that official development aid provides an important contribution to the economies of Benin and Bhutan. For Bhutan, ODA as share of its GNP increased strongly between 1985 and 1995 to more than 25% of GNP. In Benin the share of ODA in GNP is around 15%. Official Development Aid to Costa Rica declined strongly compared to GNP in the period 1985-1995 to less than 1%. Per capita, Bhutan receives the largest amount of ODA (about 115 US$ per capita in 1994) followed by Benin (about 50 US$) and Costa Rica.

The Dutch government met its official target of 0.7% of GNP for development assistance (Figure 7.16). For all donor countries together, total ODA has declined both in absolute numbers and as a share of GNP to less than 0.3% of GNP of donor countries.

Figure 7.16: Official Development Aid

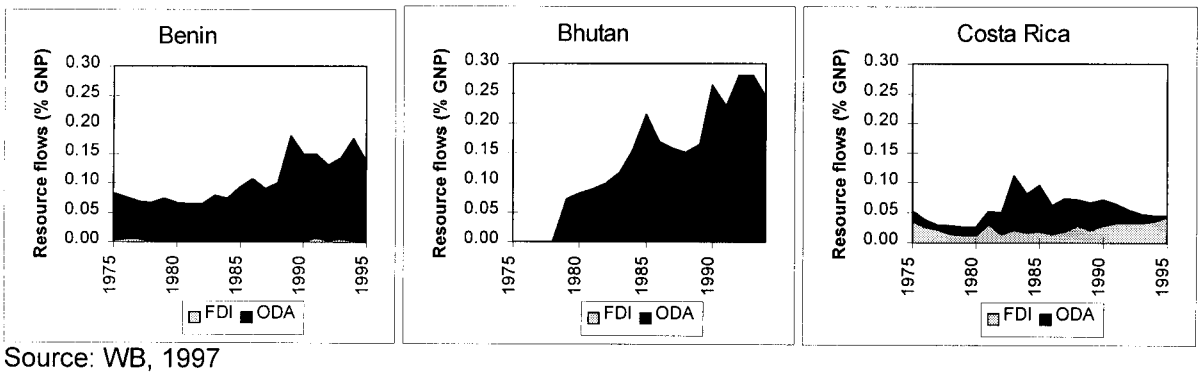


Source: WB, 1997

Official development aid provides an important contribution for the economies of Benin and Bhutan; the Netherlands complies to the official aim of contributing 0.7% of GNP to ODA.

Over the last years, private capital flows to low-income countries (mainly foreign direct investments) have gradually become larger than public flows (mainly official development aid). Figure 7.17 shows that this trend has in particular occurred in Costa Rica. In Benin official development assistance is still much larger than foreign direct investment, while for Bhutan the latter type of data is missing.

Figure 7.17: Some indications on net resource flows



Source: WB, 1997

Foreign direct investments for Costa Rica have become larger than official development aid

7.7 Conclusions

There are relatively large amounts of international data available on the state of the economic development of nations. However, the available data have some drawbacks: 1) they usually hide distributional questions and 2) they focus on the monetarised components of the economy (leaving the non-monetary components, and resources in the sense of human and natural resources aside - particularly troublesome in low-income countries). Furthermore, they reflect official registered economic activities and do not account for informal economic activities, which are very important or even dominant in Benin and Bhutan.

This chapter has shown the large differences in the economic development of the four nations, in particular with respect to the relative size of the different production sectors and the average national income. The income per capita in the Netherlands is about 4 times higher than for Costa Rica and about 10 times higher than for Bhutan or Benin.

The four countries have specific economic problems that are related to both the current economic situation (such as unemployment, high inflation rates, highly negative balance of trade, negative government budget) and the future one (meagre prospects, investments). The economy of Costa Rica has recently recovered after the economic crisis in the early 1970s. The economy of Benin is struggling to realise any growth at all in terms of (formal) income per capita.

International trade becomes more important in all four countries. All four countries are all dealing with the problem of under- and unemployment, although the severity of this problem differs (both in terms of the actual rates and in terms of the consequences for the under- and unemployed).

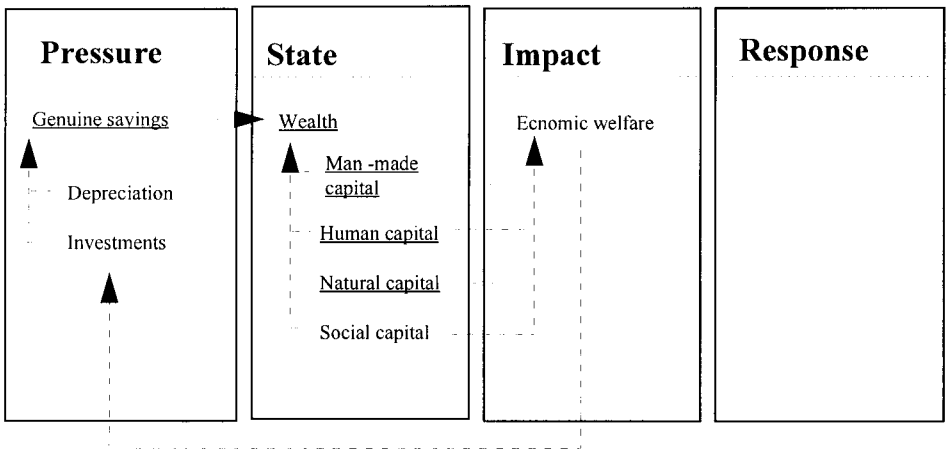
8. Wealth of nations estimates

The Environmentally Sustainable Development Department of the World Bank has recently been working on an alternative set of indicators to estimate the total wealth of nations. These estimates do not focus on the flows of money, but on available capital within a country to generate income. The rationale of this idea is that for sustainable development growth or decline of this capital is (at least) just as relevant as the trends in flows of money. Although recently new draft estimates have been published, in this discussion the 1995 methodology is presented.

8.1. Introduction

Wealth is here defined as the total available capital to produce welfare (income). It is based on four types of capitals: natural capital, man-made capital, human capital and social capital (for this last type of capital currently no estimates have been made). The various types of capital can be exchanged, and increased and decreased by means of investments and depreciation. The net in-flow of capital is called savings. The World Bank has developed a non-related method to estimate the 'genuine' savings (the word genuine is used, to show the distinction with normal economic savings which in principal takes only man-made capital into account). Both methods and their results are discussed in this chapter. The figure below provides an overview.

Figure 8.1: Overview of information presented in this chapter



Note: The purpose of this scheme is to show important linkages between the different parameters relevant for the issue and the data presented. For underlined parameters information is included in this chapter; for parameters in italic print information is included in other chapters. For parameters in normal print no information is included in this report.

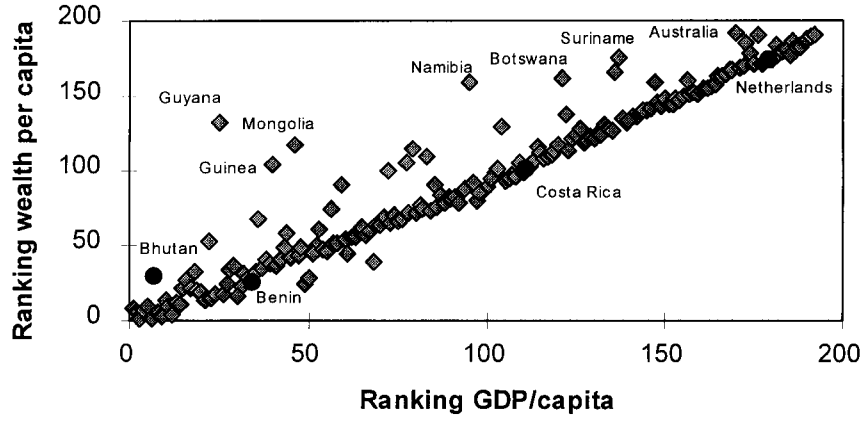
8.2 Estimates of capitals and total wealth

The results of the World Bank's assessment presented in this chapter are estimates. The World Bank adds that it will not defend any individual country wealth or savings estimate without more in-depth individual country analysis[11]. The World Bank estimates for the various amounts of capital are based on the following:

Natural capital: The value of natural capital has been based on the market value of land, minerals, energy resources, timber and water. The value of land has been directly related to GDP based on empirical relationship between the value of land and the GDP of a country.
Produced assets: Produced assets are the sum of all man-made capital such as houses, factories, roads and bridges. These assets were estimated by an economic model of the World Bank. There is a strong correlation between these estimates and GDP.
Human resources: Human resources have been estimated on the basis of the estimated future production of the present population minim the capital which has been already accounted for above. The calculation is based estimating total wealth.

The estimates for both produced assets and human resources correlate very well with GDP (natural capital is the only capital that doesn't correlate with GDP). Consequently also total wealth estimates correlate well with GDP. This is shown for 192 countries in figure 8.2.

Figure 8.2: Ranking for GDP per capita versus ranking for wealth perception



Source: WB, 1995b
With exception of a small group of countries with high natural capital, ranking based on wealth per capita correlates well with ranking based on GDP per capita.
Note: Ranking of 192 countries for GDP per capita (x-axis) compared to ranking for wealth per capita (y-axis) (1 is the lowest ranking, 192 the highest)

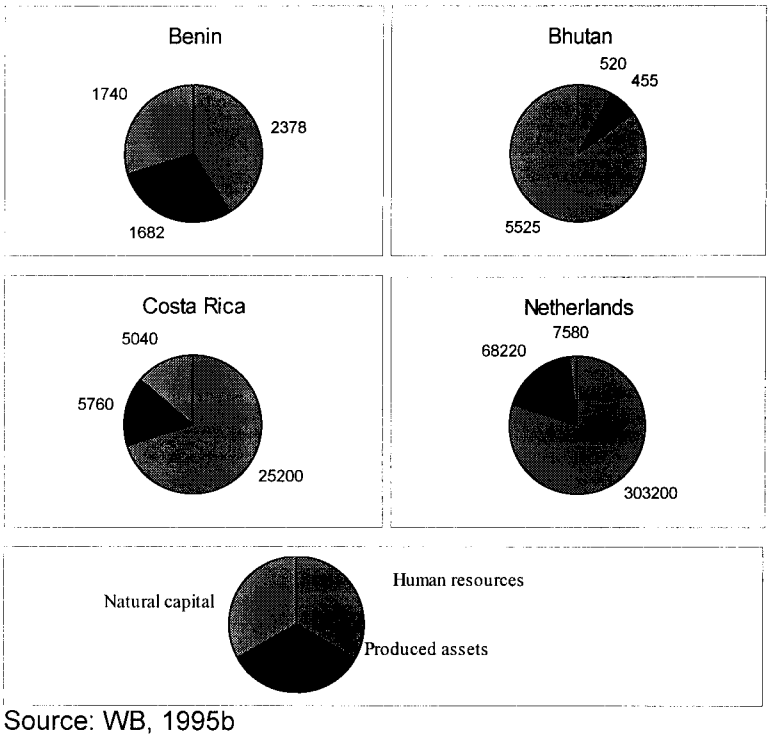
In figure 8.3 the capital estimates are shown for the four countries. The total wealth of the Netherlands is estimated at $ 380,000 per capita, that of Costa Rica at about $ 35,000 per capita and Benin and Bhutan about $ 6,000 per capita. The higher wealth estimate of the

[11]These data must be distinguished from other country data that are published by the World Bank and that are based on much more solid, detailed, country specific analyses.

Netherlands is based on a higher estimate for produced assets and human capital. The value of total natural capital of the four countries is much more comparable.

The wealth of Bhutan consists largely of natural capital, while the other types capitals are relatively underdeveloped. The wealth of Benin is evenly distributed among natural capital, human resources and produced assets. For both Costa Rica and the Netherlands human resource-capital is the most important form of capital. In the Netherlands natural capital has become a very small part of total wealth, at least in monetary terms. The differences in composition of total wealth might be one factor that determines the priorities made for sustainable development in a country: in discussions between the Netherlands and Bhutan on financing projects in Bhutan, the first seem to stress the importance of environmental protection much more than the latter which might be explained in terms of the present forms of capital.

Figure 8.3: Wealth of nations estimates of the World Bank

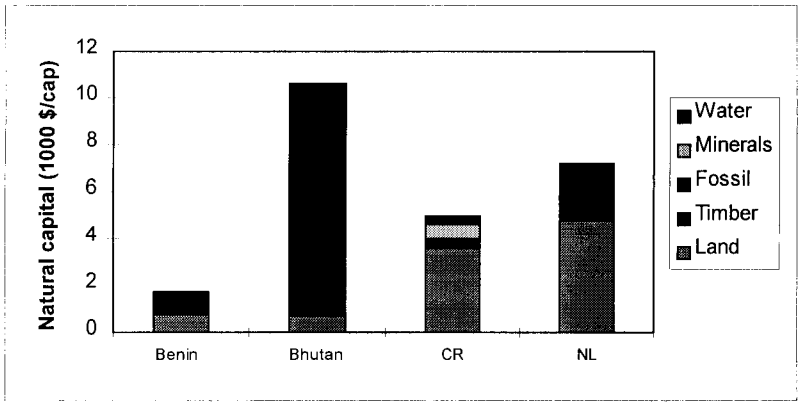


Source: WB, 1995b

The distribution of capital differs strongly, e.g. the capital of the Netherlands mainly consists of human resources and of Bhutan of natural resources

The composition of natural capital per capita between the four countries shows significant differences. The principal resources of Benin are arable land and some forest areas. Natural capital in Bhutan is much larger being mainly made up by its forests. In Costa Rica natural capital consists of land, and to a lesser extent of water, minerals (metals), and timber. Natural capital in the Netherlands consists of land and fossil fuels (natural gas). The components of natural capital are discussed in more detail under the next domain.

Figure 8.4: Composition of natural capital



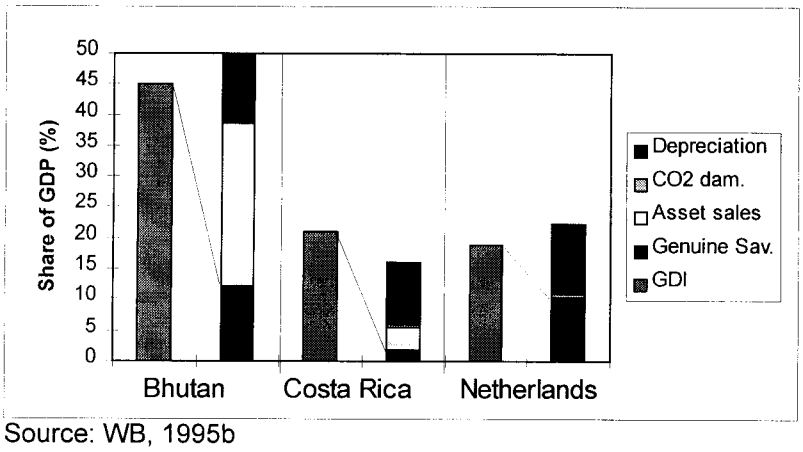
Source: WB, 1995b
The composition of natural capital differs greatly

8.3 Genuine savings

The World Bank has also been working on a new indicator for the amount of money that is saved to increase the available capital. The standard national accounts measurement of saving overstates the true level of saving e.g. by not taking into account the loss of capital by natural resource use. The new indicator, *genuine saving*, is the residual of production less consumption (investments), less depreciation of produced assets, and drawing down of natural resources (human resources have not been included yet).

In figure 8.5 investments over the period 1985-1990 are taken as the basis for the calculation of genuine savings (left column per country). The difference with the total height of the second column is the net foreign borrowing (positive for Bhutan and the Netherlands, negative for Costa Rica). Different types of deprecation are then subtracted, i.e. estimates on carbon dioxide damage and asset sales, finally leaving genuine savings as residual.

Figure 8.5: Genuine savings



Source: WB, 1995b

Figure 8.5 shows that gross investments are extremely high in Bhutan. A large share, however, is not considered to be genuine savings, based on the subtraction of depreciation and especially asset sales. Nevertheless, the resulting genuine savings - about 12 % of GDP - are still relatively high. The genuine savings in case of Costa Rica are estimated to be 1.5 %. In

case of the Netherlands the genuine savings are not much lower than gross domestic investments, about 12 % of GDP.

8.4 Conclusions

The new World Bank methods seem to provide an interesting extension of the sustainable development and wealth discussions. However, the various estimates still need to be further developed, as different potential resources such as non-timber values of forests are not included. Progress has already been made in the publication of the second capital estimates.

The estimates of natural capital show the relative wealth of Bhutan and Costa Rica, and the most important natural resources in each of the four countries (land in the case of the Netherlands and Costa Rica; forest in the case of Bhutan and land and forests for Benin). The genuine savings show high 'savings' rates in the Netherlands and Bhutan, indicating large increases in their total capital.

9 Poverty and income inequality

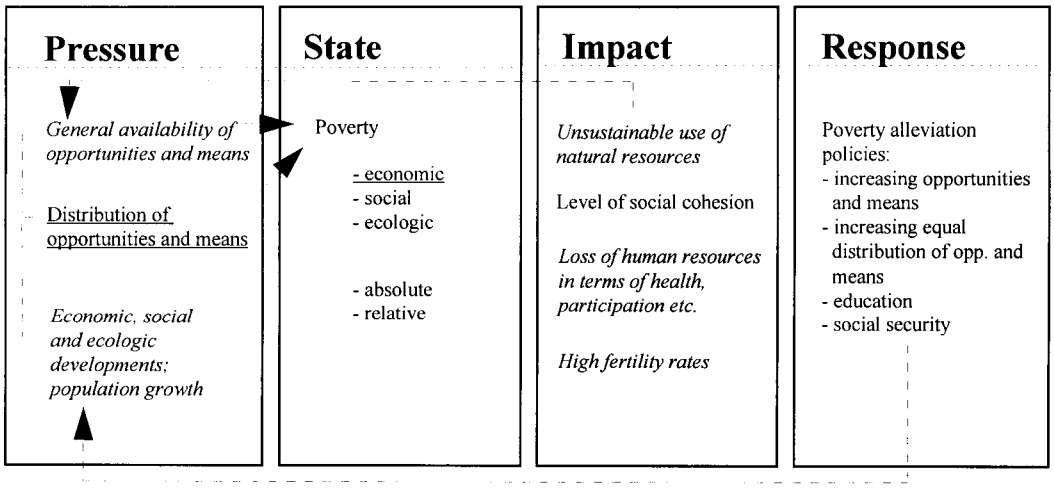
The issue of poverty is strongly linked to sustainable development as it is widely understood that poverty and social inequality can hamper sustainable use of natural resources and reduction of fertility rates. Poverty reduces the options for long-term considerations and investment in more productive and sustainable production methods.

9.1 Introduction

Poverty could be defined as a person's lack of means to fulfil his personal human needs. This means that poverty is not limited to a lack of (monetary) income; rural poverty is for instance often directly related to a lack of access to sustainable land use and access to basic services including water supply and sanitation and education and health facilities. Despite the fact that poverty is broader than income alone, the main data found are economic data. However, some data shown in other chapters could be interpreted in the context of poverty (access to sanitation, access to health services, education etc.).

Often a distinction is made between absolute poverty and relative poverty. The former refers to a situation in which need fulfilment is below an absolute minimum and the latter to the situation in which need fulfilment is much worse than that of a reference group. A related distinction can be made with regard to the cause of poverty: an very low average income of a whole nation or group or an extremely unequal distribution of income.

Figure 9.1: Overview of the information presented in this chapter



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In some of the non-industrialised countries, poverty has a very important two-fold relationship with environmental pressures. First of all, poverty can lead to overexploitation of the environment in an attempt to satisfy the most immediate needs, and reduces attention for long-term considerations. At the same time (resulting) environmental degradation can cause

poverty (e.g. overfishing endangers the livelihood of fisherman), and often the poor tend to be the main victims in such cases. Agenda21 formulates the following objectives with respect to the issue of poverty: eradicate poverty, decrease disparities in living standards and meet basic human needs (Agenda 21, 1992).

Two types of economic indicators are often used for international comparison: the head-count poverty index and indicators on income distribution.

9.2 Status of poverty

Head-count poverty index

The table above shows the percentage of people living in absolute poverty in the period 1980-1990 according to WRI. A problem is that absolute poverty rate can be differently defined, therefore WRI comments that the figures are derived from a host of country studies and may not be strictly comparable. The CSD (1996) discusses several different measures for poverty, based on setting an absolute poverty line. This line might be set on the basis of the costs of basic human needs (as done in WB, 1994b mentioned in the second half of the table for Benin), in comparison with average national income, or at 1 US$ a day.

Table 9.1: Percentage of people living in absolute poverty in the period 1980-1990

	Bhutan	*Benin*	*CR*	*NL*
WRI, 1996				
Urban population			24	
Rural population	90	65	34	
Other sources				
Urban population			1.8 [b]	
Rural population			13.7 [b]	
Total population		15 [a]	7.0 [b]	
Poverty gap index		0.044 [a]		

Sources: WRI, 1996 + [a] 1990 (WB, 1994b), [b] 1994 (EdlN, 1995)

The table shows that data from different sources - based on different definitions of absolute poverty- can differ strongly. According to WRI, in both Bhutan and Benin a large majority of the population is living below the absolute poverty limit measured in economic terms (in local currency). Also in Costa Rica a considerable share of the population in the period 1980-1990 was living below the poverty line. The other data for Costa Rica (EdlN, 1995) refers to absolute poverty[12]. For the Netherlands no data was available. The poverty gap index given for Benin is a measure for the average depth of poverty.

Other data related to the status of poverty might be found elsewhere in this report, e.g. average nutritional status, access to water and sanitation, and access to health services.

Poverty in Benin

In Benin distinction has to be made between poverty in urban areas, which is mostly related to unemployment, and poverty in rural areas which is mostly related to shortage of land. Land-

[12] Adding the category 'basic poverty' from this source increases the poverty rate for the total population to 14.7%.

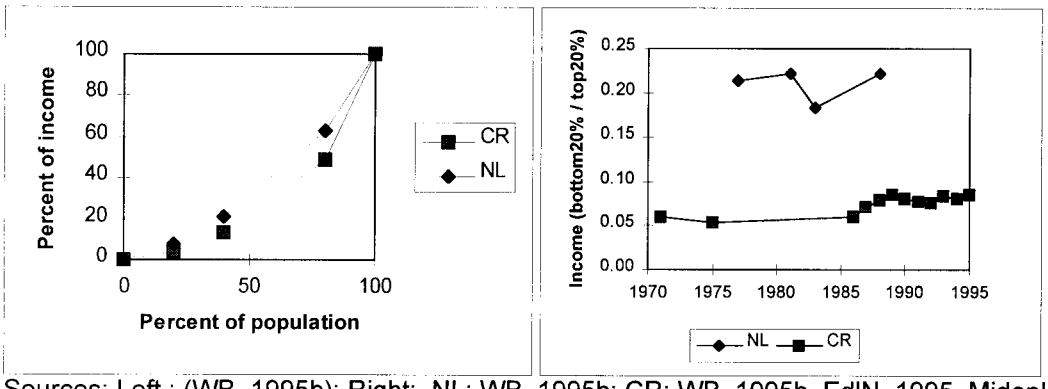
short household tend to get into a vicious circle of poverty and environmental degradation due to overexploitation of available land. A World Bank study (WB, 1994b) mentions the following vulnerable groups in Benin: female-headed households, abandoned old people, children in difficult circumstances, fishermen's families, farmer households with inadequate means, refugees and retrenched civil servants.

9.3 Causes of poverty

Income distribution

An extremely unequal distribution of income can be the cause of relative or even absolute poverty within a country or a region.

Figure 9.2: Income distribution in Costa Rica (1989) and the Netherlands (1988) and trends



Sources: Left : (WB, 1995b); Right: NL: WB, 1995b; CR: WB, 1995b, EdlN, 1995, Mideplan, 1995
Income is more equally distributed in the Netherlands than in Costa Rica.

Income distribution figures are available for Costa Rica and the Netherlands. Figure 9.2 is a so-called Lorenz curve plotting the cumulative percentages of total income received against the cumulative percentage of recipients, starting with the poorest individuals. The figure shows that distribution of income is less equal in Costa Rica than in the Netherlands. In Costa Rica the richest 20% of the country earn about 50% of national income.

Another indicator is the income share of the poorest 20% compared to the income of the 20% with highest income (the right figure). The time-series of this indicator show a slight trend to a more equal distribution of income in Costa Rica, in comparison with the early 1980s.

9.4. Conclusions

The complex topic of poverty is certainly not fully covered in this chapter. Considering only economic indicators, different poverty rates are found for Costa Rica and Benin, depending on the sources. Cultural factors (including religion) might strongly influence the interpretation of poverty. For a better discussion on this topic the following questions need to be addressed: 1) what is meant by poverty?, 2) how can poverty be measured? and 3) at what level is a person considered to be poor? In many cases distribution of other indicators (such as food availability) among societal groups can give relevant information on poverty. At the moment, one can certainly make no conclusions on poverty in any of the four countries, and no reasonable comparison either.

Part 3: Environmental domain

10. Land use, agriculture and food production

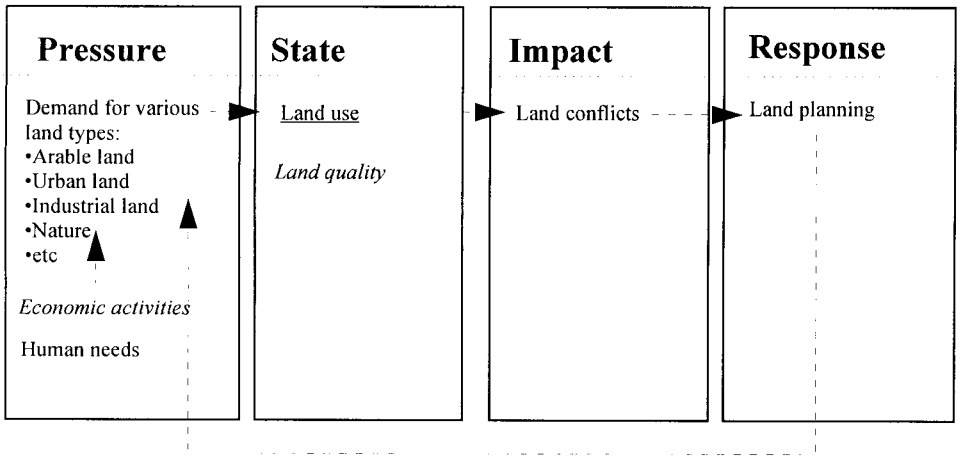
Humanity has left an impressive mark on the world's land almost everywhere around the world. The enormous increase of human population has strongly increased the pressures on available land for all kind of purposes. Information on land use change is therefore critical for integrated and sustainable land use planning. In this chapter attention is paid to changes in the various land use types in the four countries. In addition to land use changes, the related issues of agricultural production and food security are dealt with in this chapter.

10.1 Land use changes

Land is one of the most valuable resources, e.g. shown by the provisional World Bank capital estimates (chapter 8). The Dutch environmental policy considers land as one of the key-resources. RIVM recently indicated that land is one of the resources most at risk on global scale (together with water) (RIVM, 1997). Land provides the surface for all kind activities: human settlement (cities, industries), agriculture and animal husbandry, and natural habitats. For the last three functions it also provides essential inputs (e.g. nutrients) and stabilisation functions (e.g. water). Several human pressures (such as population and economic growth) have increased the demand on land. Often the intensity of land use has increased, which sometimes causes new pressures since the carrying capacity of soils is limited. Overgrazing, overproduction or other forms of too intensive and unsustainable use of soils might cause degradation of soils. Climate change might give rise to an additional pressure on land resources. In fact, climate change (human-induced or not) already causes desertification in Benin.

The figure indicates some of the relevant elements and information presented in this chapter.

Figure 10. 1: Overview of the information presented in this chapter.



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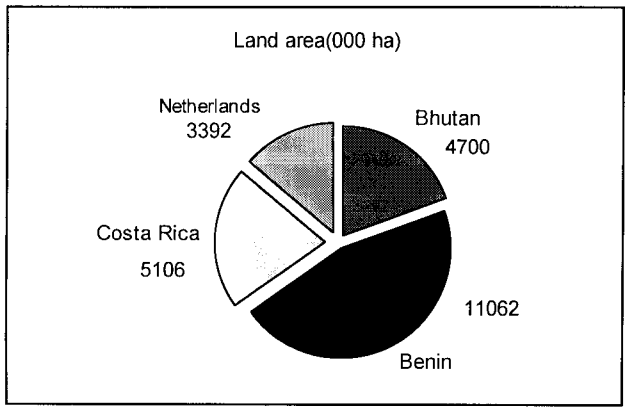
For sustainable development the following goal with regard to land use changes could be formulated: The objective is to balance competing demands for the finite quantity of land available, and to protect the quality of the soil to prevent harms to humans, ecosystems, and function such as food production.

Size of the countries
The four countries considered in this report are small countries. When the four countries are compared with regard to land area Benin is about 2-3 larger than the other three countries. The Netherlands is the smallest of the four countries.

Figure 10. 2: Size of the four countries



Source: WRI, 1996.
Benin is by far the largest of the four countries

Land use
Figure 10. 3 shows the changes of various land according to the FAO[13].

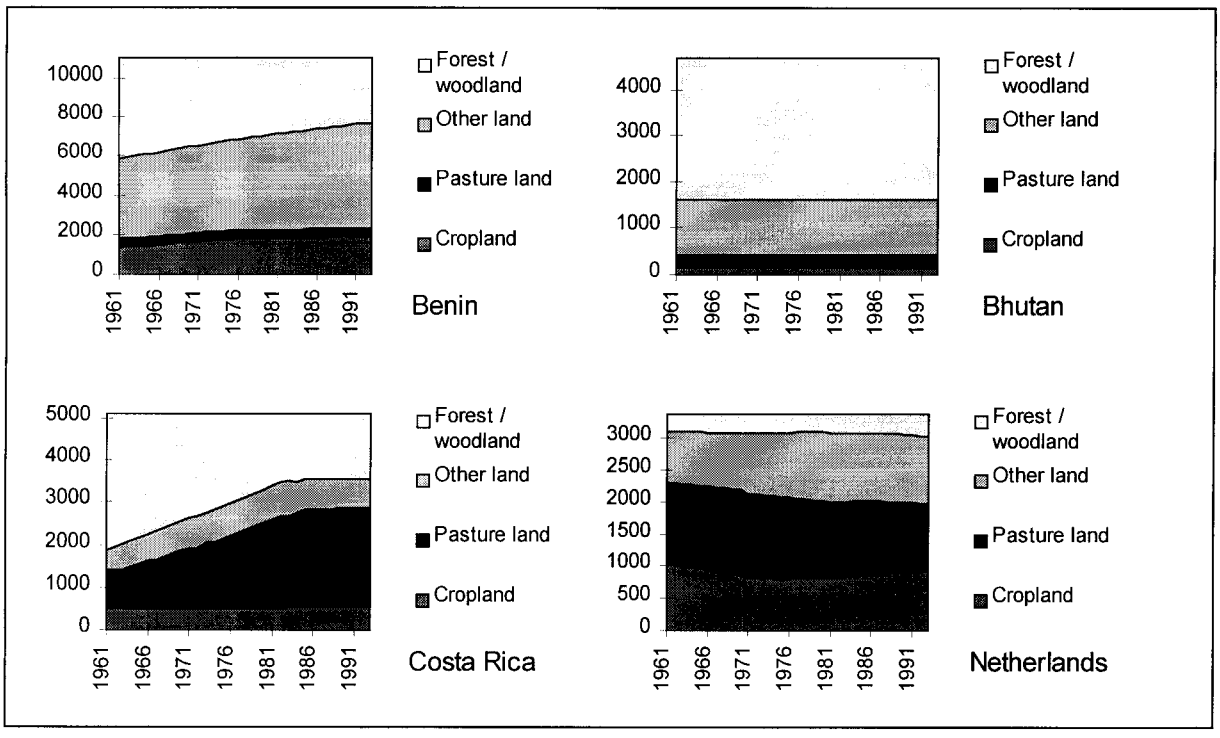
In 1961, half the total land area of Benin was still covered with woodland, i.e. mostly wooded savannah and open forests. This land includes agricultural land which was left under 'forest fellow' for recovery. Pressure on woodland in Benin is enormous, especially as result of demographic pressures and the demand for agricultural land. In 1990, the area has declined to almost half its original size, while the categories other land and 'cropland' have grown. The category 'other land' refers in this case to degraded savannah used for extensive agricultural production and animal husbandry.

In Bhutan the main land use is forest and woodland, covering about two-thirds of the country (the Forest Law of Bhutan requires at least 60% of the country to be covered by forests). The actual trends in land use in Bhutan are uncertain: FAO data shows some remarkable changes in land cover which are probably due to different (types of) assessments and definitions used (in the figure simply a static situation has been assumed on the basis of data in 1992). In Bhutan, the category 'other land' is the second largest area and includes mountain areas,

[13] The definition of the land types are as follows: *Cropland* includes land under temporary and permanent crops, temporary meadows, market and kitchen gardens and temporary fallow. *Permanent pasture* is land used for 5 or more years for forage, including natural crops and cultivated crops. *Forest and woodland* includes land under natural or planted stands of trees, as well as logged-over areas that will be reforested in the near future. *Other land* is simply the total land minus the land types mentioned above. It includes uncultivated land, grassland not used for pasture, built-on areas, wetlands, wastelands and roads.

perpetual snow and glaciers. Only 10% of the country is used as cropland and pasture land[2]. Assessments indicate that this is about the maximum area that can be used for agricultural land in Bhutan without causing major erosion.

Figure 10. 3: Land areas (in 1000 hectares)



Source: FAO, 1995

In Costa Rica the shares of the different land types have changed significantly, especially forest and woodland has been converted into pasture land. Since 1980, the changes have been slowed down, among others due to a more conservationist policy with regard to the forests. Agricultural land now covers about half the country.

In the Netherlands, several decades ago forest and woodland declined to an area covering only 10% of the country. The major land use is other land (built up area, roads etc.), pasture land and cropland. The category 'other land' has strongly grown since 1960.

Almost no information was available on the change of land conditions (some remarks are included in the next sections).

10.2 Introduction to agriculture and animal husbandry

In the past decades there has been a substantial increase in the global production of food (green revolution), but unfortunately this has not been in every region of the world. The increase in agricultural production has not been without negative side-effects. For instance, natural areas have been strongly reduced, agriculture has become one of the key reasons for increase in freshwater withdrawals, and there are signs that intensive agricultural production

[2] One national Bhutanese source mentioned 16% (RGB, 1992a)

in western countries are unsustainable. It is expected that land conflicts will increase in the near future.

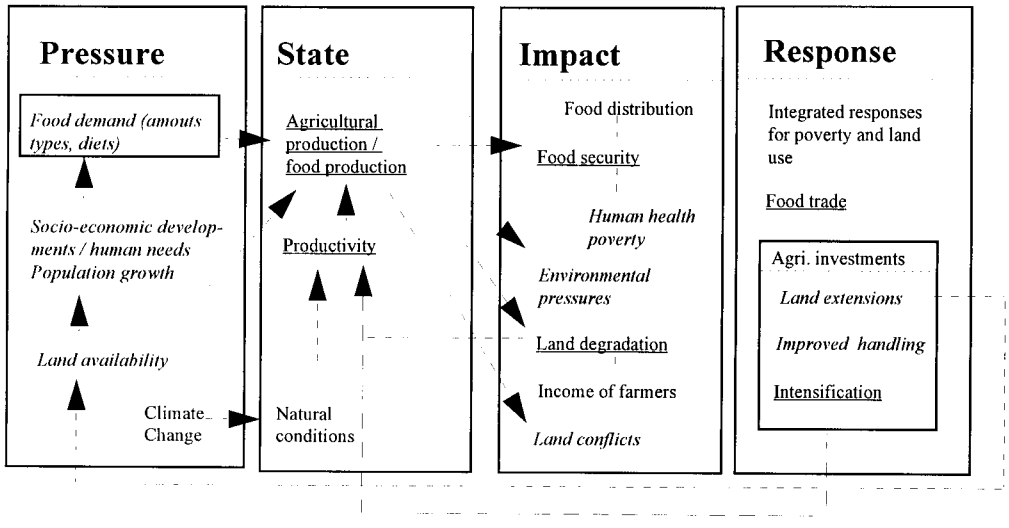
Three types of food production can be distinguished:
- Agriculture
- Animal husbandry
- Fisheries

The first two a clearly related to land use and will be discussed in this chapter. Important factors with regard to current and future food security are: production, trade, land availability and land conflicts, suitability of land, management types, the environmental consequences, and food diets. Special interests deserves the issue of land degradation and the increased water use. An overview of the information covered in this chapter is shown below.

The sustainable development objective of agriculture and food production could be formulated as to maintain an sufficient supply of food, without causing unacceptable side effects on the environment, in particular without undermining the productivity of the soil.

Agricultural production is covered in the third section, animal husbandry in the fourth section. In the last section the topic of food security is discussed.

Figure 10. 4: Overview of information presented on agriculture and animal husbandry



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10.3 Agriculture

10.3.1 Agricultural output

Table 10.1 shows that the agricultural differs strongly among the four countries

The main agricultural product in Benin and the Netherlands are roots and tubers (in the Netherlands potatoes, in Benin cassava and yams), in Bhutan cereals (among others rice) and in Costa Rica fruit. In Benin the production of maize, yams and cotton (non-food) has been growing. The total amount of agricultural output is highest in the Netherlands.

Table 10.1: Agricultural production in 1992

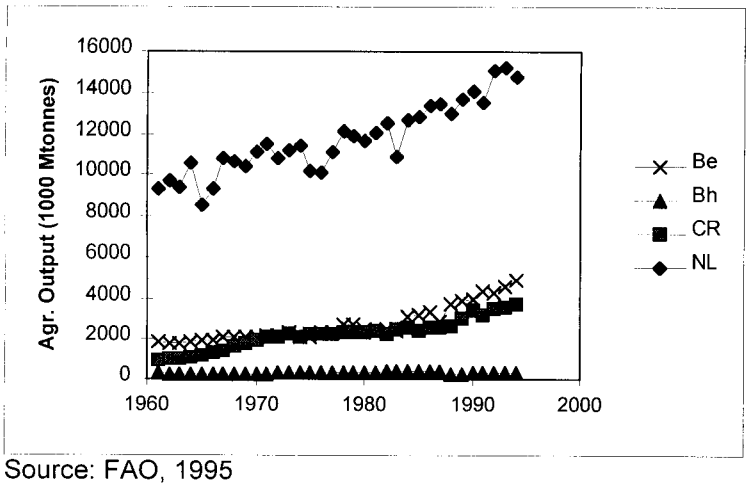
	Agricultural production in Mtons			
	Benin	Bhutan	Costa Rica	Netherlands
Cereals	628	106	204	1466
Maize	483	40	34	95
Other grains	130	7	0	72
Roots & tubers	2316	56	142	7699
Pulses, total	65	2	33	28
Nuts, etc.	386	1	50	13
Vegetables	237	10	174	3659
Fruits	161	65	2397	873
Sugar	5	13	293	1232
Non-food	194	0	237	48
Total	4605	300	3564	15185

Source: FAO, 1995

The types of products and the production is of course strongly related to agricultural potential of soil and climate, causing not only differences between the four countries but also within these countries. For instance in Benin, climate and soils are responsible for a clear gradient in agricultural potential from south to north.

Figure 10.5 shows the total agricultural output as function of time.

Figure 10.5: Total agricultural output.



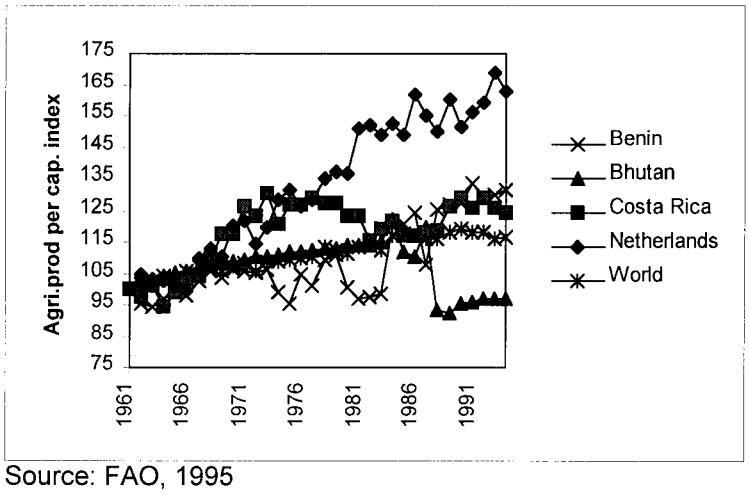
Source: FAO, 1995

Agricultural output increases in Benin, Costa Rica and the Netherlands

Costa Rica and Benin have been able to triple their total agricultural output since 1960, while the Netherlands was able to almost double their agricultural output. Production trends are probably most important for Bhutan and Benin, since both countries are characterised by a high economic dependence on agriculture, a low level of per capita supply and limited ability for food imports.

The FAO also produces an index which compares the agricultural production per capita of a reference year (here 1961) to the actual production per capita (figure 10.6). The figure shows that over the whole period the Netherlands has been able to increase the agricultural production per capita strongly. Costa Rica also had a strongly increasing production per capita until 1960. However, since 1960 production per capita did hardly increase. Benin has been able to increase the production per capita since the 1980s. According to FAO-data, Bhutan is struggling to have any increase in production per capita. The fall in production during the late 80s probably caused by statistical error.

Figure 10. 6: Agricultural production per capita index (reference year 1961).



Source: FAO, 1995

Agricultural production per capita strongly increased in the Netherlands

10.3.2 Land availability and productivity

In the next section we discuss the trends behind the changes in agricultural production. The agricultural output (per capita) is determined by two factors:

- Availability of agricultural land (per capita) (10.3.2a)
- And production per hectare (productivity) (10.3.2b)

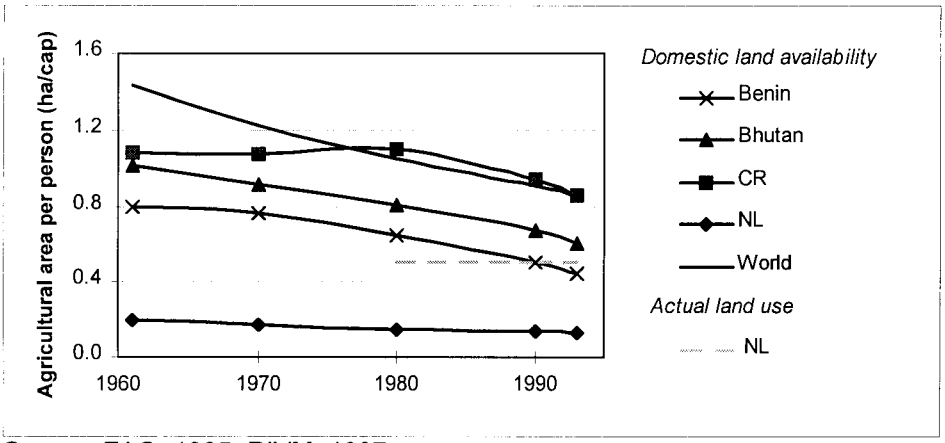
10.3.2a Availability of agricultural land

Figure 10.7 shows the agricultural area (including pasture land and cropland) divided by the population in each country and the world as a whole. The second line for the Netherlands indicates the total land used by the people in the Netherlands for consumption, not only within the country, but also outside it.

The agricultural area per person in each of the four countries and in the world as a whole is radically decreasing, indicating the rising pressure on available agricultural land. In order to satisfy food demand of a growing population, either the agricultural area per person should be held at a certain level or the production per hectare has to be increased. The available area for agricultural use is limited as a result of natural potential of soils and the need for land for

other use types. As a consequence, increase of productivity will have to play an important role in satisfying the increasing food demand (see next section).

Figure 10.7: Agricultural area (pasture land and cropland) per person



Source: FAO, 1995; RIVM, 1997a
The available agricultural land per person is decreasing

By means of international trade, the Netherlands has been able to use additional land for production of food, feed and wood (taking into account imports and exports of food). Figure 10.7 includes an indication of the total land used for consumption in the Netherlands. RIVM calculated that the population used 0.5 hectare per person in the period 1980-1993 (including forest products). Wackernagel and Rees (1996) estimated this area to be 0.71 hectare per person (only including agricultural land, and not land for forest products etc.). In both cases, the total area is equal to several times the available area within the Netherlands (2 to 3 times). It should be noted that besides imports for domestic consumption, the Dutch economy also imports food and feed for use within the Dutch economy in the food and animal industries to produce products that are subsequently exported to other European countries. The actual area used by the Costa Ricans and the Beninese for agricultural production for their population will be less than the area mentioned in the figure in view of the areas used for export products.

10.3.2b Productivity

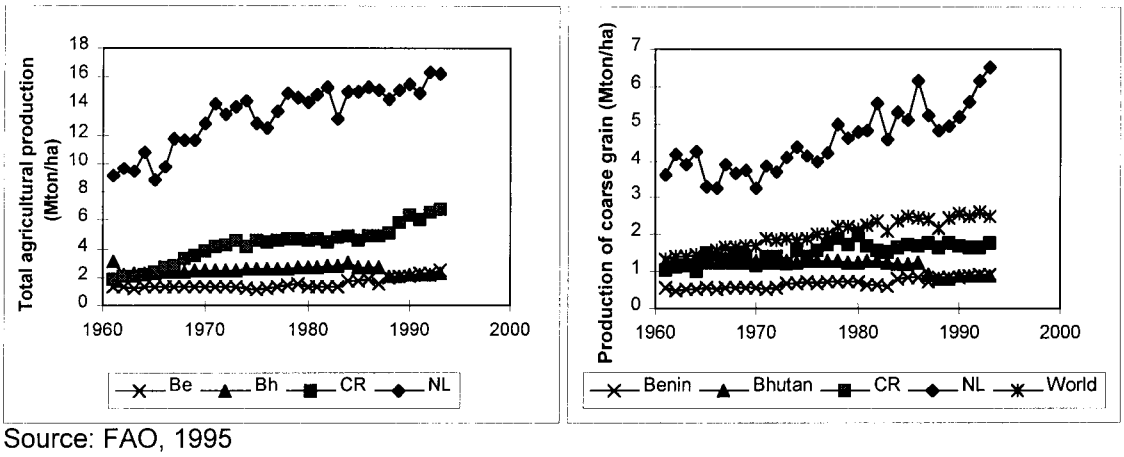
The productivity (yield per hectare) is related to the following factors:

- Natural potential of soil and climate
- Cropping intensity
- Conditions of the soils (e.g. fertilisers) or using other (improved) crop types.
- Handling of agricultural products
- Changes in potential of soil as a consequence of environmental degradation (climate change, acidification, pollution, erosion and soil degradation)

In this section we will focus on productivity as such (output per hectare). In the next section we pay attention the factors determining the productivity, i.e. cropping intensity, improving yields and changes in potential of soil due to environmental degradation.

Figure 10.8 shows the total agricultural production (Mton) per area of cropland (left) and the production of coarse grains per area of coarse grain harvested (right). This last crop type has been selected since it is an important agricultural product in all four countries. In the two figures the same trends emerge.

Figure 10. 8: Productivity per hectare for total agricultural production (left) and coarse grains (right)



Source: FAO, 1995

Output per hectare increases strongly in the Netherlands and Costa Rica, but much more slowly in Bhutan and Benin

First of all, a few natural factors determine the trends in these figures: climate and soils, and crop types used. These factors not only partly determine the differences between the four countries, but can also determine changes in time: in Benin agricultural output is strongly dependent on the varying rain conditions (e.g. causing the low production during the seventies).

The total output of agricultural production per hectare (figure 10.8) has increased in Benin, Costa Rica and the Netherlands but at different rates. In the Netherlands a much higher output per hectare is produced than in the other three countries. In the period 1960-1993, the Netherlands was able to increase output by a factor two due to improved agricultural knowledge, new crop varieties and high inputs of fertilisers, equipment etc. Costa Rica was also able to improve its output per hectare, but at a lower level.

In 1960, the agricultural output of Bhutan seemed to be relatively high in comparison with Costa Rica and Benin (according to the data). The production per hectare in Bhutan, however, did not show much increase over the whole period, despite all attention paid to this subject in Bhutan's Five-Year Plans (the decrease in the end of the period is most probably the result of statistical error).

The production per hectare of Benin slowly increases over the whole period. The improvement was, however, less than a factor two. This means that in Benin the increase in production - necessary to feed the growing population - is mainly achieved by increasing the area under cultivation, primary in the north where most sorghum, yam and animal production is located. Most agricultural methods remain traditional and yields are unstable and low. For Benin, also an overview is available per region of current production in comparison to estimated sustainable production (WB, 1994b).

Intensification: Increasing cropping intensity and yield

The productivity per hectare can be increased by means by intensification such as increasing cropping intensity, irrigation, use of fertilisers, and use of other crop types. In general terms,

these intensification methods are able to increase productivity, but might also cause potentially negative side-effects. The nature of the soil and of the climate should allow for more intense use.

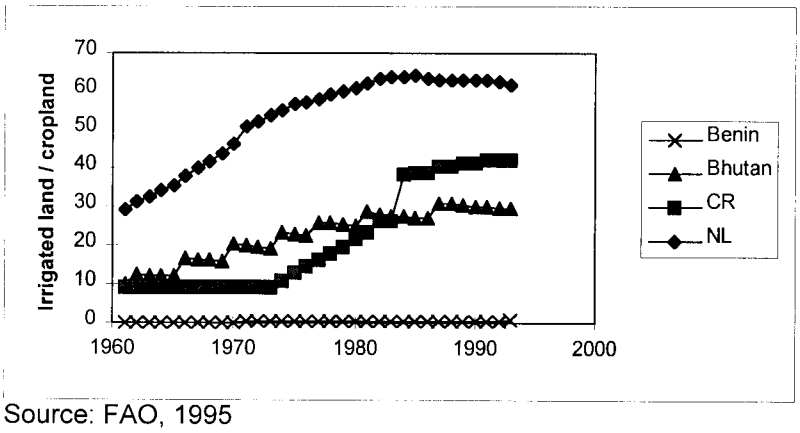
Increasing cropping intensity

In traditional farming methods, land areas are often left 'fallow' after some years of use for agricultural purposes. During this period the original productivity of the soil recovers. As a result of pressures to produce more food, tendencies exist to shorten fallow periods and to increase cropping intensity. According to the Global Environmental Outlook (RIVM, 1997) the potential of increasing cropping intensity is rather low. Moreover, the shortening of fallow periods within traditional farming methods, as described above, tends to result in enormous soil degradation.

Irrigation

Irrigation can dramatically increase production by promoting higher crop yields and allowing multiple cropping. On the other hand irrigation can have potentially negative side-effects on sustainability such as runoff, soil erosion and salinisation. The potential of irrigation is determined by the availability of irrigation water. The figure below shows the share of cropland area that is irrigated. This share can be used as a more general indicator for the question to what extent arable land and water resources are already used in an intensive manner. However, because water availability and soil suitability play an important role, interpretation is rather difficult. It is expected that on global scale the increase in irrigation will slow down due to increasing costs, growing competition for water and decline of food prices. Environmental and health impacts may also limit further expansion.

Figure 10. 9: Irrigated land divided by total cropland



Source: FAO, 1995

Irrigated land is highest in the Netherlands, followed by Costa Rica and Bhutan.

The figure shows that currently about 60-70 % of the Dutch cropland is irrigated (only 30% in 1960). Also in Bhutan and especially Costa Rica the area irrigated has increased significantly. In Benin, irrigation is virtually non-existing (probably due to lack of available water; relationship with cotton production is unknown).

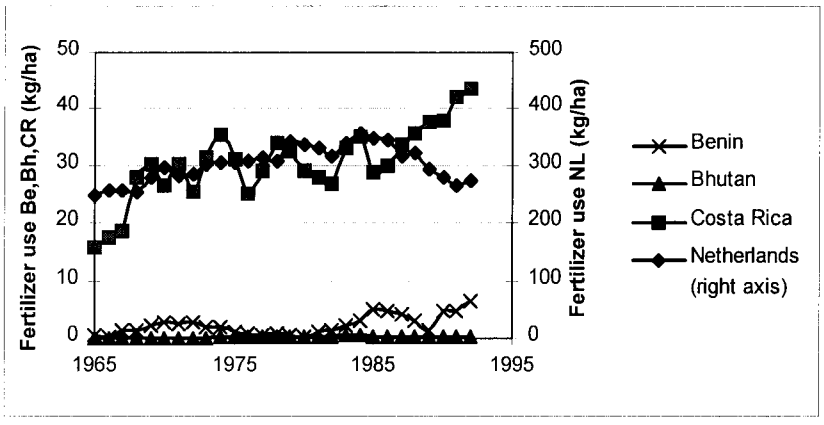
Fertiliser use

Another method of intensification of agricultural production is the use of fertilisers. In many areas, lack of soil inputs, combined with inherently fragile conditions of the land, shorten

fallow periods and continuous cropping create conditions where nutrients are steadily lost and production declines.

Fertiliser use can play a role with regard to sustainably increasing food production, both positively (increases outputs, prevents soil exhaustion) and negatively (fertilisers can lead to pollution, eutrophication, soil acidification, nitrate contamination. The actual environmental effects will depend on pollution abatement practices, plant types and meteorological conditions.

Figure 10. 10: Synthetic fertiliser use per hectare



Source: WB, 1995a.
Fertiliser use in the Netherlands is extensive, in Costa Rica moderate and in Benin and Bhutan almost not existing
Note: the Netherlands are shown on the right vertical axis

The Netherlands have been shown on the separate right vertical axis due to the high use of fertilisers, which has been strongly increasing until 1985. At that time, the amount of fertilisers was so high that nutrients were accumulating in the environment, leading to environmental damages. The main cause was the large excess of manure as the result of the intensive forms of animal husbandry practised in the Netherlands (see further in this chapter). Since the late 1980s, attempts have been made to reduce the fertiliser load. In Costa Rica and Benin fertiliser use has been increasing, but still at a much lower scale than in the Netherlands. The data indicates that in Bhutan practically no fertiliser is used. Compared to global averages, the amount of fertilisers used in Benin, Bhutan and even Costa Rica is rather low. Reasons might be lack of foreign exchange, prohibitively high prices, and inefficient distribution systems.

Data is available on the amount of tractors and harvesters used in the four countries for agricultural production. Data on pesticides use or energy used for agricultural production is not sufficiently available.

Other methods to improve productivity

Except for intensification and extension practices mentioned earlier in this text, there are several other methods to improve food production and increase sustainability of agricultural production, such as: 1) improving agronomic practices, 2) improving efficiency of water use, 3) reducing post harvest losses, 4) developing and applying alternative 'sustainable' agricultural methods, 5) improvement of traditional agricultural methods: i.e. retaining their sustainability but increasing yields, 6) mixing varieties of interplanting, 7) use of household

waste as fertiliser, 8) disseminate knowledge and methods to those who use and cultivate the land, 9) increasing food imports to areas where the limits of sustainable agricultural production has been reached, 10) rehabilitate degraded lands and 11) changing land tenure.

The last option especially refers to the situation in Benin. The tenure rights system in Benin is rather unclear, and small holding predominate everywhere. The present land tenure has resulted in farmers and stock raisers losing interest in maintaining and managing their land assets.

10.3.3 Environmental degradation

Soil degradation and erosion

On a global scale it has been estimated that about 10% of the Earth's vegetated surface are at least moderately degraded (RIVM, 1997). The most important reasons include: 1) too intensive use of the land; 2) faulty agricultural methods / mismanagement, 3) overgrazing / practices of animal husbandry, 4) deforestation, 5) desertification - climate change, 6) salinisation and 7) fires.

Soil degradation in Benin

In Benin, several reports mention the problems with respect to erosion and fertility loss. Losses in terms of agricultural production in certain regions have been estimated at 10% of total value of due to loss of soil fertility and up to 30% due to erosion (Especially as a result of demographic pressures, farming practices tend to become more unsustainable. Other factors contributing to this are overgrazing, firewood production, crop types and bush fires (WB, 1995e).

Most soils in Benin, as elsewhere in Africa, have a low capacity for retaining nutrients. This means that fallow periods are essential to maintain soil fertility. In the traditional farming system, especially in the north of Benin, fallows and forest fallows (fallow period for more than 15 years so that bush growth is re-established) are a necessary component, not only to restore the organic content in the soil, but also for firewood collection and grazing. Loss of fertility occurs, when fallow periods become infrequent or too short, because of lack of suitable farming land. This can also happen as a consequence of firewood collection, and grazing. In this situation a vicious circle threatens poor farmers: they generally will try to maximise food production by using all land at their disposal, and thus reducing the area under fallow. However, this will further reduce the fertility of the soil, which forces the farmer to use his land even more intensively. Especially in some areas in northern Benin, a continuation of this process may easily lead to desertification.

There has been some study on the extent of erosion in Benin (see WB, 1994b). Erosion is dependent on slope, rainfall and plant cover. Tree plantations or savannahs generally have a low erosion per hectare. Maize, yam and sorghum have a much higher 'erodibility' factor. Total erosion in Benin has been estimated at 27.5 million tons per year. The loss of fertility is only know related exports: Mineral exports in the form of cereals and root crops are six times as high than restitution through fertiliser (this would require 120000 tons of fertiliser). This means that some of the present forms of agriculture could also been seen as 'soil nutrient mining'.

Soil degradation in Bhutan
In Bhutan erosion is a continuos threat as result of extreme fragility of the steep and rugged Himalayan environment. As a result of population growth there is a strong pressure to expand agriculture into new areas. However, these areas tend to be more marginal, more steeply sloped and thus erosion prone. Assessments indicate that virtually all arable land is already used. There are signs that shifting cultivation, currently practised on steeply sloped hills is spreading in Bhutan in response to demographic pressures. Due to growing scarcity of unoccupied land, rotation periods of shifting cultivation has been shorten, which might result in soil degradation and erosion (WB, 1994a; Flavin, 1991).

In Bhutan there is a complex relationship between forest, crop and pasture land. Sustainability of land-use requires a delicate balance between these lands and the human and live-stock populations. Wood and non-wood forest products, such as leaf mulch and fodder for cattle feed are essential inputs into the farming system. Without nutrient transfer from off-farm activities - primary from forest land - soil fertility cannot be maintained. Cattle dung, composted with leaf mulch, is virtually the only available fertilisers (WB, 1994a).

Other environmental impacts
Other possible environmental impacts from agriculture are water demands (irrigation), energy requirement (horticulture in the Netherlands), and pollution as a result of fertiliser use and use of pesticides. However, no comparable data was found. The Dutch form of agriculture is by some considered to be unsustainable since nutrients cycles are not closed, and agriculture depends on high inputs in terms of energy, fertilisers and pesticides.

10.4. Animal husbandry

Figure 10.11 below shows the total amount of large livestock (cattle, sheep, goats, pigs, horses, mules and asses) per person (left) and per hectare (right) in each of the four countries.

The figure left shows that in each of the four countries the ratio of persons and large livestock is around one[14]. In Bhutan and Costa Rica livestock is mostly cattle, in Benin goats, cattle and sheep and in the Netherlands mostly pigs. The ratio is about constant in Benin and Bhutan, since 1980 slowly decreasing in Costa Rica and until the mid 1980s strongly increasing in the Netherlands.

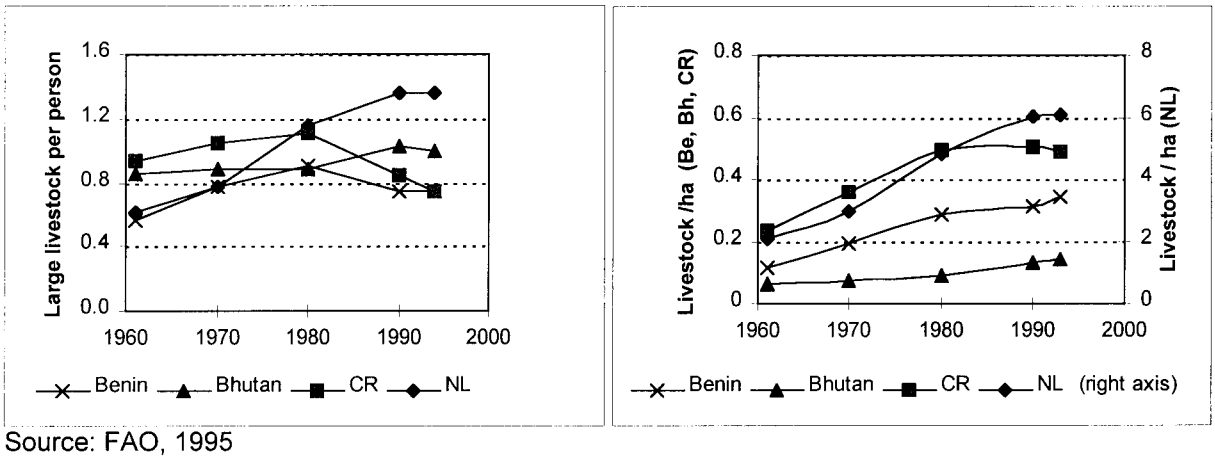
The ratio between livestock and land is extremely high in the Netherlands as a result of so-called intensive animal husbandry. As shown in the figure the ratio increased greatly in the period 1960-1985, during which the Netherlands became a large exporter of animal products. However, due to overproduction and environmental problems, the growth of the animal husbandry has (almost) stopped in the late 1980s. Environmental problems relate especially to the production of manure and consequent emissions of nutrients[15]. Although at a lower level, the livestock in Costa Rica has also been increasing greatly up to the 1980s. In Benin, the amount of animals per hectare is again much lower, but is increasing with the same speed as

[14] For Bhutan a World Bank study (1994a) gives slightly lower numbers, including a small decline form 1992 onwards

[15] In fact, there is some relationship between the nutrients excess in the Netherlands and loss of soil nutrients in some developing countries from which nutrients are exported by means of animal feed for animal husbandry in the Netherlands (causing loss of soil fertility). The nutrients return in the Netherlands as part of the manure.

amount of animals per hectare is again much lower, but is increasing with the same speed as the human population. Cattle raising is done mostly by nomads. In their search for pasture land and water, the nomads descend into the southern departments causing numerous social conflicts between herders and agriculturists. Feed and water problems increasingly result in overgrazing and environmental degradation. In Bhutan the number of livestock has been greatly increasing. There is a growing evidence of occasional overgrazing and resulting erosion in small areas.

Figure 10. 11: Number of large livestock per person (left) and per hectare (right).



Source: FAO, 1995

There is enormous amount of large livestock per hectare in the Netherlands

Note: In the right picture for the Netherlands the right axis is used.

Although not available at the moment, assessment of carrying capacity on the basis of climate, soil types, agricultural methods etc. could help to increase insights in the numbers presented above.

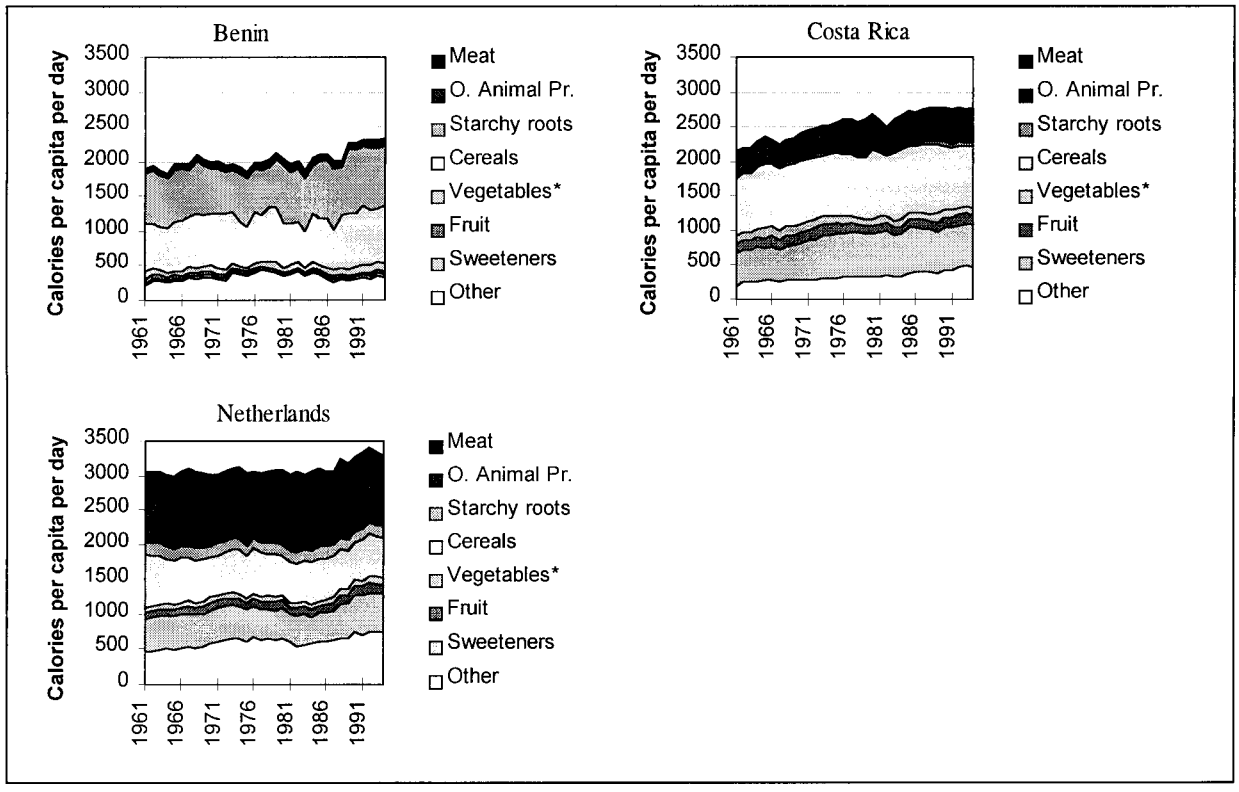
10.5 Food security

Current food security

For food security not only the food production is important, but also uncertainty or variability of yields, price of agricultural products, and distribution of food among certain groups of people threaten food security. The international goal with regard to food security is to reduce the number of undernourished people by half their present number before 2015 (agreed at the World Food Summit, 1996).

Figure 10.12 shows the *average* daily calorie supply in Benin, Costa Rica and the Netherlands. The global average of daily calorie supply per capita is 2700 kcal/cap. The critical level for health is 1900 kcal/cap (RIVM, 1997). Table 10.2 shows the daily calorie supply as given by some other sources.

Figure 10. 12: Average daily calorie supply per capita



The average daily calorie consumption has been increasing in each country. The population in the Netherlands consumes more animal products (Source: FAO, 1995)
Note: (O.Animal Pr. = Other animal products; Vegetables include pulses)

The average daily calorie intake has been increasing in the three countries shown. Current average consumption is between around 2300 calories in Benin, around 2800 calories in Costa Rica and just below 3300 calories in the Netherlands. In the Netherlands especially meat and other animal products (including diary products) contribute a for much higher share to food supply.

Table 10.2: Current food security

	Daily calorie supply per capita	*Calories available as % of need*	*(% of children < 5yr)*		*babies with birthweight < 2500 g*
			wasting	*stunting*	*%*
	1992	*1988-1990*	*1980-1991*	*1988-1990*	
Benin	2532 [a], 2156 [b]	104 [d]	20-30 [b]		10 (1991) [e]
Bhutan	2500 [c]	128 [d]	4 [d]	56 [d]	
Costa Rica	2889 [a]	121 [d]	2 [d]	8 [d]	6.6 (1985) [e]
Netherlands		114 [d]			4.0 (1983) [e]

Source: [a] UNDP, 1996; [b] WB, 1994b; [c] Flavin, 1991; [d] WRI, 1996, [e] WB, 1995a

Just as figure 10.12 also the second column of 10.2 (the ratio of estimated calories) suggests that the average availability of calories is sufficient to satisfy the needs in each of the four countries. However, due to seasonal, annual and geographic variation and the distribution problems (related to poverty) this is not the case. Benin produces in principal enough food to be self-sufficient, but there are 'pockets of food insecurity' throughout the country. According

to the World Bank (1994b) malnutrition affect some 18% of the population in Benin. Malnutrition also occurs in Bhutan, Costa Rica and to a much lesser degree in the Netherlands.

The last three columns of table 10.2 show some data on malnutrition. A considerable share of the children in Benin, Bhutan and Costa Rica is reported to be "wasting" and "stunting"[16]. WRI reports that (for various years during 1980s and 90s) 10% of the babies in Benin were born with a birth weight below 2500 g, this was 6,6% in Costa Rica and 4,0% in the Netherlands.

Food trade and aid

In case production falls short of needs, it is necessary to buy food from abroad or to seek food aid. The table below shows imports or exports of food in the four countries for three important types of food products.

Table 10.3: Net annual food imports of cereals, oils and pulses

	cereals		*oils*		*pulses*	
	1000 tons		*tons*		*tons*	
	1981-83	*1991-93*	*1981-83*	*1991-93*	*1981-83*	*1991-93*
Benin	101	156	15862	8317	212	118
Bhutan	9	36	0	249	0	0
CR	152	408	3230	14085	11102	2113
NL	3454	2760	-37406	-102670	248157	736787

Source: WRI, 1996

Except for oils in the Netherlands, the four countries are net importers of cereals, oils and pulses. The Netherlands at the same time is an exporter of other agricultural products.

The Netherlands has by far the highest net imports of cereals, but part of this is used as feed for meet production for export. Costa Rica has the second position, and imports of cereals are strongly increasing. Also in Benin and Bhutan imports seem to be (slowly) increasing. Food imports indicate some form of dependence on other countries. Bhutan already for some years intends to become self-sufficient with respect to food production, but up to now is not able to be successful in this. About 10% of grain consumption is imported.

Table 10.4: Net food aid received for cereals, oils and milks

	cereals		*oils*	*milks*
	1000 tons		*tons*	*tons*
	1980-82	*1990-92*	*1990-92*	*1990-92*
Benin	8	11	915	227
Bhutan	1	4	408	222
CR	16	42	183	0
NL	-68	-106	-8786	-3101

Source: WRI, 1996

[16] Wasting indicates current acute malnutrition and refers to the percentage of children whose weight-for-height is below minus 2 standard deviations from the median of the reference population. Stunting indicates chronic undernutrition and refers to the percentage of children below minus 2 standard deviations (WRI, 1996).

Food aid plays a major part in meeting food needs in many developing countries, especially in Africa. The table below indicates the amount of food aid received or given by each of the four countries.

Both Benin, Bhutan and Costa Rica receive food aid from other countries. The Netherlands are a donator of food aid.

Future of food security
There have been a large number of studies looking at the issue of future food security. These studies strongly diverge with regard to their conclusions, but agree on the fact that important aspects with regard to food security will be:

- potential for expansion of cropland area and potential for irrigation of cropland
- potential for increasing yields and improving productivity
- significance of soil erosion as a major threat to sustainability and productive capacity
- the contribution of agriculture to environmental pollution and the role of alternative, less environmental damaging, agricultural methods
- the impact of environmental pollution on agriculture (climate change, water scarcity, acidification and more local forms of pollution)

Slight differences in assumption with regard to these issues can lead to substantial differences in outcomes. As a consequence the various studies differ strongly with regard to their conclusions.

Most global models indicate that over the next two decades *average global* production will continue to increase to meet effective demand. However, the studies also indicate that regional differences can be large: the most troublesome regions are sub-Saharan Africa and South-Asia which are not expected to be able to fulfil demand by regional production. Europe is expected to maintain adequate food supply, while in Latin America improvement of the current situation is expected (WRI, 1996).

10.6 Conclusions

There are signs that in all four countries, land available for agriculture, nature or urban development is scarce. Conflicts over land, either between owners and/or functions, are already occurring or are likely to occur in the near future. One of the main functions of land for human societies is the production of food by means of agriculture and animal husbandry. Although the problems with regard to agriculture differ, the agricultural sector in Benin, Bhutan and the Netherlands seems to be at an important cross-roads. Critical decisions will need to be made on how development is to proceed. In Benin and Bhutan the main question is whether agriculture will be able to increase food production (and how) and at the same time prevent erosion and loss of soil fertility. In the Netherlands, the discussion will be about a transition to alternative, less environmentally damaging forms of agriculture.

The information at the moment is still rather fragmented. Information on fertility and erosion is scarce, which is also the case for data on human nutritional status.

11. Forests

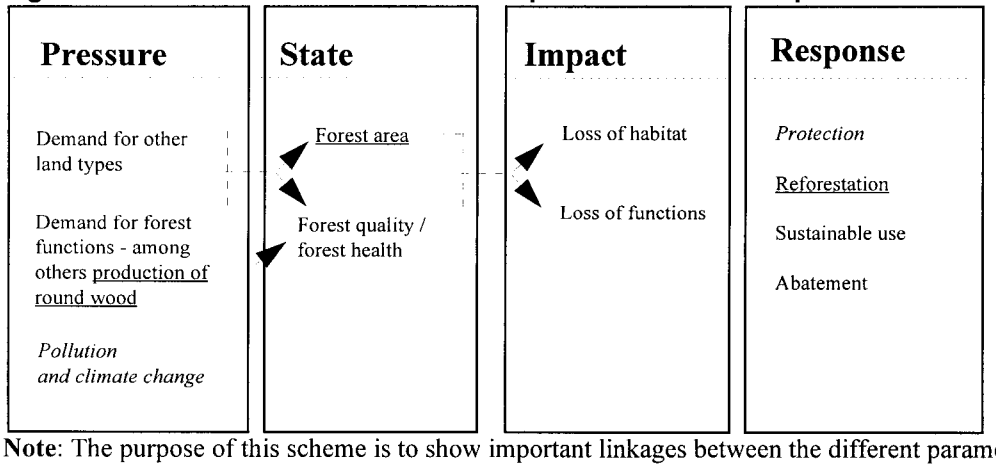
Forests are among the most diverse and widespread ecosystems of the world. Forests provide many significant resources and functions for humans and ecosystems (such as oxygen production, timber production and contribution to biodiversity) The need for a larger food production (see previous section) has resulted in a massive increase of cropland during the last centuries. This conversion has occurred largely at the expense of forests. Forests are also under threat due to exploitation for wood production. As a result there is a world-wide concern with regard to ongoing deforestation.

11.1 Introduction

Around 1700 half of the earth was still covered with forests. In 1980, this area had been declined to 38% as a result of all kind of human activities. Forests provide a large number of resource functions. These include the following (De Groot, 1992):
Production functions: Production of food, timber, medicinal resources, genetic resources and other materials.
Regulation functions: Climate stabilisation, erosion control, water regulation, filter for pollution and other biological regulation functions.
Carrier functions: Habitat for wildlife, recreation and tourism.
Information functions: Religious information, cultural information, nature conservation and scientific and education information.

The function of forest as a habitat for wildlife will be discussed in the chapter on biodiversity. This chapter includes information with respect to the function 'production of timber', since it is the function of which most information can be found.

Figure 11. 1: Overview of the information presented in this chapter



Note: The purpose of this scheme is to show important linkages between the different parameters relevant for the issue and the data presented. For underlined parameters information is included in this chapter; for parameters in italic print information is included in other chapters. For parameters in normal print no information is included in this report

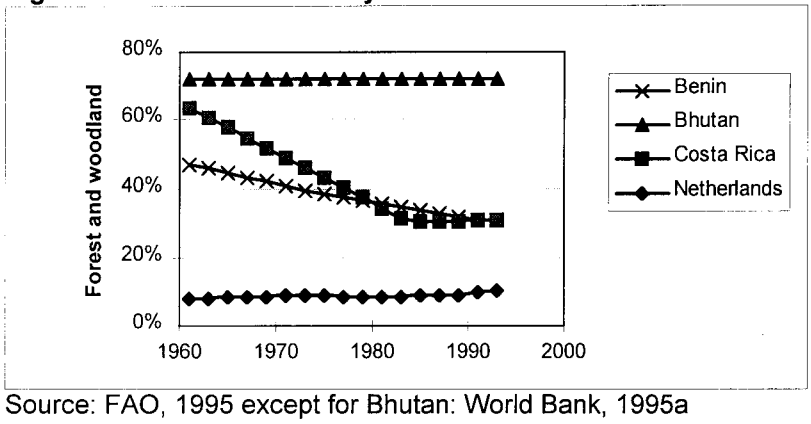
An overview of the information covered in this chapter is given in figure 11.1. Important pressures to the size of forests are demand for other land types (conversion) and exploitation for timber. At the same time pollution and climate change are important pressures for quality

of the forests. Societal response might consists of protection, reforestation programmes, promotion of sustainable forest and use and abatement measures. This chapter first present information on forest state in the four countries. Next, it discusses the issue of deforestation (pressure). Finally it pays some attention to other forest functions and the issue of societal response.

11.2 State of forest area

The forested area has been declining as a result of conversion to cropland and exploitation for wood production. At the moment the most dramatic changes with respect to forest cover take place in low income countries e.g. Brazil, West coast countries of Africa, Indonesia, Thailand etc. . Although the forest area seemed to have stabilised in developed countries, the present forest coverage is only at a small portion of what it once was. Figure 11.2 shows the area covered by forests and woodlands in each of the four SDA countries (World Bank, 1995 and FAO, 1995).

Figure 11. 2: Area covered by forests and woodlands



Source: FAO, 1995 except for Bhutan: World Bank, 1995a

Forests are under threat in each of the four countries; Bhutan is still mainly covered with forests.

For Benin, the two sources used differ considerably as to the size of the forest and woodland area (ranging between 35000 to 50000 sq. km in 1990), but both indicate a strongly decreasing forest cover. The reason for this difference is the gradually changing landscape in Benin from thick forest cover via wooded savannah to savannah. About 20000 sq. km (20%) could be considered as real forest cover. The remaining area consists of open stands of woodland and savannah. Deforestation is taking place at a considerable pace as a result of conversion to agricultural land, overgrazing of savannah land, bush fires, and fuel wood collection, and as yet hardly any policy measures to protect the forest cover.

The trends in forest cover in Bhutan is subject of some confusion. Various international data sources indicate that slow deforestation is occurring in Bhutan (FAO, 1996; WRI, 1996). However, national information sources claim that no net deforestation has occurred over the past decades and that current forest cover is about 72%. Some even indicate an increase in forest cover. Figure 11.2 is based on the latest assessment indicating a forest cover of 72%, but no trend has been included. Deforestation remains a threat in Bhutan, as result of high timber and fuel wood consumption and a large international market for timber.

In the Netherlands the forest area is very small but has been growing slowly over the last 30 years (although it used to be much larger some centuries ago). As a consequence, deforestation is presently not considered to be a problem in the Netherlands. However, the

health of the forests has been declining steadily for at least two decades as a result of pollution, in particular acidification. Despite improvements with regard to emissions of pollutants the declining trend in quality of forests has not been reversed yet.

In the period 1960-1990 the area covered by forest and woodland declined greatly in Costa Rica. However, deforestation seems to have been slowed down during the 1980s, and finally may have (temporary) come to an end during the 1990s among others. as a result of forest protection policies. The change of forest cover in Costa Rica during the last decades is also shown in figure 11.3.

Figure 11. 3: Change in forest cover in Costa Rica

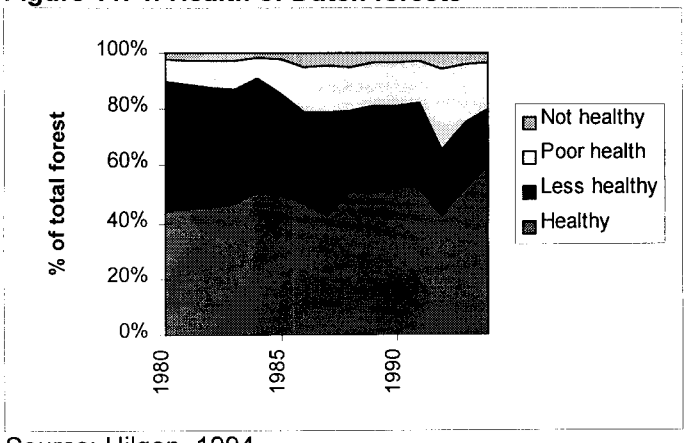
Original source: C. Quesada, redrawn from Meadows et al, 1991
Forest cover declined strongly in Costa Rica during the last century

Natural forests, secondary forests and plantations
In Bhutan the main part of the forests are still undisturbed natural forests. In the Netherlands there is no natural forest, and all forests are so-called secondary forests. The area covered by plantations is still extremely small in each of the four countries but growing. Plantations might partly compensate for the losses of forest resources, but they are generally less diverse.

Additional data on forest conditions
Several other types of information could help assessing the actual state of the forests. WRI (1996) mentions the following types of information:
- degree of degradation, as measured by extent of fragmentation and biomass removal
- degree of naturalness; extent to which recent human activities have modified forest structure and species composition
- intensity of forest management
- relative health of the tree species within a forest.

The health of trees within a forest is annually estimated in the Netherlands. Figure 11.4 shows the health of the Dutch forests. The trends give a slightly mixed impression. On the average, the share of 'healthy' forest seems to be improving. However, the shares of the two lowest categories (poor and not healthy) are not declining yet. The effect of natural events such as dry years is clearly visible in the data.

Figure 11. 4: Health of Dutch forests



Source: Hilgen, 1994

The health of Dutch forests seems to be slowly improving but still about 50% is not very healthy or worse.

11.3 Deforestation

11.3.1 Total deforestation rates

Based on the World Bank over the period 1980-1990 the average deforestation rates in this period have been calculated. The global average deforestation rate in 1981-1991 has been -1.9 % per year (equal to an area of about the size of Egypt per year). The calculated deforestation rates are -1.3% per year for Benin, -2.9% for Costa Rica and +0.3% for the Netherlands. For Bhutan the discussion in the previous section indicates that there is considerable uncertainty with regard to changes in forest cover.

11.3.2 Causes of deforestation

The main causes of deforestation are:

- conversion of forest area to agricultural land
- conversion of forest to plantations
- pressures of rural population; fuel wood, overgrazing, bush fires
- exploitation of forest for timber production

Data on forest logging

A major cause of deforestation is the logging of forest for wood production. The table below indicates the degree of logging in each of the four countries.

Table 11.1: Logging of closed broadleaf forests for wood production in 1990

	Annual logging of closed forests		
	Extent	*% of closed forest*	*% that is primary forest*
	1990	*1990*	*1990*
	1000 ha	*%*	*%*
Benin	0	0.3	57
Bhutan	2	0.2	79
CR	34	2.6	27
NL	x	x	x

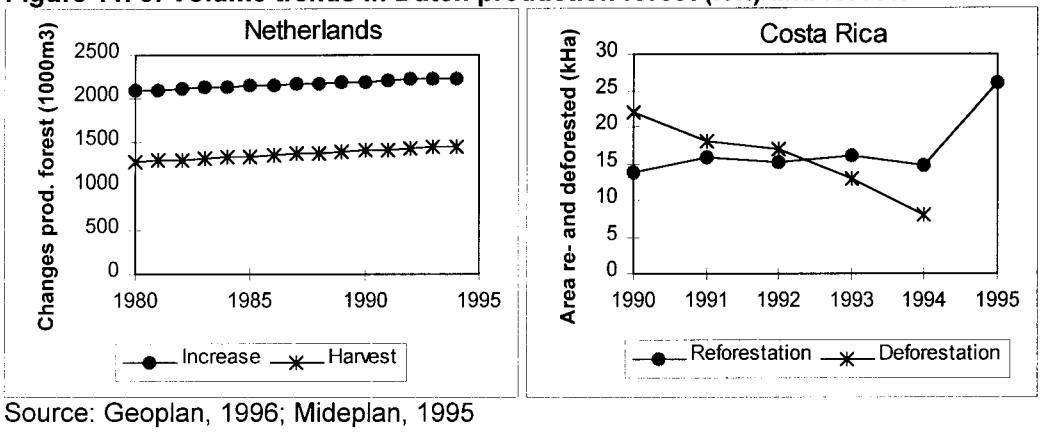
Source: WRI, 1996

According to table 11.1, logging of closed broadleaf forests is highest in Costa Rica. The figure given for Benin is very low, especially in comparison with the deforestation rate mentioned in the previous paragraph. This either means that most of the deforestation in Benin is not caused by logging or that the deforested areas are not considered to be closed forests. Officially, the cutting of forest timber is prohibited except from old state-managed teak plantations, which produce around 46000 m^3, which is not enough to meet national needs.

The allowed logging volume in 1992 in Bhutan was 210000 m^3 including non-commercial, village use of timber (80000 m^3). According to official policy, in recent years logging in Bhutan has been slowed down considerably by its government, in view of sustainable exploitation of forests. Ecologically allowable cut (which is cutting at the pace of natural regeneration) or regeneration through replanting are unknown or uncertain.

For the Netherlands and Costa Rica figure 11.5 shows the annual increase and logging of production forests (the Netherlands) and the total deforestation and reforestation rates.

Figure 11. 5: Volume trends in Dutch production forest (left) and forests in Costa Rica.



Source: Geoplan, 1996; Mideplan, 1995

In both the Netherlands and Costa Rica forest area increase is currently larger than deforestation because of harvest.

Logging in the Netherlands is about two-thirds of the annual increases of production forests. This is in compliance with the governmental policy, which aims at increasing the self-sufficiency of wood production in the Netherlands. In Costa Rica, recently a major policy shift occurred in 1993 which is meant to support reforestation and discourage deforestation . This policy has so far resulted in discouraging the use of fuelwood) and (intentional sponsored) replanting of forests as a deliberate reforestation policy.

Roundwood production

Table 11.2 gives an indication of round wood production in each of the four countries. According to the FAO the term roundwood refers to 'all wood felled or harvested from forests and trees'. This broad category is subdivided into two main categories:

- fuelwood and charcoal production : all wood used for cooking, heating and power.
- industrial roundwood : all other roundwood products.

The first category is strongly related to the use of the forest by the rural population. The second type of wood production also comprises domestically harvested wood used for construction houses, huts etc. The data refer to domestic roundwood production and not to

consumption. The data for Benin, Bhutan and Costa Rica from the FAO are based on modelling.

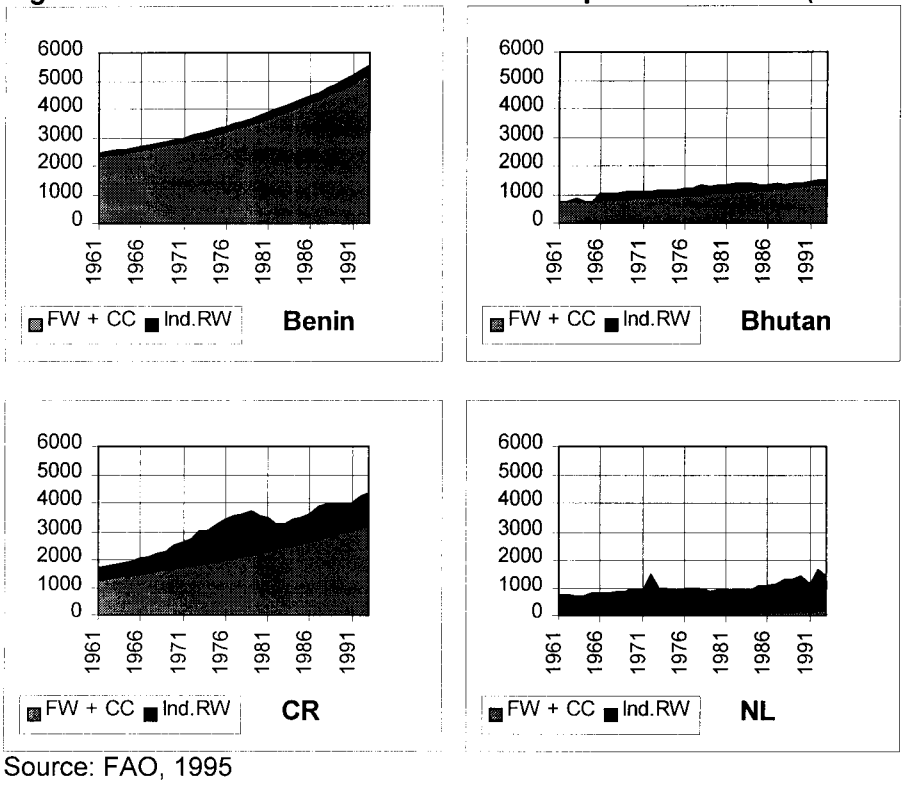
Table 11.2: Summary of wood consumption

	Year	*Industrial roundwood*		*Fuelwood*		*Fuelwood and charcoal*	
		FAO	Others	FAO	Others	FAO	Others
		1000 m3	1000 m3	1000 m3	1000 m3	1000 m3	1000 m3
Benin	1992	296 [a]	(30 [b] 40 [c]) + 86 [e] = 120	4811 [a]	8700 [e]	5075 [a]	9100 [e]
Bhutan	1990	987 [a]	210 [c]	1272 [a]	2200 [f]	1272 [a]	
Costa Rica	1990	987 [a]		2873 [a]	4490 [g]	2981 [a]	5240 [g]
	1993	1103 [a]		3096 [a]	1910 [g]	3210 [a]	2280 [g]
Netherlands	1992	1492 [a]	1428 [d]	167 [a]	-	167 [a]	

Sources: [a] FAO, 1995; [b] WB, 1992; [c] WB, 1994a; [d] Geoplan, 1996; [e] ROB, 1991; [f] Flavin, 1991; [g] Mideplan, 1996;

Note: The industrial roundwood for Benin in the column 'others' is the sum of timber production (30-40 1000 m3) and indigenous wood use (86 k 1000 m3). However, the same report mentions the use of 510,8 kton of indigenous wood use, which is much higher.

Figure 11. 6: Production of roundwood in the period 1961-1992 (in 1000 m3)



Source: FAO, 1995

Note: FW + CC : Fuelwood and charcoal
Ind. RW : Industrial roundwood

In each of the four countries production of roundwood is strongly increasing.

There are several differences between the various sources in table 11.2 but the order of magnitude complies rather well. The differences between the production in the four countries are considerable. Production of roundwood is highest in Benin and consists mainly of fuelwood and charcoal, indicating the high rural pressures on forest resources. Also in Bhutan, fuelwood is the main type of wood consumption. In Bhutan, this is almost completely

organised for governmental organisations as wood cutting for personal consumption is strongly discouraged. In Costa Rica, in addition to fuelwood and charcoal also industrial roundwood is an important type of roundwood production. In the Netherlands production of roundwood consists almost only of industrial roundwood.

Figure 11.6 indicates that in each country roundwood production is increasing, according to FAO estimates.

Table 11.3 the production figures are compared with the total forest area and population per country. This gives some indication of the pressure from wood production on forests, and the importance of fuelwood for energy production. Obviously, it should be noted that the figures are rather crude, and that pressure from wood production will be concentrated on specific sites.

Table 11.3: Fuelwood and roundwood production per hectare forest

	year	*Industrial roundwood Production / forest area (k-m3/ha)*	*Fuelwood and charcoal Production / forest area (k-m3/ha)*	*Fuelwood and charcoal Production per capita (k-m3/cap)*
Benin	1992	0.0	2.0	2.7
Bhutan	1990	0.1	3.7	0.7
CR	1990	0.6	1.7	3.3
CR	1993	0.7	0.8	1.5
NL	1992	4.3	0.0	0.5

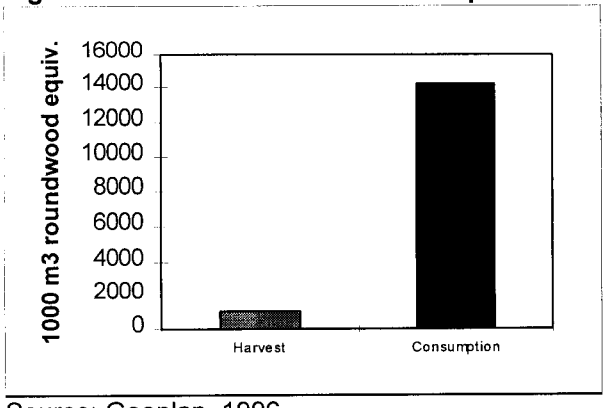
Note: The information in the columns are based on calculations using wood production as indicated in table 11.2, total forest cover as indicated earlier in this chapter and population number as indicated in the chapter on demographic trends.

Table 11.3 shows that on average the productivity from forest for industrial roundwood in the Netherlands is rather high. For fuelwood the intensity of consumption is high in Benin, and was high in Costa Rica, although recently this situation has been changing. The consumption of fuelwood per capita, is highest in Bhutan, followed by Benin, and Costa Rica. This is especially caused by differences in temperature (Bhutan versus Benin and Costa Rica) and fuel used for heating and cooking purposes.

Roundwood consumption
In case of the Netherlands, the figure below gives an impression of domestic production and consumption in the Netherlands in 1992.

Figure 11.7 shows that the Netherlands has to import the largest share of its wood consumption. The Dutch use for instance wood from the Scandinavian countries and Canada.

Figure 11.7: Production and consumption of roundwood in the Netherlands.



Source: Geoplan, 1996

Consumption of roundwood in the Netherlands is much higher than production.

Processed wood production

Wood can be further processed into secondary products. The table below gives production figures for sawwood, panels and paper and paperboard.

Table 11.4: Production of sawwood, panels and paper and paperboard in 1980 and 1992

	Sawwood (m3)		*Panels* (m3)		*Paper & paperboard* (Mton)	
	(m3)		(m3)		(Mton)	
	1980	1992	1980	1992	1980	1992
Benin	9	24	0	0	0	0
Bhutan	5	35	0	13	0	0
Costa Rica	524	772	68	72	12	19
Netherlands	337	405	153	111	1701	2835

Source: WRI, 1996

Production of processed wood is high in the Netherlands and Costa Rica (sawwood). In all four countries the production of processed wood has been increasing. The production of paper and paperboard in the Netherlands has increased strongly in the period 1980-1992.

11.4 Other functions

Production functions of forests in Benin are: 1) production of fuelwood and other roundwood, 2) production of cashew nuts, coconuts etc., 3) production of gathered forest products (honey, fruits, medicinal plants) and 4) production of game. Moreover, forests are of vital importance preventing erosion and exhaustion of soils. Some forests also have a religious function ('bois sacré').

In Bhutan, conservation of forests is strongly related to the notion of sustainable development, since forests are considered to be the most valuable resource. This is related to the steep gradients in the mountains; forests are essential to prevent erosion and to cultural factors (Bhudist conservation ethic). Important production functions are almost the same as mentioned for Benin. In addition, forests play an important role in providing leaf mulch for nutrients and fodder for agricultural purposes. In the erosion-prone Himalayan ecosystems, forests strongly prevent erosion. The forests of Bhutan are increasingly playing a role for attracting tourism. In addition to this, forests have an enormous religious function. The

importance of forests for Bhutan is recognised by its government, who ruled by law that more than 60% of the country should remain forest.

In Costa Rica, the function that most catches the eye - in addition to the production and regulation functions mentioned above - is the enormous attraction these forests have for eco-tourism and national recreation purposes. Some interest exists in using Costa Rica's forests for the production of pharmaceuticals.

Finally, in the Netherlands the most important functions are: 1) production of wood and other forest products, 2) recreation and even hunting grounds, 3) ecological regulation, 4) climate regulation and cleaning of air, 5) protection of water and soil, 6) recreation, and 7) natural landscape.

11.5 Societal response

In Figure 11.1 four possible types of societal responses were identified: protection, reforestation, abatement, and sustainable forest use. Reforestation in fact has partly been covered by giving the deforestation rates in the previous chapter, which showed that at the moment the Netherlands has a negative deforestation rate. The issue of protection is covered in the chapter on biodiversity. Most of the protected areas are forest areas.

11.6 Conclusions

The information in this chapter does not show the complete picture of the state of the forests for sustainable development. Important missing aspects are related to goals, forest quality, and non-production functions. Some information has not been included in this chapter partly because of the overlap with the chapter on biodiversity.

Bhutan and Costa Rica are still rich in forest cover (including primary forests) with over 70% and 30% forests, respectively. Primary forests in the Netherlands were cut down centuries ago for cultivation. Forest cover in Benin is still around 30%, but deforestation is occurring at a considerable pace due to conversion to agricultural land, overgrazing of savannah land, bush fires and firewood collection.

Some data are available on the use of forest for wood production but almost none for the use of forests for other functions.

Costa Rica and Bhutan are currently trying to protect their indigenous forests, and have even started capitalising on their forests through a Trust Fund (Bhutan) and eco-tourism and joint-implementation (Costa Rica). The results of the climate negotiations (Kyoto, 1997) could even open up new avenues for capitalisation on forests for Bhutan and Costa Rica.

12. Water and Fisheries

This chapter discusses freshwater, marine water and coastal zones and fisheries. Evidence accumulates that many water resources are being used in unsustainable ways. Since freshwater resources are unevenly distributed, the question arises whether some regions or countries will face critical shortages of water that could undermine human health and economic development. The issue of fish-supply is especially related to marine waters since about eight out of every ten fishes harvested are marine fish. Similar concerns are raised as with respect to water supply: can future supply be guaranteed if there are so many signs that present supply rates are already unsustainable ?

This chapter gives an overview of the available information regarding the four countries with respect to 1) freshwater (water quality and quantities), 2) marine water and coastal zones and 3) fisheries.

12.1 Freshwater

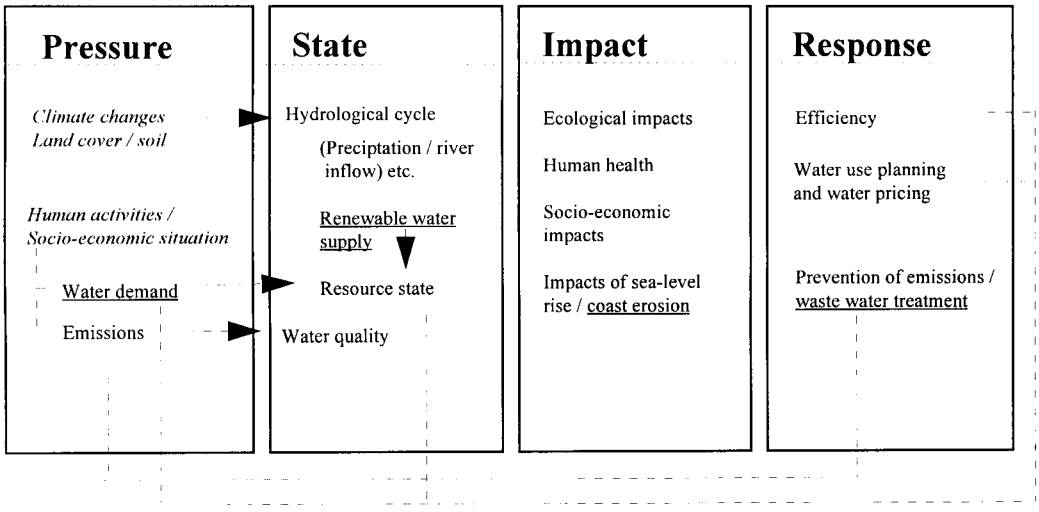
12.1.1 Introduction

Freshwater resources include rivers, lakes, reservoirs, and underground aquifers. In general sense, the following functions of freshwater resources can be identified:
Production functions: Supply of human drinking water, water use for agricultural, industrial and other purposes.
Regulation functions: Water availability in soils, run off, water storage
Carrier functions: Habitat for water animals and plants; fisheries, recreation and transport.
Information function: Significance for landscape, religious functions, cultural functions, scientific functions.

The ability of the freshwater resources to fulfil these functions depends on both water quantify and water quality aspects. This section will especially focus on the function of water resources for production functions.

Figure 12.1 gives an overview of some of the elements that are important for freshwater resources and the information presented in this chapter. The quantity aspects of water are determined by water demand on one hand and water availability on the other. For the first, human activities - such as irrigation and domestic water consumption - are important pressures. The latter is influenced e.g. by changes in the hydrological cycle. Changes in both water quality and water quantity can have significant impacts in the ecological domain (e.g. desiccation of ecosystems and water pollution), for human health (access to safe drinking water) and in the economic domain (via reduced human capital, water availability for irrigation or flooding). The main societal responses to water problems might be 1) increased efficiency, 2) increase of access to safe drinking water, 3) water use planning and water pricing and finally prevention of emissions, e.g. by waste water treatment.

Figure 12.1: Overview of the information presented in this section



Note: The purpose of this scheme is to show important linkages between the different parameters relevant for the issue and the data presented. For underlined parameters information is included in this chapter; for parameters in italic print information is included in other chapters. For parameters in normal print no information is included in this report

The following objectives for sustainable development may be formulated with respect to freshwater resources:

- Quantity: To ensure that water resources are adequate to fulfil the functions assigned to these resources. In particular, this may require that sufficient water is available to meet people's needs (domestic, industrial and agricultural) while sustaining the environmental functions of freshwater. This could include encouragement of efficient use of water.
- Quality: To sustain and improve water quality at a level required for the functions assigned to the water resources. In particular, this might require limits to the pollution discharges into the resource, and thus waste water treatment for discharges not meeting effluent standards.

In this section, first available information on water quantity will be discussed. Next, the scarce available information on water quality will discussed and finally some attention is paid to the issue of flooding.

12.1.2 Water quantity

Water availability

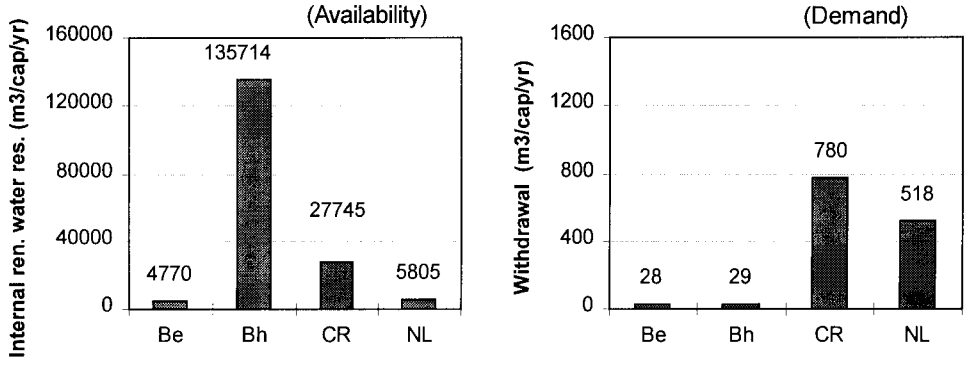
The Global Environmental Outlook (UNEP, 1997) shows that globally, the availability of freshwater is expected to remain a serious topic of concern in and between many countries. Climate change could even worsen this by causing considerable changes in precipitation and thus resources availability as well as run off patterns in regions, catchment areas and between riparian states, which may even affect regional and riparian country political balances.

It is possible to estimate the internal renewable water availability of a country or in catchment areas shared by riparian states . This information can be used as an (very rough) indicator of maximum sustainable use of freshwater. The internal renewable water reserve or resource is defined as the volume of rainfall minus evaporation plus inflow via rivers (ideally also and groundwater movements via aquifers) minus outflows. In figure 12.2 the internal renewable

water availability of each of the four countries are presented The original data come from different sources.

Figure 12.2 shows that Bhutan and Costa Rica are extremely rich in terms of (theoretical) water availability per capita. Water withdrawal per capita is low in Benin and Bhutan, and relatively high in Costa Rica and the Netherlands.

Figure 12.2: The annual internal renewable water supply in 1995 (left) and annual withdrawal of water per capita (right)



Source: WRI, 1996
Bhutan and Costa Rica are very rich in water resources
Note: for Costa Rica in 1970, other countries late eighties or early nineties

The water availability per capita is sometimes directly interpreted as a water stress index. A volume of 1,000 cubic meters per capita per year is used as approximate benchmark below which water stress might occurs; a volume of 500 cubic meters per capita per year is regarded as an benchmark for water scarcity[17]. Benin, Bhutan, Costa Rica and The Netherlands are all well above these figures and are also expected to remain above these amounts into the future. Especially, Bhutan and Costa Rica are extremely rich in terms of water resources.

Also comparing water supply and demand can present an overall indication of water scarcity (figures left and right). However, certain 'safety' factors should be taken into account for seasonal and geographic variation. Figure 12.2 (right) shows that water withdrawal per capita is low in Benin and Bhutan, and relatively high in Costa Rica and the Netherlands. Moreover, it seems that for each country total internal renewable water availability is well above total demand.

However, this does not mean that the four countries do not have water supply problems. First of all, seasonal and geographic variation can cause certain problems (e.g. long dry season in Benin and the Central Valley of Costa Rica). Second, access to the resources can be complicated. Finally, pollution can reduce or even eliminate actual use of resources for several functions. As a result, water scarcity is reported in Benin, but also (to some lesser degree) occasionally during dry and hot periods.

[17] At the moment, some 20 countries especially in Africa and western Asia are affected by water scarcity. With increasing populations and increasing withdrawal of water, the number of countries which are affected by water scarcity is expected to increase to over 50 over the next 30 years.

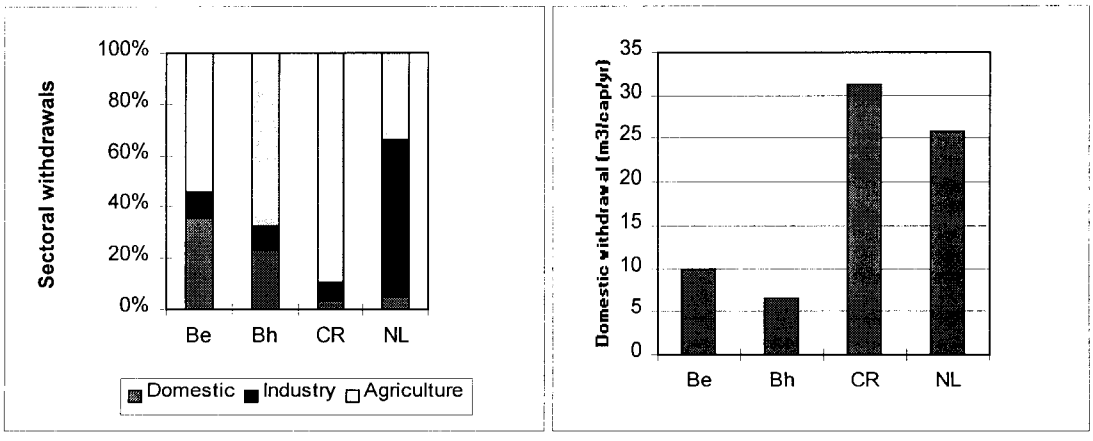
The Netherlands has both an abundance and a shortage of freshwater. Despite a good average rainfall, alluvial soils and large discharges of rivers, (small) water deficits do sometimes occur during summer. Moreover, due to the use of water from underground aquifers and more importantly due to drainage of agricultural land about 10 % of the total area of the country is affected by a permanent lowering of groundwater tables. Desiccation (water depletion) is a major concern for both nature protection and agriculture, which have led to integrated water policy developments addressing both interest sectors. The problems with regard to pollution of both surface and ground water resources due to domestic and industrial discharges worsen the quantity problem. To counteract these pressures water pricing was recently introduced for water abstractions whether for industrial or domestic use. Treatment and discharge charges are already levied for some twenty years.

Benin has four river basins with a throughput of 10 billion cubic metres. However, water supply in the north of Benin is insufficient. Except for the principal rivers, most rivers are seasonal. The network of waterways experiences problems of continuously declining water levels and sedimentation. Moreover, as result of the gradual loss of original vegetation, in some areas water runoff intensifies on unprotected soils, and water well replenishment declines.

Water consumption

Figure 12.3 gives information on sectoral water withdrawal.

Figure 12.3: Sectoral water withdrawal (left) and domestic water withdrawal (right)



Source: WRI, 1996.
In Benin, Bhutan and Costa Rica the agricultural sector consumes the largest amount of water.
Note: for Costa Rica data is from 1970, for the other three countries late eighties or early nineties

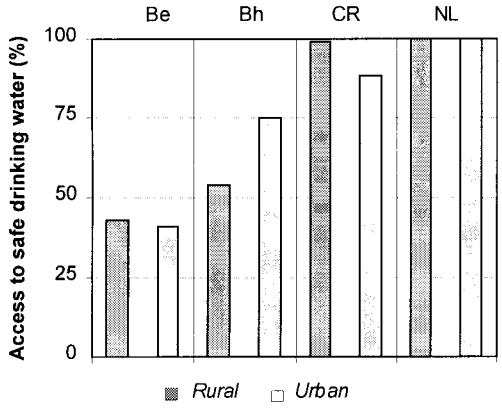
On global scale, the agricultural sector (irrigation) withdraws the largest amount of water, which is also the case for Benin, Benin, Bhutan and Costa Rica. In the Netherlands the main water user is the industrial sector (especially power plant cooling).

The absolute domestic water consumption per capita is largest in the Netherlands and Costa Rica, followed by Benin and Bhutan. A more striking difference between the four countries is the access of households to safe drinking water. In the Netherlands, in most areas in Costa Rica, and in urban areas in Benin and Bhutan access to drinking water is via households

connections. In rural areas in Benin, Bhutan and too a lesser degree Costa Rica access to drinking water is mostly via communal water pumps. In the Netherlands (virtually) all drinking water is treated before consumption; in the other three countries this is less common.

The figure 12.4 gives an indication of access to safe drinking water.

Figure 12.4: Access to safe drinking water



Source: WRI, 1996
Access to safe drinking can still be improved in Benin and Bhutan.

The figure above shows that access to safe drinking water is near to 100% in Costa Rica and the Netherlands, the two countries with highest domestic consumption. In Bhutan and Benin access is much lower. In Benin, increasing the access to safe drinking water is an important priority.

In rural areas the 'sustainability' of installed access to safe drinking water is a very serious problem. E.g. during the 1980s and early 1990s a large amount of water points was installed in Benin. Access to groundwater is rather difficult due to rock formation and depth of aquifers. By 1994 29% of pumps were out of order and 13% of wells had dried up. This poor performance is related to economic, technical and cultural reasons.

12.1.3 Water quality

Water quality is defined here as the biological, physical and chemical composition of water , with respect to its functions. Functions that are very dependent on high water quality are: drinking water, some industrial purposes, special applications e.g. in hospitals, and habitat functions for animals and plants (including commercially exploited fish). The most common emissions of pollutants into water resources are:

- discharging of insufficiently treated domestic waste waters (e.g. oxygen depleting substances, bacterial pollution)
- discharges of polluted industrial effluents (various among others heavy metals)
- discharges of agricultural and agro-industrial activities (nutrients, pesticides)

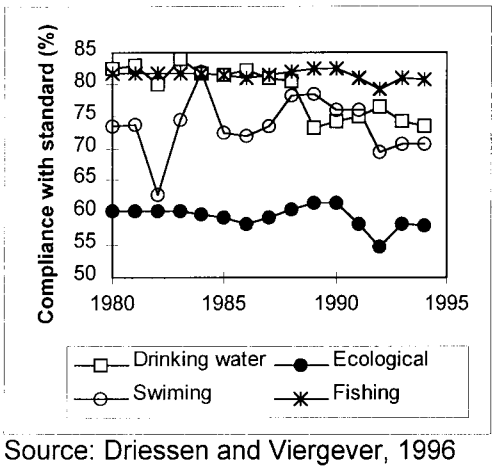
Water quality plays an extremely important role for human health. Not only directly, by its function for drinking water, but also indirectly i.e. via the consumption of fish and other water products and by means of various water-borne diseases. In Benin, water associated diseases

such as malaria, diarrhoea and schistomiasis account for high levels of morbidity and mortality.

In Benin, Bhutan and Costa Rica domestic waste water is an important cause of water pollution. In the Netherlands, this type of water pollution has been significantly reduced by waste water treatment (see further in this section). In the Netherlands, the agricultural sector is increasingly important for water quality. Also in Benin (cotton production) and Costa Rica (coffee and bananas) agriculture could be an important cause of water pollution by means of pesticides.

Only for the Netherlands data was found on water quality. In general terms, quality of water resources has been slowly improving since the 1960s, although especially high concentration of nutrients, sometimes high concentration of pesticides and polluted water soils still poses some problems. The figures below give some indication of the quality of water in the Netherlands.

Figure 12.5: Compliance of water-standards based on specific functions



Source: Driessen and Viergever, 1996

The figure left shows that - on average - the compliance of water with a specific function with the standards for this function in the Netherlands has been rather constant since 1980. The quality of drinking water shows a clear decline; note that only groundwater has been included (the main source of groundwater in the Netherlands), the quality of drinking water from surface water is improving (for a discussion of method and figures see Driessen and Viergever, 1996).

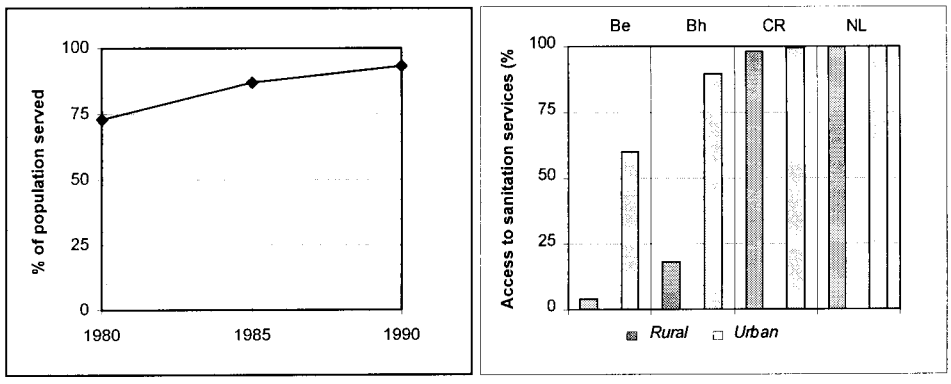
Wastewater treatment

Treatment of human waste water is essential to prevent surface water pollution (and corresponding impacts on human health and on plants and animals). However, in many countries as little as 4 % only of the total effluent volumes is discharged into surface and /or groundwater receiving bodies after some form of (limited) treatment.. At present only data was available for the Netherlands. In addition the share of people with access to is shown (has been discussed earlier in the chapter on human health).

Full treatment (first is mechanical, second is biological and third is de-nutrientification treatment) of wastewater has started in the Netherlands especially from 1970 onwards, when the Dutch faced serious quality problems with regard to surface water. The figure shows that

the fraction of population served by full wastewater treatment is still increasing and reached a level almost 95% during the 1990s.

Figure 12.6: Percentage of population served by wastewater treatment in the Netherlands (left) and access to sanitation services (right)



Source: WRI, 1996
Note: r = rural, u = urban

12.1.4 Flooding

Two-thirds of the population in the Netherlands live in inundation-prone areas. Most of these areas are protected by dikes. Also in Benin, flooding is a serious threat, both in north Benin, and in the cities in the south. In particular, in Cotonou where the main cause is urban development in areas which are frequently flooded.

12.2 Marine waters (quality and coastal protection)

Benin, Costa Rica and the Netherlands all have a large marine and coastal area. Some of the problems that could occur in these areas are:
- water pollution (among others waste, oil spills, discharge by polluted rivers)
- coastal erosion (human activities, natural causes, climate change)

Table 12.1: Size of marine waters

	Shelf to 200 m depth (thds sq. km)	*Exclusive economic zone (thds sq. km)*
Benin	x	27
Bhutan	0	0
Costa Rica	16	259
Netherlands	85	85

Source: WRI, 1996

Marine water pollution

Eutrophication is a major concern in coastal waters of the Netherlands. The concentration of heavy metal and organic substances have been considerably reduced since the 1980s, but are above the natural levels. There is a continuing problem with releases of oil from ships' bunkers and the impacts on sea birds. Increased concentrations of pollutants can be found in top predators.

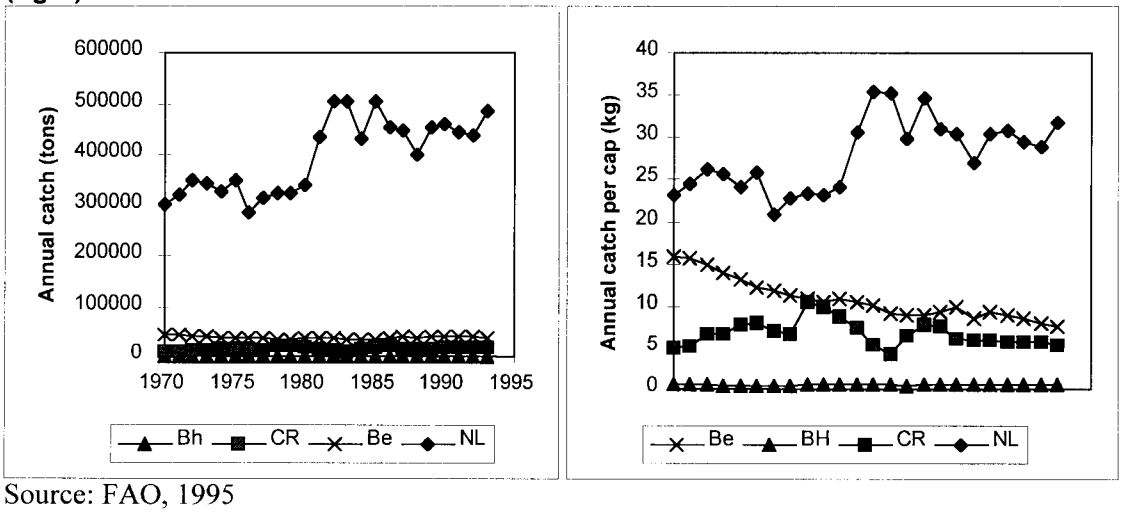
Coastal erosion
Coastal erosion is reported in the Netherlands and Benin. Especially in Benin, coastal erosion is considered to be a serious problem. Causes might be uncontrolled removal of beach sand and the Cotonou port management works which has modified sand distribution patterns. However, the phenomenon is occurring throughout the African west coast and has more complex causes. In the Netherlands, a comparable situation exists and large amounts of sand have to be added to the natural beaches and dunes each year. Sea level rise, as a result of climate change, might worsen this problem in the future.

12.3 Fisheries

In recent years, there have been continued signs that marine fisheries are in serious trouble. The causes of this are primarily overfishing, but also coastal degradation and a lack of sensitivity in fishing techniques. In 1993, the FAO estimated that more than two thirds of the world's marine fish stock were being caught at or beyond their level of maximum productivity. At the same time a large share of the global population depends on fish as their source of protein. Especially marine fisheries are important, since about 8 of every 10 fish harvested is provided by the sea.

Annual catch
Figure 12.7 below shows the annual catch (including both marine and freshwater fish, molluscs and crustaceans) and the annual catch per person in the period 1970-1993 in each of the four countries.

Figure 12.7: Total annual catch of marine and freshwater (left) and total annual catch per capita (right).



Source: FAO, 1995
Total annual catch and annual catch per capita are the highest for the Netherlands.

The annual catch and the annual catch per capita are highest for the Netherlands and catches have been increasing over the first half of the period. More than 99% of the Dutch catch is in marine waters (in several seas and oceans). For the Netherlands per capita catch is not indicative of per capita annual consumption, since a considerable amount of fish is exported to other European countries. After 1982 the increase of catches stopped, among others as a result of government policy (EU) to prevent exhaustion of the European fishing grounds. Despite such policies, there are still signs that current catch in some seas is not sustainable.

In Benin about three-quarters of the catch is harvested in freshwater (lagoons). In the last few years fisheries from these lagoons have been declining, and despite some increases in marine fisheries catch per capita has been strongly declining. The reasons for decline of lagoon fisheries are (ROB, 1991; WB, 1994b):

- overexploitation
- siltation of lagoons
- increasing salinity of the lagoons

More than 85% of the catch in Costa Rica is done in marine waters. The per capita catch of Costa Rica is almost constant. The small catch in Bhutan is totally from freshwater.

Fish stocks

At the moment no information is available with regard to the state of the fish stocks. There are at least, two operational problems with respect to fish stocks. First of all, there are large uncertainties involved in estimating present stocks and even larger with regard to estimating the minimum required biological level. The second problem is that especially the Netherlands, but probably also Costa Rica catches fish in several marine waters.

12.4 Conclusions

At first glance, data on yearly water availability do not indicate serious water stress nor water scarcity for Benin, Bhutan, Costa Rica and the Netherlands, either now or in the foreseeable future. However, such data does not include temporal, geographical and social distribution. Some signs of water scarcity have been reported in the Netherlands and especially Benin. As a result of an increasing population and increasing demands from agriculture, water stress might increase in some areas.

Almost no data on water quality was available. Available data in the Netherlands show that current freshwater resources - especially groundwater - suffer from water pollution but the situation is slowly improving. In Benin and Costa Rica, local 'chemical' water pollution has been reported. Bacteriological pollution of water is much more common in these countries. Purification of urban waste water (domestic and industrial) in these countries is still scarce, putting serious pressure on the receiving water bodies. The use of pesticides and fertilisers in agriculture causes water pollution in the Netherlands, Benin (cotton) and Costa Rica (bananas).

The access to safe drinking water widely differs between the countries. In Benin and Bhutan, access to safe drinking water is below 25% in rural areas. In Costa Rica and the Netherlands access is near 100%. In Benin and Bhutan increasing access to safe drinking water is an important priority for policy making.

Some data are available on fishing in each of the countries but show large differences between them for catches and their contribution to food security (high per capita catches in Benin and the Netherlands, slightly lower in Costa Rica and very low in Bhutan). In Benin and the Netherlands signs of depleting fishing stocks have been reported.

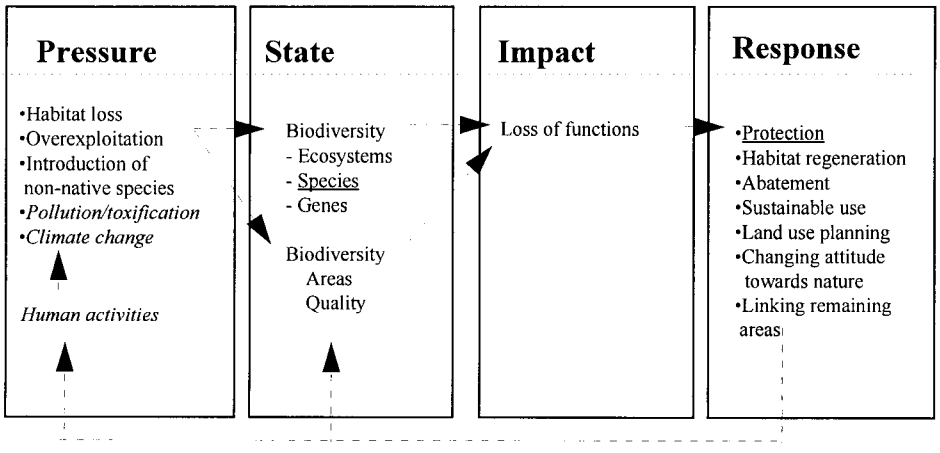
13. Biodiversity

The earth is home to a large amount of different plants, animals and other living organisms. Preserving this 'biodiversity' and protecting all kinds of life are considered to be key elements of sustainable development. There are ethical reasons for preserving biodiversity but more practically reasons to preserve biodiversity relate to its important functions such as stability of ecosystems or certain economic purposes.

13.1 Introduction

The Global Environmental Outlook (UNEP, 1997) shows that nature in all its diversity is being threatened all over the world. According to the Global Biodiversity Assessment, the extinction rate of animal and plant species since 1600 has been estimated to be 50 to 100 times the average estimated natural rate. In the near future this rate might even increase to 1000 till 10,000 times the natural rate (UNEP, 1995).

Figure 13.1: Overview of the information presented in this chapter



Types of biodiversity

Generally, three (related) types of biodiversity are distinguished: diversity of ecosystems, species and genes. It is clear that the relationships between these different types are quite strong: e.g. it is impossible to protected species diversity in a reasonable way, without protecting corresponding habitats.

Functions of biodiversity

It is useful to identify the functions of biodiversity to understand the its crucial role (de Groot, 1992):

- Production functions: Biodiversity as the raw material for all kind of products
- Regulation functions: The role of biodiversity within the cycles of elements
- Carrier functions: The habitat for animals and plants
- Information functions: The importance of biodiversity as study object for science, education, religious and cultural functions

Sustainable development

The fundamental importance of protection of biodiversity for sustainable development was already realised during the UNCED conference, and simultaneously with other conventions and programmes the Convention on Biodiversity was agreed upon. The objective included in this document with regard to the notion of sustainable development and biodiversity can be summarised as to conserve - as far as reasonably possible - the wide variety of species and ecosystems.

Biodiversity has become a very important issue for policy-making in recent years. However, it is a difficult to be make the concept operational for scientific purposes. Several institutes are currently attempting to develop comprehensive assessment methods, but these methods are not operational yet.

13.2 Main geographic and natural systems

Geography and climate are important factors determining the type of (terrestrial) ecosystems present. Table 13.1 summarises the main geographic and climatic features of each of the four countries.

Table 13.1: Main geographic and climatic features

	Geographic features	*Climate*
Benin	Mostly flat to undulating plain; some hills and low mountains	Humid in south; semiarid in north
Bhutan	Mostly mountainous with some fertile valleys and savannah.	Tropical in southern plains; cool winters/hot summers in central valleys; severe winters and cool summers in Himalayas
Costa Rica	Coastal plains separated by rugged mountains	Tropical; wide variety of micro climates
Netherlands	Coastal lowland and reclaimed land, river delta; some hills in Southeast	Temperate; marine

Table 13.2 gives a short description of the main or most interesting natural ecosystems present.

Table 13.2: Some of the most important ecosystems.

	Ecosystems
Benin	Natural vegetation is mostly Sudanian woodland. However, present ecosystems have been greatly influenced by human activities. In the North: Degraded savannah woodland interspersed with gazetted forest, South: Residual forest, small areas deciduous and semi-deciduous forest, Coast: Mangroves
Bhutan	Tropical moist deciduous vegetation zone (Duar plain), temperate coniferous zone, alpine vegetation zone
Costa Rica	Tropical moist forest; areas of lower montane and montane forests; some dry forests in north-west; Agricultural areas, Mangroves
Netherlands	Small areas of deciduous and coniferous forests, agricultural areas, wetlands

13.3. Biodiversity of terrestrial ecosystems

Biodiversity of terrestrial ecosystems is strongly threatened, mainly as a result of conversion of natural ecosystems into cropland and pasture land. In fact, globally the fraction of non-domesticated area decreased between 1700 and 1980 by one-third, from 94% to about 64% (Bakkes and van Woerden, 1997). The loss of primary or old forests has even been more dramatic; in Europe for instance only 1% of the area is old-growth forest. It should be noted that also domesticated areas, such as crop- and pasture land, can contribute to biodiversity.

Habitats and habitat loss

The figures shown in figure 10.1 could be interpreted as an indication of loss of non-domesticated areas. However, some caution should be taken interpreting the 'others'-category.

Species

At the moment still little is known about (trends in) biodiversity. The available information is mostly about numbers of known species. Table 13.3 en 13.4 show some information on known species. The tables include only known species in Bhutan, Costa Rica and Benin the real amount of (currently unknown) species is much higher. The tables also give the amount of known endemic species (end.), the amount of known threatened species (thr.) and the number of total known species per area-unit.

Table 13.3: Mammals, birds and higher plants

	Mammals				Birds				Higher plants			
	Numbers of known species				Numbers of known species				Numbers of known species			
	Total 1990s	End. 1990s	Thr. 1990s	No/area 1990s	Total 1990s	End. 1990s	Thr. 1990s	No/area 1990s	Total 1990s	End. 1990s	Thr. 1990s	No/area 1990s
Benin	188	0	7	85	423	0	1	190	2000	x	3	899
Bhutan	99	0	18	59	543	0	12	326	5446	75	20	3268
Costa Rica	205	6	8	120	850	7	10	496	11000	950	456	6421
Netherlands	55	0	2	36	456	0	3	295	1170	x	1	758
World	4327				9672				270000			

Source: WRI, 1996

Note: end. = the amount of known endemic species; thr. = the amount of known threatened species; no/area = index indicating the number of total known species per 10,000 square kilometre. x= no data

Table 13.4: Reptiles, amphibians, and freshwater fish

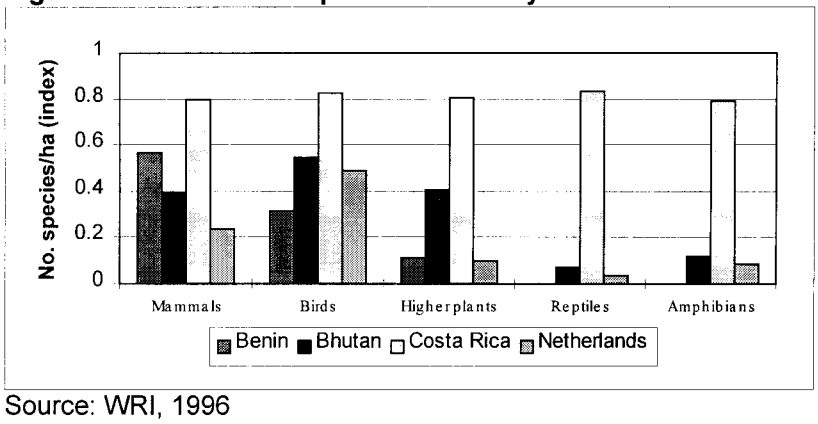
	Reptiles				Amphibians				Freshwater Fish	
	Numbers of known species				Numbers of known species				Numbers of known species	
	Total 1990s	End. 1990s	Thr. 1990s	No/area 1990s	Total 1990s	End. 1990s	Thr. 1990s	No/area 1990s	Total 1990s	Thr. 1990s
Benin		1	2			0	0			0
Bhutan	19	2	1	11	34	0	0	14		0
Costa Rica	214	36	7	125	162	34	1	95	130	0
Netherlands	7	0	0	5	16	0	0	10	82	2
World	6900				4400					

Source: WRI, 1996

Note: end. = the amount of known endemic species; thr. = the amount of known threatened species; no/area = the number of total known species per 10,000 square kilometre.

The columns 'total number of known species', and 'the number of species per area' clearly indicate the ecological richness of both Bhutan and Costa Rica (see also figure 13.2). About 5% of all mammals, birds (10%!), higher plants, reptiles, and amphibians known in the world is present in Costa Rica. A high number of these species are endemic. Costa Rica is included in the list of twenty countries with the highest level of biodiversity of WCMC (WCMC, 1994). Bhutan is not included in this list as result of the fact that the list is based 1) on both area and biodiversity per area parameters (so favouring larger countries) and 2) on identified species (in Bhutan assessment of species richness is still at very early stages). Considering the wide variety of geographic areas and its large untouched areas, it is very likely that biodiversity is on very high level in Bhutan.

Figure 13.2: Number of species divided by the total land area



Source: WRI, 1996

Costa Rica and Bhutan are very rich in terms of Biodiversity

The columns 'threatened species' in tables 13.3 and 13.4 are rather difficult to interpret since species can also be threatened for natural reasons (edge of habitat). Table 13.5 gives the ratio between threatened species and total known species in each of the four countries.

Table 13.5: Ratio between threatened and total known species

	Mammals	*Birds*	*Higher plants*	*Reptiles*	*Amphibians*	*Freshwater fish*
Benin	3.7	0.2	0.2	x	x	0.0
Bhutan	18.2	2.2	0.4	5.3	0.0	0.0
Costa Rica	3.9	1.2	4.1	3.3	0.6	0.0
Netherlands	3.6	0.7	0.1	0.0	0.0	x

Source: WRI, 1996

The ratio between threatened and total known species is difficult to compare for different countries.

These data cannot be used for comparison of countries. The differences between the countries might be caused by a different level of accuracy of the data, natural causes or human pressures. The data might be used to show the danger of loss of biodiversity or time trends for one single country.

Threats to future biodiversity

In the context of the Global Environment Outlook, RIVM (Bakkes and van Woerden, 1997) tried to estimate the pressures on natural areas for the main global regions. Based on the conclusions of this publication and the present situation in the four countries some threats with respect to future biodiversity are discussed here.

The non-domesticated areas in Benin are under very high pressure, mainly as result of on-going population growth. It is expected that in Africa forests and grassland/savannah will largely be converted into agricultural land. The sum of the pressures 'population density', 'forest clearance for timber', 'economic activity' and 'climate change' are thought to double in the near future. The risks in Bhutan seem to be somewhat smaller, but one should note that also in Bhutan there is a considerable pressure caused by population growth whereas the Bhutanese area is fragile with respect to erosion. In East Asia economic activities are expected to increase strongly, which might cause increasing transboundary air pollution.. As for the whole region of Latin America, the natural areas in Costa Rica are at a relatively moderate risk: population growth is slowing down, and the projected increase in agricultural production can be largely met through intensification. In the Netherlands, total non-domesticated area is projected to be fairly stable in size. However, climate change could be a dominant pressure on the small natural areas.

13.4 Marine biodiversity and coastal zones

In the chapter on fisheries, already attention has been paid to the topic of exploitation of marine fish stocks. In addition to overexploitation, coastal zones are also at risk due to a range of development-related pressures. This is a very serious situation, since coastal zones provide important marine habitats (both with respect to biodiversity, but for reproduction of many marine species). Bryant et al (1995) tried to estimate the global coastlines under threat based on the pressures population density, road and pipeline density, cities and major ports. Table 13.6 gives an overview of coast lines of the four countries, and the share being endangered (as identified by Bryant et al, 1995).

Table 13.6: Coast line and endangered coast line

	Coastline km	*% endangered (Bryant et al, 1995)*	
		Serious risk	*Medium risk*
Benin	121	100%	0%
Bhutan	0	-	-
Costa Rica	1290	ca. 25%	ca. 25%
Netherlands	451	100%	0%
World		34%	17%

Source: WRI, 1996; Bryant et al, 1995

In Benin and the Netherlands most of the coastline is endangered.

Table 13.7 gives an overview of the status of marine species.

Bhutan is a land-locked country and consequently there are no marine animals. The other three countries all have some marine mammals and turtles. In addition to species, coastal habitats can be considered. Coastal ecosystems account for almost one third of all marine biological productivity. Estuarine ecosystems, which include mangroves and seagrass beds, are among the most productive ecosystems on earth. Moreover, many coastal habitats serve as nursery areas, but are often heavily affected by human activity. The Netherlands have a large number of important wetland areas. Benin and Costa Rica both have mangroves-habitats. Since it has been estimated that already half of the world's mangroves have been destroyed, protection of these areas is very important.

Table 13.7: Marine biodiversity

	Coastal marine species			Habitats		Protected areas	
	Turtles, total	mammals, total	mammals, thr	Mangroves	Coral Reefs	Number	Reg. priority sites
	1990s	1990s	1990s	1990s	1990s	1990s	1990s
	no.	no.	no.	thds ha	thds ha	no.	no.
Benin	x	2	1	3	x	x	x
Bhutan	-	-	-	-	-	-	-
Costa Rica	4	x	1	40.5	present	13	1
Netherlands	x	3	0	0	0	4	2
World	7	56	15	x	x	1306	73

Source: WRI, 1996
Note: thr. = the amount of known threatened species;

13.5 Protection of biodiversity

Tables 13.8 and 13.9 shows some information on protection system as a possible indication of how well biodiversity in each of the four countries is preserved. The first table includes international protection systems, the second table shows national protection systems.

Table 13.8: International protection systems

	biosphere reserves		world heritage sites		wetlands of int. importance	
	1994	1994	1994	1994	1994	1994
	no.	thds ha	no.	thds ha.	no.	thds ha.
Benin	1 [a]	2500 [a]	0	0	0	0
Bhutan	1	880	0	0	0	0
Costa Rica	2	729	1	585	3	30
Netherlands	1	260	0	0	15	313
World	327	217710	119	113400	652	43267

Source: WRI, 1996 and [a] WB, 1995e

Table 13.9: National protection systems

	Protected area		*Totally protected*	*Protected > 100kHa*
	kHa	*(%)*	*(%)*	*%*
Benin	77	6.9	6.9	6.9
Bhutan	966	20.6	15.5	6.9
Costa Rica	648	12.7	9.9	0.5
Netherlands	429	11.5	7.8	0.1
World	959,568	7.1	3.7	0.8

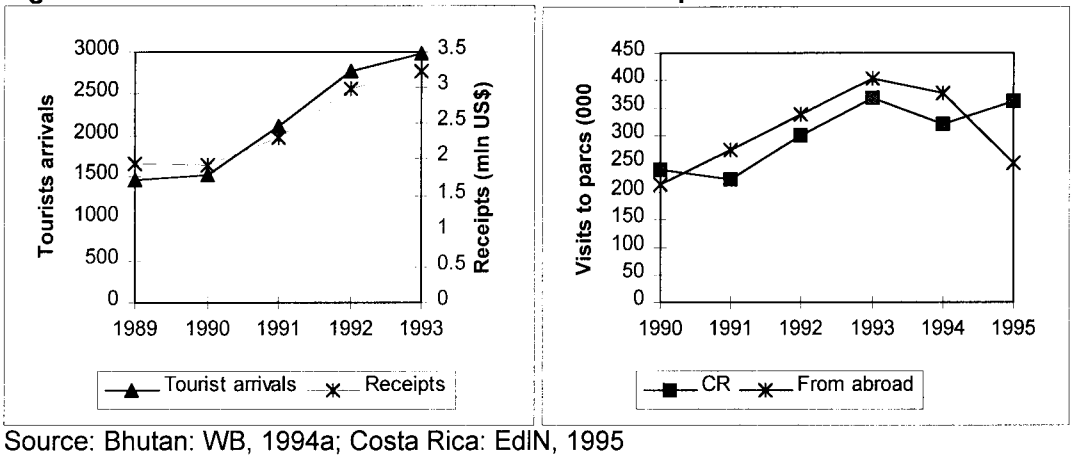
Source: WRI, 1996
More than 20% of Bhutan is protected. The protected areas in the Netherlands and Costa Rica seem to be fragmented.

Although the quality of the protection might vary, table 13.9 shows the strict preservation policy in Bhutan[18]. Partly as a result of deforestation, almost all major forests in Costa Rica, the Netherlands and Benin are now protected. Table 13.9 also mentions the part of the country protected by means of nature reserves larger than 100,000 hectares. The data suggest that reserves in Costa Rica and the Netherlands might be fragmented, thus a threat to biodiversity. However, some comments should be made here: 1) small countries will always have relatively small reserves and 2) how the data deal with adjacent reserves is not certain. Nevertheless, it is clear that for ecological functions reserves need to have a minimum size.

13.6 Tourism

Biodiversity can be a major attractor of tourism. The figures below give an indication of tourism in Bhutan and visits to the national parks in Costa Rica.

Figure 13.3: Tourism in Bhutan and visits to national parks in Costa Rica



Source: Bhutan: WB, 1994a; Costa Rica: EdlN, 1995

Tourism is increasing in Bhutan and Costa Rica.

Tourism in Costa Rica is on a much higher level than in Bhutan. For Benin, it is known that the main park of Benin - Pendjari - attracts about 3000 tourists a year (WB, 1995e).

13.7 Conclusions

Biodiversity has also been identified as a priority area within the context of the agreements on sustainable development between Benin, Bhutan, Costa Rica and the Netherlands. However, at the moment measures for biodiversity are still poorly developed. In many non-industrialised countries systematic collections are still relatively poor, so that biodiversity is most probably underestimated.

The data shown in this chapter refer mainly to species estimates and very little to ecosystems. Further development of a core set of indicators for biodiversity and its uses is important. In the Netherlands, an approach to policy-making has been developed on the basis of 'target ecosystems'. This system can also be used for assessing the level of biodiversity. Attempts are being made to develop a similar approach for Benin as part of the co-operation with the

[18]Other sources give numbers that differ from the values in the table above. One sources mentions that in Costa Rica 21% of the total area is protected (EdlN, 1995). For Benin, the World Bank (WB, 1995e) reports that in total 24% of the total area is somehow protected, of which about half could be interpreted as reserve. However, despite the protected state in many of these areas land is cleared for farming, hunting and stock raising.

being made to develop a similar approach for Benin as part of the co-operation with the Netherlands. Another interesting approach is made through the limited set of indicators within the Q-Q-index (Ten Brink and Bouma, 1995).

On the basis of the simple species numbers discussed in this chapter, Bhutan and Costa Rica have already been identified as 'biodiversity hotspots'. In the Netherlands and Benin there are also several interesting areas with respect to biodiversity, in particular at the ecosystem level. As to protection, all countries have established some form of policy: Bhutan apparently having the most stringent regulations, covering most of the country, both in national and in international context.

14. Energy and Materials

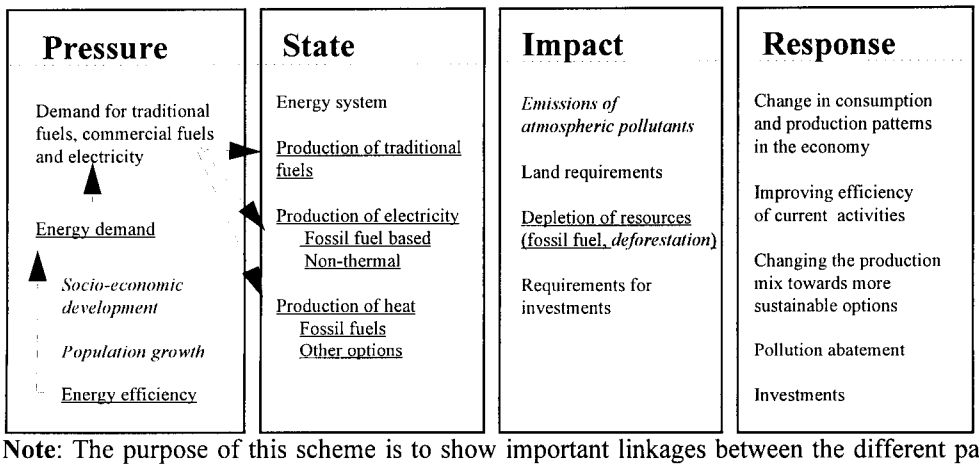
Industrialisation of countries is generally accompanied with increase in energy consumption and consumption of all kind of basic materials. Large flows of energy- and materials can cause several environmental impacts during their production and consumption cycle. The chapter is divided into two main parts: 1) energy and 2) materials (which especially focuses on metals).

14.1 Energy

14.1.1 Introduction

Global consumption of energy has increased strongly during the last century. This growth was by far the largest in the industrialised countries. Extensive use of energy plays a prominent role with respect to several local, regional and global environmental problems. Among the most serious forms of possible environmental degradation are acidification and global warming. Moreover, some worry about exhaustion of the most accessible fossil energy resources. At the moment, the growing industrialisation of many developing countries is reflected in rapidly rising consumption in these countries. In addition to environmental problems, the need to produce additional supplies often leads to problems with regard to raising the huge sums required to finance capital-intensive energy production facilities. The figure below provides an overview of the information presented in the sections on energy use.

Figure 14.1: Overview of the information presented in this section



Note: The purpose of this scheme is to show important linkages between the different parameters relevant for the issue and the data presented. For underlined parameters information is included in this chapter; for parameters in italic print information is included in other chapters. For parameters in normal print no information is included in this report.

Energy use and sustainable development

A sustainable development objective with regard to energy use could be formulated as: To meet the energy demand in an adequate and reliable way, while at the same time safeguarding future energy supply options and keeping environmental pressure within acceptable limits. Such policy includes:

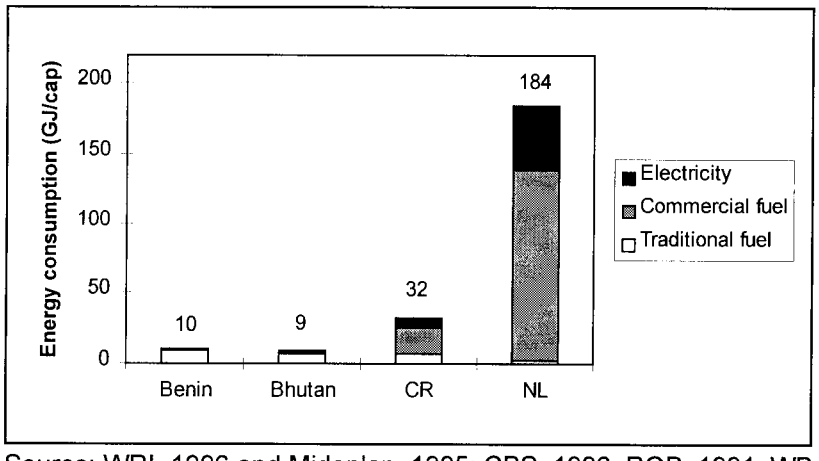
- Attention for the issue of fossil energy depletion
- Encouragement of sustainable use of renewable energy sources
- Energy efficiency improvement

In the following sections the issues of energy consumption, energy production, impacts of energy use, and energy resources will be discussed and finally some comments are made on possible responses.

14.1.2 Energy consumption

Figure 14.2 shows three different forms of find energy consumption: traditional energy (fuel wood and charcoal), commercial fuels for heat (oil, natural gas and coal for direct use by consumers) and electricity (produced by either renewable or non-renewable sources).

Figure 14.2: Energy use[19]



Source: WRI, 1996 and Mideplan, 1995; CBS, 1996; ROB, 1991, WB, 1994a

A person in the Netherlands uses about 20 times as much energy as a person from Benin or Bhutan and about six times as much as a person in Costa Rica.

Traditional energy use in Benin and Bhutan is much higher than commercial energy use. In combination with population growth, traditional energy use (firewood) can lead to heavy pressures of the available forest and woodland. In Costa Rica commercial energy use over the last two decades has been strongly growing, while traditional energy use decreased. In the Netherlands almost no use of traditional energy is made. The total energy use per capita in the Netherlands is about 20 times higher than in Benin and Bhutan, and about six times higher than in Costa Rica.

Table 14.1 gives an indication of the energy use per sector.

Table 14.1: Sectoral energy consumption

	Benin [b] *1981*	*Costa Rica* [c] *1994*	*Netherlands* [d] *1994*
Industry	4.5 [a]	26.4 [a]	42.3
Transport		47.1	18.1
Households	95.5	25.6	18.9
Others		1.0	20.6 [a]

[a] Including energy use of the service sector;
Source: [b] ROB, 1991; [c] Mideplan, 1995; [d] CBS, 1996

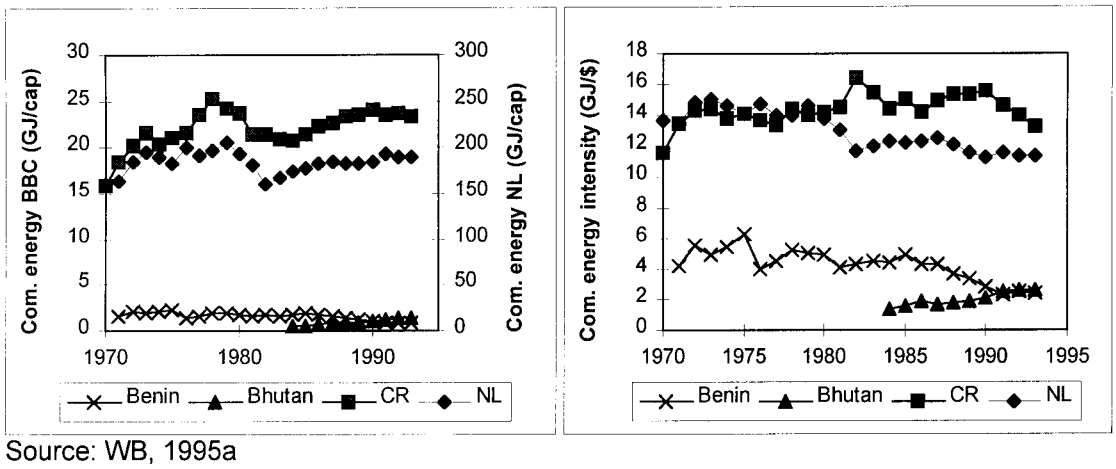
[19] Electricity indicates that part of the total commercial energy consumption used for electricity production. For fossil-fuel based electricity production an efficiency of 40% has been assumed.

In Benin energy is mainly consumed by households (fuelwood). In Costa Rica, the transport sector is the largest consumer of energy. In the Netherlands the industrial sector is the largest consumer. The service sector is included in the sector 'others' for the Netherlands, and is added to industry in the case of Benin and Costa Rica.

Consumption of commercial energy

Figure 14.3 below shows commercial energy consumption and the ratio of energy consumption and GNP (the so-called energy intensity). For consumption of traditional energy only for Costa Rica trend-data is available.

Figure 14.3: Commercial energy consumption per capita (left) and per unit of GNP (right).



Source: WB, 1995a

Note: In the figure left the Netherlands are shown on a separate right axis

Energy intensity is highest in Costa Rica and the Netherlands

The consumption of commercial energy per capita in the Netherlands is about 10 times the consumption in Costa Rica and about 200 times the consumption in Bhutan and Benin. Commercial energy use per capita tends to be increasing in Costa Rica and Bhutan, is rather constant in the Netherlands (mainly due to the strong drop in energy use during the early eighties) and is decreasing in Benin.

The trend of the Netherlands with regard to energy intensity (right figure) is downwards, as result of technological development and economic change to less energy-intensive sectors. The energy intensity of Costa Rica is slightly higher than that of the Netherlands. Although data is rather poor, the energy intensity of Bhutan seems to be strongly increasing due to the growth of small industries. The energy intensity of Benin is decreasing.

14.1.3 Energy production and supply

Electricity production

Electricity in Benin, Bhutan and Costa Rica is mainly produced by means of hydropower. In the Netherlands electricity is mainly produced by thermal production in coal and gas-fired plants. As a result table 14.2 shows that in Benin and Bhutan virtually all electricity is produced by renewable methods, and in Costa Rica most of the electricity is produced in this

way[20]. In the Netherlands most of the electricity is produced using non-renewable energy. Hydropower production mentioned for Benin is from the Nangbeto power plant (60 MW) serving consumption needs of both Benin and Togo.

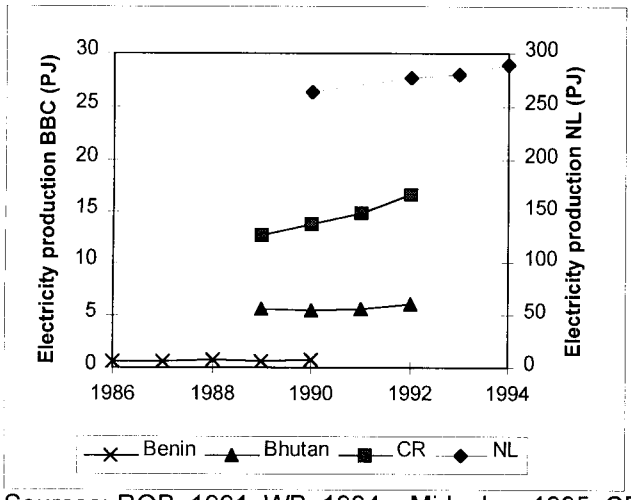
Table 14.2: Electricity production

	Benin 1990	*Bhutan 1993*	*Costa Rica 1993*	*Netherlands 1994*
Coal				29.7%
Liquid		0.1%	19.5%	4.0%
Natural gas				48.1%
Nuclear				4.1%
Hydro	100.0%	99.9%	72.9%	0.0%
Geo/wind/sun etc.			7.6%	0.4%
Waste				2.3%
Imports				11.3%
Total non-renewable	0%	0%	20%	97%
Total renewable	100%	100%	80%	3%
Total electricity generated (GJ/cap)	0.16	9.47	5.30	18.84
Total electricity consumed (GJ/cap)	0.16	1.21	5.30	18.84
Population with access to grid	30%	20%	93%	100%

Sources: Benin: ROB, 1991/WB, 1994b; Bhutan: WB, 1994a; Costa Rica: Mideplan, 1995; Netherlands: CBS, 1996

The difference between 'total electricity generated' and 'total electricity consumed' in Table 14.2 shows that Bhutan exports most electricity it generates (to India). The access to grid (electricity network) in Bhutan is very low (20%). Rugged terrain and the sparse population density make further expansion of the grid very costly or even impossible. Access to grid is also low in Benin. In both countries off-grid generation could thus provide an interesting option for future electricity generation.

Figure 14.4: Electricity production



Sources: ROB, 1991; WB, 1994a, Mideplan, 1995, CBS, 1996

In Bhutan, Costa Rica and the Netherlands electricity production is increasing.

Note: The Netherlands is shown on the separate right axis

[20] Renewable does not always mean 'environmentally sound': For instance, large hydroplants can have significant negative environmental impacts.

Figure 14.4 gives an overview of the changes in electricity production over time. In Bhutan, Costa Rica and the Netherlands electricity production is increasing

Energy production (excluding electricity)

Table 14.3 shows the contribution of all other uses of energy sources for final production excluding the energy used for electricity production.

Table 14.3: Domestic energy use other than electricity production

	Benin 1981	*Bhutan 1993*	*Costa Rica 1993*	*Netherlands 1994*
Traditional	88%	100%	25%	0.1%
Coal	0%	0%	0%	5%
Liquid	12%	pm	75%	46%
Natural gas	0%	0%	0%	48%
Other	0%	0%	0.3%	1.4%
Total domestic consumption (GJ/cap)	11	7	27	135

Sources: ROB, 1991; WB, 1994a, Mideplan, 1995, CBS, 1996

As indicated earlier, in Benin and Bhutan traditional fuel production is the main type of energy production. For Benin the data on oil consumption is rather old, but include illegal imports of oil from Nigeria. In Costa Rica liquid fuel consumption is relatively important, especially for transport. In the Netherlands, fossil energy production (liquid fuels and natural gas) is by far the most important type of energy. The category 'other' could be considered as renewable energy production: alcohol production in Costa Rica, and heat produced from waste in the Netherlands.

Countries can also import or export forms of energy. Imports and exports of energy are often very important with regard to the financial balance of trade. The table 14.4 indicates net imports of energy.

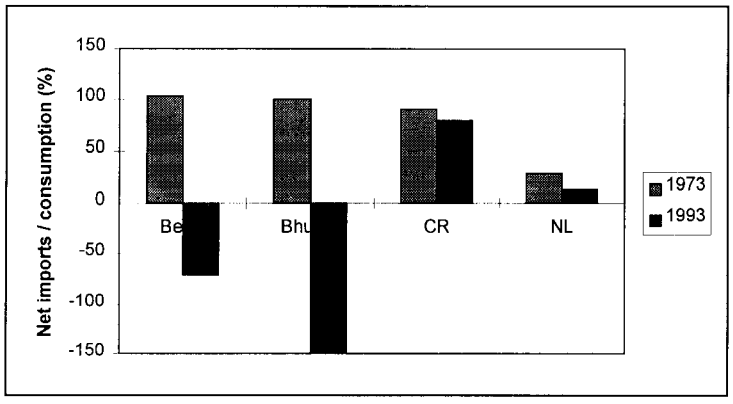
Table 14.4: Net imports of energy

	Benin 1993	*Bhutan 1993*	*Costa Rica 1993*	*Netherlands 1994*
Coal				-352
Liquid	13 - pm	pm	-75	-1417
Natural gas				1110
Electricity		5		-38
Total	13	5	-75	-697

Sources: Benin: WRI, 1996; Bhutan: WB, 1994a, Costa Rica: Mideplan, 1995; Netherlands: CBS, 1996

Benin has small off-shore oil production that directly exports unrefined oil. The imports for oil from Nigeria to Benin are uncontrolled (unofficial/illegal) and mostly unknown. Also in Bhutan some imports of oil exist but the volume of these imports is unknown. The Netherlands has by far the largest imports of oil and coal, although the country at the same time exports large quantities of natural gas. The total imports and exports in comparison with consumption according to WRI (1996) are shown in the figure below.

Figure 14. 5: Net imports of energy compared to energy consumption



Source: WRI, 1996

Benin and Bhutan are net exporters of commercial energy (official figures only), while Costa Rica and the Netherlands are net importers

The figure above shows that Benin and Bhutan are now net exporters of commercial energy, while in 1973 these countries were net importers of energy. In case of Bhutan, this involves the export of electricity generated by hydroplants. Costa Rica is dependent on imports of oil. The Netherlands still import large quantities of oil, but the dependence on this fuel has decreased strongly due to inland production of natural gas.

14.1.4 Energy resources

Traditional energy resources

In the chapter on forests we have already tried to estimate the pressure from fuelwood use on the forests and woodlands in each of the four countries. The impact of unsustainable use seems to be most severe in Benin. In general terms, it is recommended that the fuelwood consumption is made more sustainable in Benin and Bhutan, by either reducing demand via substitution to renewable energy resources or by harvesting wood in sustainable ways.

Non-renewable energy resources

Table 14.5 indicates the current estimates for resources of non-renewable energy in each. The energy-value of the resources have been estimated from the tonnage mentioned in the WRI-tables.[21]

Table 14.5: Energy resources of non-renewable energy

	Benin	Bhutan	CR	NL
Coal (PJ)				14566
Lignite (PJ)			791	
Crude oil (PJ)	171			685
NG (PJ)	p.m.			59344
total	171	0	791	74594
Lifetime (years)	24	0	13	23

Source: WRI, 1996 and own calculations

Note: PJ = Pentajoule = 10^{15} Joule.

[21] The lignite resources of Costar Rica refer to identified resources. The coal resources in the Netherlands refer to identified recoverable resources.

Identified fossil fuel resources are by far largest in the Netherlands and consists mainly of natural gas. The exploitation of coal is currently not economical in the Netherlands. Benin has some crude oil resources and Costa Rica some lignite resources. The last line of the table shows an estimated lifetime of these resources assuming that for total national commercial energy production only these resources were used. It should be noted that discovery of additional resources can significantly raise these figures. Total reliance on domestic fossil energy resources would exhaust the available resources in Benin, Costa Rica and the Netherlands in about two decades.

Renewable energy resources

Hydro-energy
Table 14.6 indicates both potential and installed hydropower.

Table 14.6: Potential and installed hydropower

	Benin	*Bhutan*	*CR*	*NL*
hydro potential (MW)	500	12000	37000	500
hydro installed (MW)	60	356	868	36

Source: WRI, 1996, WB, 1994a and WB, 1994b

Bhutan and Costa Rica have a enormous potential for hydropower. This potential is only partly exploited. It should be noted that both the building and exploitation of hydropower plants can have severe environmental impacts and it is unlikely that the whole potential can be tapped without causing too much damage. Cautious exploitation is therefore required; run-of-the-river type of technology seems to be most promising. Potential in the Netherlands and Benin is much more limited.

Other renewable energy resources
Table 14.7 gives some characteristics of other renewable energy resources and some crude estimates on the potential resources in each of the four countries.

Table14.7: Characteristics and crude estimates of potential of renewable energy resources

	Global potential	Variability	Status of development	Environmental characteristics	Capacity factor	Potential in four countries
Solar	Extr.large	Daily, seasonal, weather	Developmental, some commercial	Very clean, visual impact, local climate, PV manufacturing	<25% w/o storage, intermediate	Be, Bh, CR : ++ NL : +
Wind	Large	Highly variable	Many commercial	Very clean, visual impact, noise, bird mortality	variable, most 15-30%	NL, Bh : ++
Geothermal	Very large	Constant	Many commercial	Clean, dissolved gases, brine disposal	High, base load	NL: +
Waste	Very large	Constant	Commercial	Toxic residues, gaseous emissions, conflicts with recycling	As needed with short-term storage	NL : ++
Biomass	Very large	Seasonal, climate dependent	Some commercial	Clean, impacts on fauna and flora, toxic residues	As needed with short-term storage	Be, Bh, CR, NL: ?/ +
Oceans	Very large	Seasonal, tidal	Developmental	Very clean, impact local aquatic env., visual impact	Intermittent to base load	CR : ?

Source: WEC, 1993 and own comments
Note: ++ : Relatively high potential; + : Good opportunities; ? : Unknown/maybe

In Benin and Bhutan, the advantage of many solar technology is that is can be placed off-grid. This includes solar cells, solar boilers and solar heaters. This last method could reduce the demand for fuel wood in Benin.

14.1.5 Responses in the field of energy

Basically one could identify four possible changes within the energy system:

- Changing consumption and production patterns to less energy-intensive activities
- Improving energy efficiency of activities
- Changing the mix of energy production methods
- Cleaning the production methods used

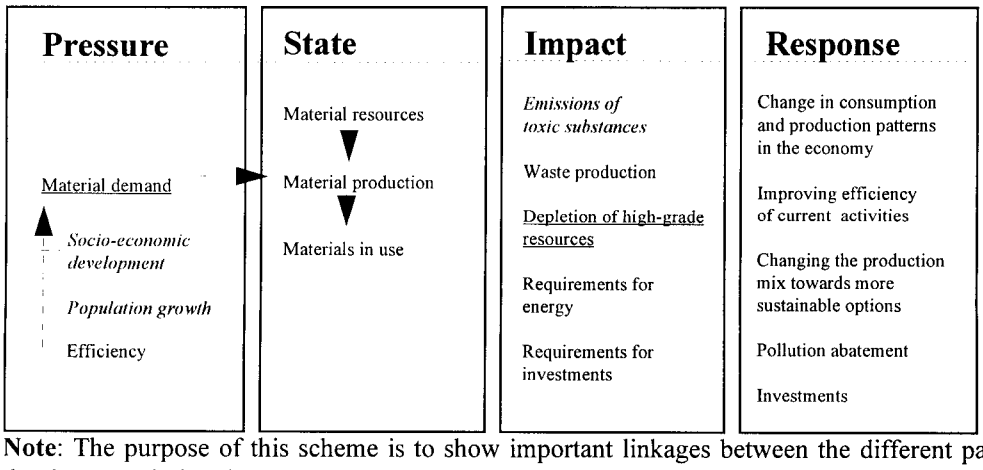
The possible contribution of each of these responses in the Netherlands has been studied in detail and potential results have been estimated quantitatively. In the short medium term improving energy efficiency has to play the most important role.

14.2 Materials

The economic activities in industrialised countries currently cause an enormous throughput of materials such as minerals, chemical products and timber. Often these materials are only used once after which they are simply discarded. A more sustainable form of development might be based on a lower throughput of materials and 'closing of the material cycles'. This last objective implies re-use of waste, prevention of emissions of toxic substances and reducing the use of primary material to the absolute minimum.

Only limited information was found on the consumption of metals and minerals and on waste generation.

Figure 14.6: Overview of the information in this section



Note: The purpose of this scheme is to show important linkages between the different parameters relevant for the issue and the data presented. For underlined parameters information is included in this chapter; for parameters in italic print information is included in other chapters. For parameters in normal print no information is included in this report.

14.2.1 Metals and minerals

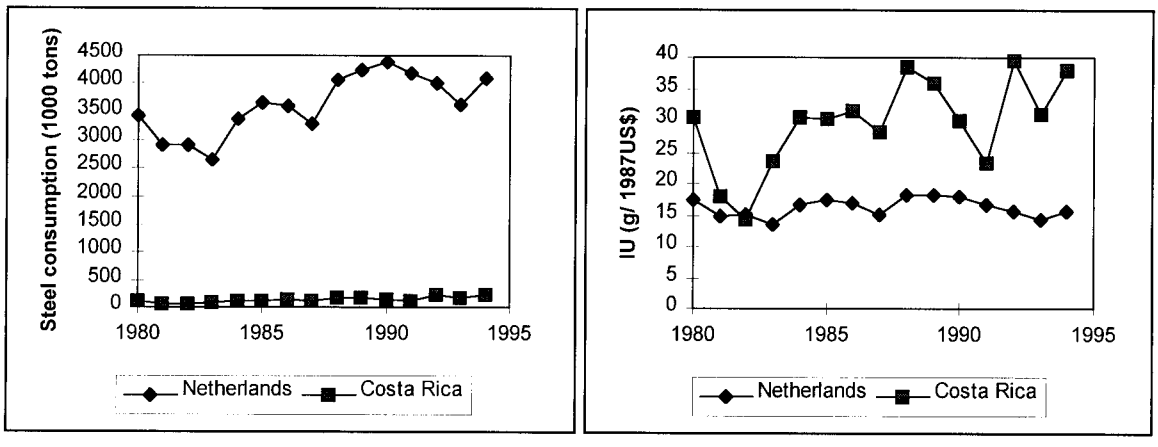
Aluminium and iron are used in very large quantities. Other metals are used in smaller quantities, but are often more scarce and require more energy to produce. There are four potential problems related to large quantities of metals and open material cycles:

1) extraction might deplete high-grade and cheaply exploitable deposits,
2) metal exploitation requires a sizeable amount of energy,
3) current metal use leads to an important flux of substances to the environment and
4) during mining ore has to be extracted producing large amounts of waste and causing degradation of near-by land.

Consumption of metals

Figure 14.7 below show the use of metals in Costa Rica and the Netherlands. No data was available on metal use in the other two countries.

Figure 14.7: Steel consumption (left) and consumption per unit of GDP (right) in Costa Rica and the Netherlands



Source: IIIS, 1996

Steel consumption in the Netherlands is higher than in Costa Rica but intensity of use is about equal.

The figure shows that steel consumption in the Netherlands is about 20 times higher than consumption in Costa Rica. The right figure shows the so-called intensity of use, i.e. steel consumption per unit of GNP. In Netherlands intensity of use is about constant (it has grown strongly during the first part of this century). Intensity of use for Costa Rica has an irregular pattern among others as result of data uncertainties. The overall level of intensity of use in Costa Rica seems to be higher than in the Netherlands.

Resources and production

Only for Costa Rica resources of metals are reported: gold and bauxite (resource 78 Mton of bauxite). However, at the moment no data is available on production.

For a complete assessment of material flows, also other materials should be included. Interesting indicators for this topic are the MIPS and ecological rucksack indicators of the Wuppertal Institut (Adriaanse et.al, 1997).

14.2.2 Waste

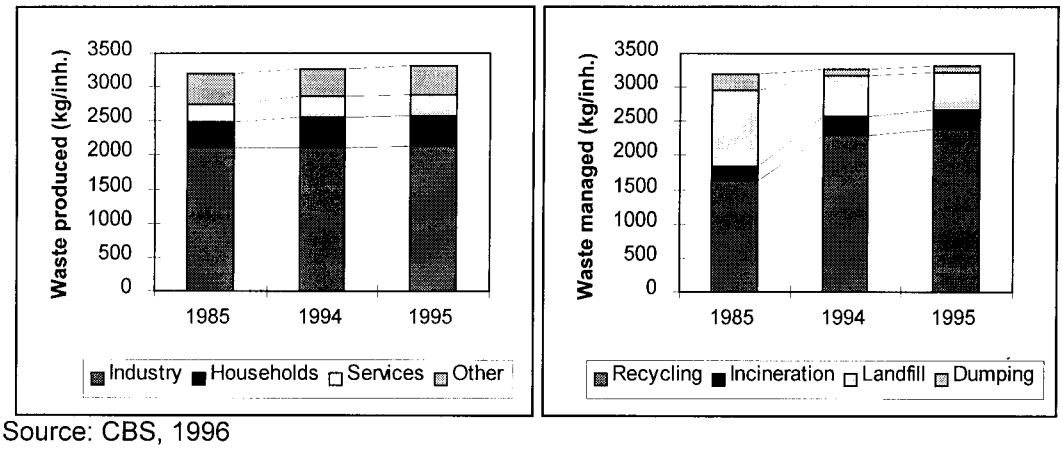
The sustainable development objective for waste is clearly to minimise the amount of waste produced, and if it is produced to make best use of the waste and minimise pollution. Generally speaking, wastes are produced in three ways:

1) through the production and consumption of goods and services,
2) through contamination of the environment,

3) through end-of-pipe treatment of emissions and effluents to prevent environmental contamination.

With regard to waste, one should distinguish between waste types: e.g. hazardous and normal waste. There is almost no data available on waste in Benin, Bhutan and Costa Rica. In the Netherlands a total of 52 million tonnes of waste is generated (ca. 3300 kg per person) each year; in addition about 17.5 million tonnes of manure surplus and 65 million tons of dredging materials are generated. Figure 14.8 shows the sectoral decomposition of waste generation and the disposal methods. At the moment most waste is recycled. About one third is still burned, disposed of at landfills or dumped.

Figure 14.8: Waste production and management in the Netherlands

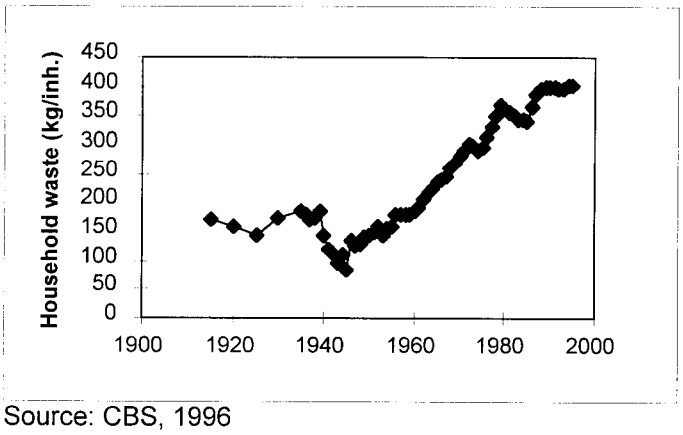


Source: CBS, 1996

Production of waste increases in the Netherlands but a larger share is recycled.

The amount of waste produced by industry is rather stable. The production of household waste (14% of total waste) is shown for a longer time period in Figure 14.9.

Figure 14.9: Production of household waste



Source: CBS, 1996

Production of household waste increased steadily during this century.

Household waste per person increased strongly from 1945 to 1980. The interesting aspect of this indicator is that is clearly related to the behaviour of individuals: they can influence this indicator by buying long-life products with minimal packaging. In Benin available data indicates that the amount of waste (mainly household waste) produced in Cotonou is 160

kg/inhabitant/year, of which about 20% is collected by normal waste collection services and the rest is burned pr left at unmanaged garbage heaps (ROB, 1991).

Interesting additional indicators are recycling rates of metals but especially glass and paper. These last two categories can reflect in the Netherlands the commitment (or not) of individual households to work for a better environment.

14.3 Conclusions

Energy data give a general impression of environmental pressure, certainly in industrialised countries, but to some extent also in less industrialised countries. Although available data already provide an interesting comparison, data need further refinement and checks against national data sources.

The Netherlands consumes much more (commercial) energy per capita than any of the other countries. The other three countries do not only use less commercial energy, but commercial energy is more largely based on renewable energy (hydropower). The energy consumption in Bhutan and Benin consists mainly of conventional energy. The use of firewood and charcoal in these countries causes considerable extra pressure on remaining forest resources. There is a considerable potential for renewable energy in each country.

The Dutch economy also consumes the highest amount of materials of the four countries. Not much data was available for the other three countries on this issue. The same is the case for waste production and treatment.

15. Atmosphere

Air pollution occurs at three different scales. At the local level air pollution of all kind of substances provides a continuing threat to human health, especially in urban areas. At regional level, acid precipitation and atmospheric transport of nutrients and toxic materials provide a threat for ecosystems, humans and agricultural crops. At the global level especially the rising concentrations of greenhouse gases and ozone-depletion gasses are important risks.

15.1 Introduction

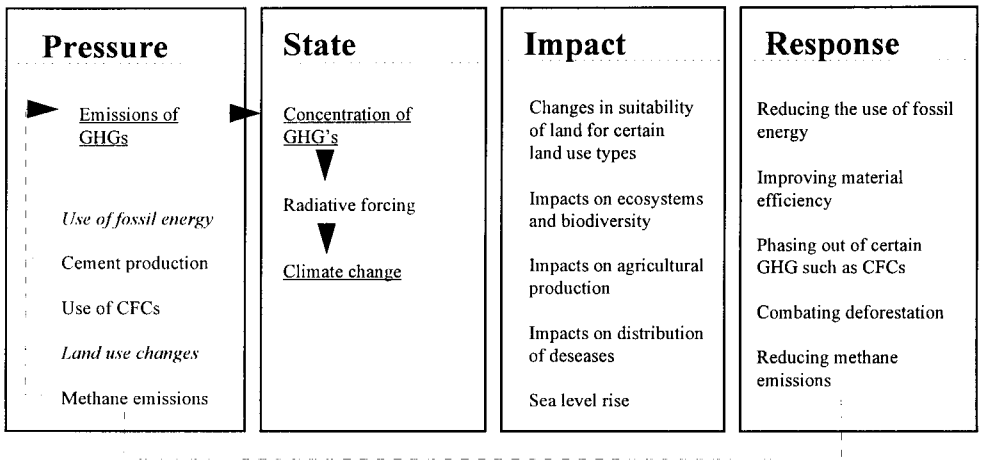
This section focuses - due to the lack of data and relevance of other topics - on the issue of greenhouse gas emissions. In addition data -especially for the Netherlands- are presented on ozone layer depletion, acidification, and local air pollution.

15.2. Greenhouse gas emissions - Climate Change

Introduction

Greenhouse gasses (GHG) within the earth's atmosphere (such as carbon dioxide, methane and water) are able to absorb some of the outgoing infrared radiation emitted by the earth - and partly transfer this energy back to the earth's surface. Due to all kind of human activities, the atmospheric concentrations of many of the greenhouse gasses (GHG) has increased strongly since the pre-industrial period. The result of this might be an enhanced greenhouse effect. Figure 15.1 gives an overview of the information presented in this section.

Figure 15.1: Overview of the information presented on climate change



Note: The purpose of this scheme is to show important linkages between the different parameters relevant for the issue and the data presented. For underlined parameters information is included in this chapter; for parameters in italic print information is included in other chapters. For parameters in normal print no information is included in this report.

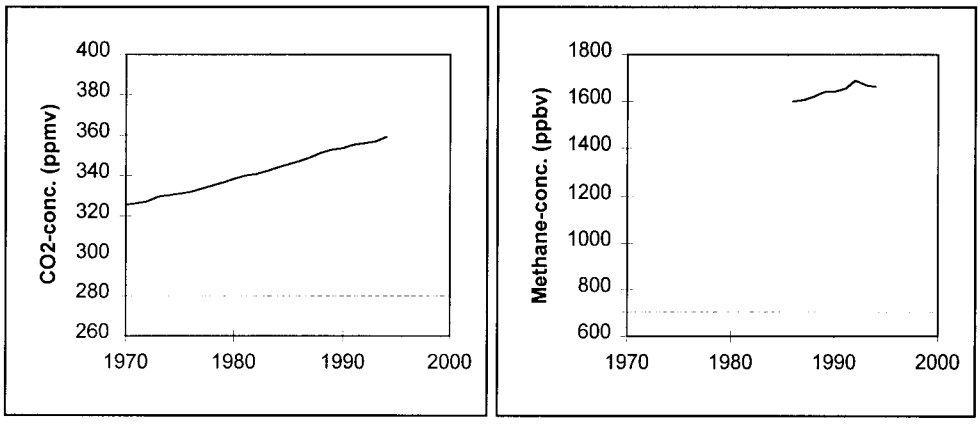
Sustainable development

The goal of the international negotiated Climate Convention is to stabilise greenhouse has concentration at a 'safe' level that does not alter the climate system in harmful ways. Research has indicated that it will be extremely difficult to stabilise atmospheric carbon dioxide concentration at any reasonable level. Stabilisation of the carbon dioxide concentration at 450 ppmv for instance would require that present global emissions are stabilised almost immediately and reduced to a level of about a third of present emissions before the end of the next century. At the same time however, emissions might increase further as a consequence of the expected economic growth.

Greenhouse gas concentrations and average global temperature

Figure 15.2 indicates the average global concentration of the two most important gasses with regard to the enhanced greenhouse effect, carbon dioxide and methane.

Figure 15.2: Atmospheric concentration of carbon dioxide and methane



Source: WRI, 1996

Atmospheric Concentration of carbon dioxide and methane has increased.

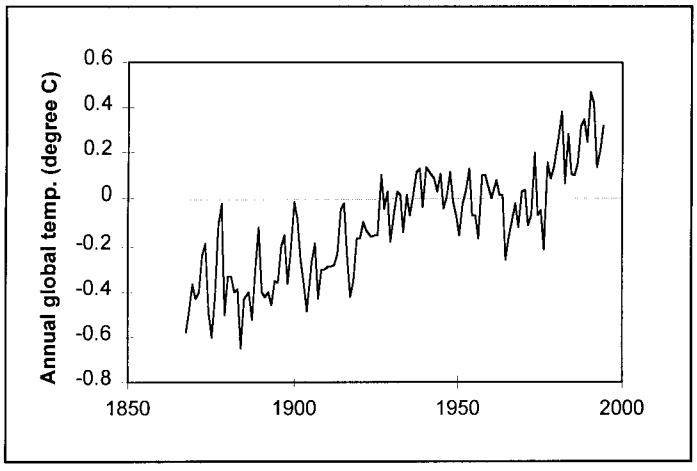
Note: The dotted lines indicate the estimated pre-industrial concentrations (ppmv and ppbv are respectively parts per million and per billion expressed in volume units).

The figures indicate that the average concentration of carbon dioxide has increased with about 30% and of methane with about 130% since pre-industrial times and that their concentrations are still increasing. The atmospheric concentrations of other heat-trapping gasses such as nitrous oxide, chlorofluorocarbons (CFCs) have increased as well.

Figure 15.3 shows that global annual temperature has been increasing over the last 130 years.

The Intergovernmental Panel on Climate Change has indicated that - if nothing is done to limit the greenhouse gas emissions - the global average temperature could increase by between several degrees Celsius over the next 100 years (IPCC, 1996). The consequences of such a temperature increase could be enormous.

Figure 15.3: Average global annual temperature index (jan.-jun.)



Source: IRI/LDEO, 1997

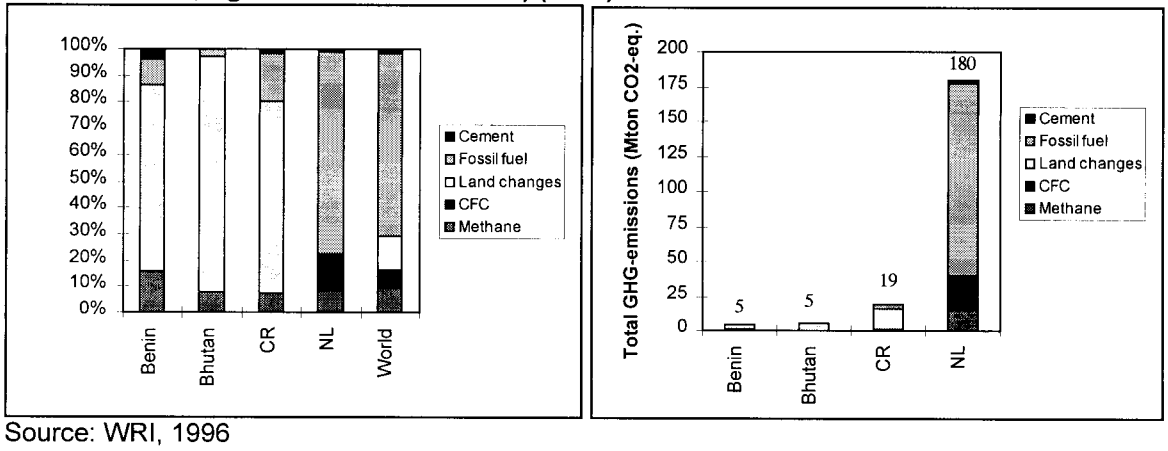
Average global temperature increased more than 0.6 degrees Celsius during the last century.

Present greenhouse gas emissions

Figure 15.4 shows the emissions of carbon dioxide, chlorofluorocarbons (CFC) and methane expressed in so-called carbon dioxide equivalents[22]. The emissions of the most important contributor, carbon dioxide, are classified as coming from three causes: cement production, fossil fuel burning and land-use changes.

For Benin, Bhutan and Costa Rica land-use changes are by far the most important cause of greenhouse gas emissions in 1990. For the Netherlands, burning of fossil fuels is the most important cause of emissions. The total greenhouse gas emissions are by far highest in the Netherlands. It should be noted that the data on carbon dioxide emissions resulting from land use changes are highly uncertain and especially in case of Bhutan the accuracy of the data is questionable. Local sources indicate that in fact currently no net deforestation in Bhutan takes place which would reduce carbon dioxide emissions to almost zero.

Figure 15.4: Causes of emissions contributing to the enhanced greenhouse effect (left relative shares, right absolute emissions) (1991)



Source: WRI, 1996

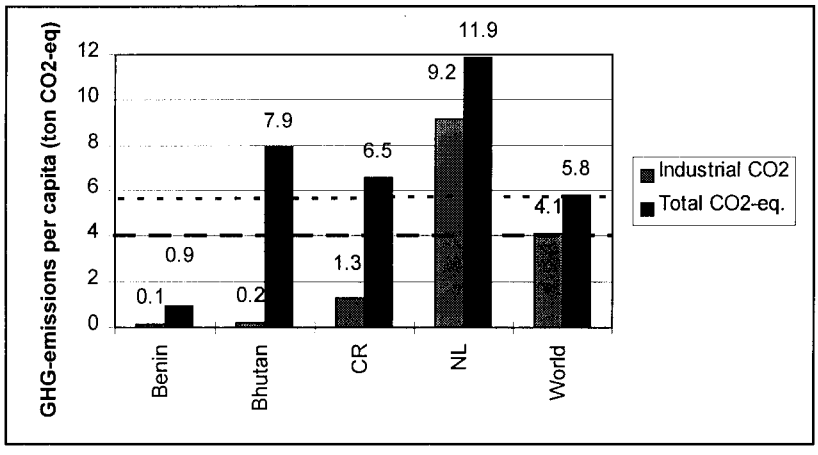
Emissions of greenhouse gasses in the four countries differ strongly with respect to total extent and relative contribution of possible causes.

[22] The possible impact of the gasses carbon dioxide, chlorofluorocarbons and methane in causing an enhanced greenhouse effect has been assessed differently by the climate experts. Therefore, the emissions of all gasses are usually expressed in terms of carbon dioxide equivalents to enable comparison.

Figure 15.5 shows the same total emissions as **Figure 15.4,** but this time expressed per inhabitant so as to compare the greenhouse gas emissions of the four countries with the global average. Two different categories have been included:

1) 'industrial emissions', which is equal to the sum of carbon dioxide emissions caused by fossil energy burning and cement production, and
2) 'total emissions of carbon dioxide equivalents', which also includes land-use changes, chlorofluorocarbons (CFCs) and methane emissions.

Figure 15.5: Emission of greenhouse gases



Source: WRI, 1996

Emissions per capita in the Netherlands are about two times the global average.

For *industrial carbon dioxide emissions*, the emissions per capita are by far the highest in the Netherlands (more than a factor of 2 above the world average). For the other three countries, emissions are well below the per capita world average: in the case of Bhutan and Benin the emission per capita is about 2% of the Dutch emissions, and in the case of Costa Rica about 12%.

The category *total carbon dioxide equivalents*, also including emissions resulting from land-use changes and other greenhouse gases, is more uncertain. For Bhutan, Benin and Costa Rica the emissions are now determined by land use changes (mainly deforestation), but data sources differ strongly on land use changes and deforestation rates and consequently on the resulting emissions. For Bhutan, *Figure 4.14* is based on the information provided by local sources that no net deforestation takes place in Bhutan (consequently the corresponding carbon dioxide emissions are zero). However, WRI indicates - on the basis of the FAO Forest Resources Estimates that actually (relatively slow) deforestation occurs in Bhutan, which would make Bhutan a high emitter of carbon dioxide per capita (due to its small population size). These data are global in scope, and individual countries sometimes question the FAO estimates. For Costa Rica, a similar problem exists.

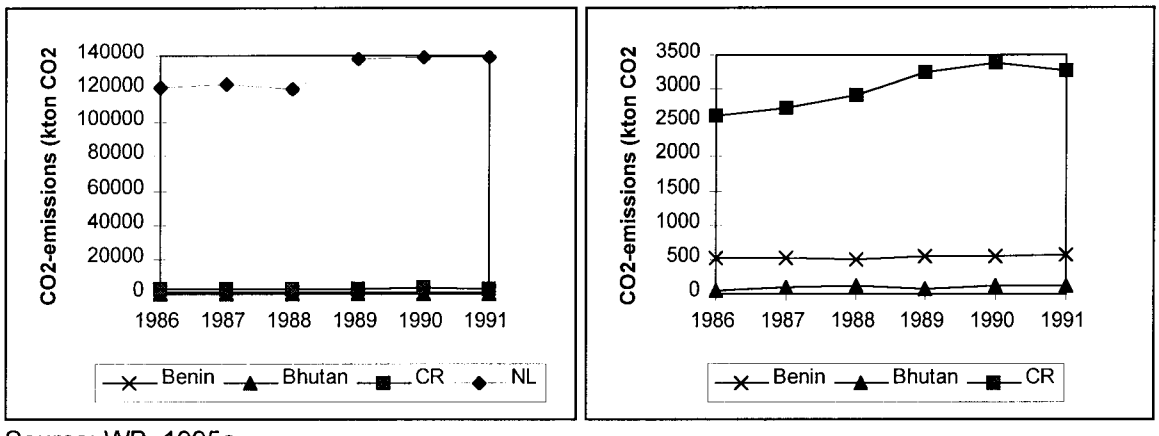
The Netherlands still has the highest emissions, which have been raised considerably due to addition of the greenhouse enhancing potential of chlorofluorocarbon emissions. The emissions per capita of Benin and Bhutan are still very low compared to the global average.

The emissions per capita of Costa Rica are now significantly higher as result of land use changes.

Trends in emissions resulting from fossil energy use

In Figure 15.6, the trends in carbon dioxide emissions are compared (in the right figure the Netherlands have not been included to be able to see trends for the other three countries).
The emissions of carbon dioxide resulting from fossil energy use are by far highest in the Netherlands. The emissions have increased strongly in the economic prosperity years 1988-1990 and were rather constant in the other years. The right figure does not include the Netherlands and shows that the emissions of the second highest emitter, Costa Rica, on average increase. The emissions of Benin and Bhutan are much lower and relatively constant.

Figure 15.6: Emissions of carbon dioxide resulting from fossil energy use

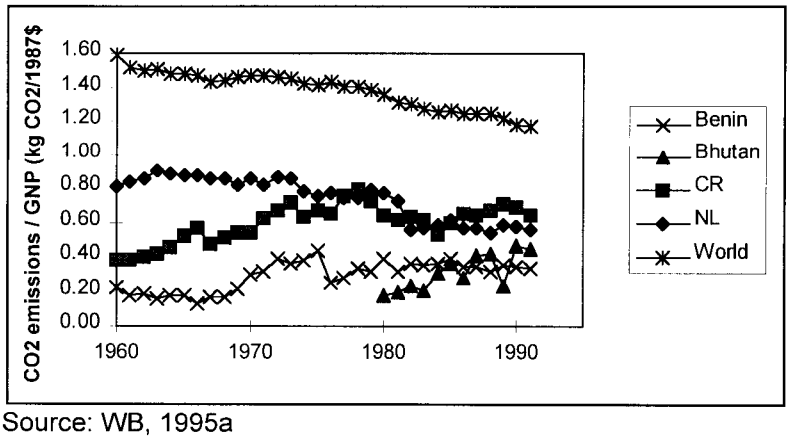


Source: WB, 1995a

Emissions tend to rise in the Netherlands and Costa Rica

Figure 15.7 compares the emission of carbon dioxide per unit of GNP.

Figure 15.7: Carbon dioxide emissions from fossil energy use divided by GNP



Source: WB, 1995a

Carbon dioxide emissions per unit of GNP are currently highest in Costa Rica

The ratio between carbon dioxide emissions and GNP is higher for world as a whole than for each of the four countries. Until 1970, the Netherlands had the highest ratio of the four countries, but this ratio declined constantly, as a result of the use of less carbon intensive fuels, changes in the structure of the economy and as a result of improving energy efficiency

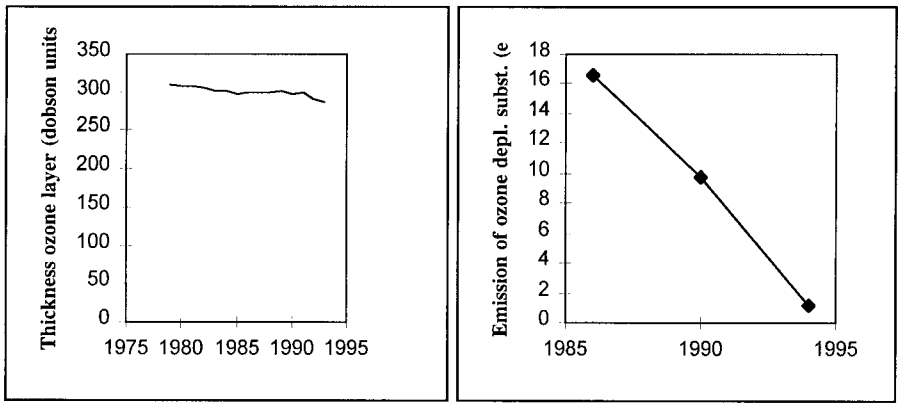
(see earlier chapters). Since 1980, Costa Rica has the highest ratio. The ratio for Benin has been rather constant for most of the period included. The ratio for Bhutan has been growing since 1980.

15.3 Depletion of the ozone layer

The ozone layer - a protective atmospheric 'layer' against to much UV-radiation- has in the last decades significantly been reduced due to emissions of certain substances - such as chlorofluorocarbons (CFCs). Figure 15.8 shows the thickness of the ozone layer around the world and the right figure shows the consumption of ozone depleting substances in the Netherlands. No data was available for the other three countries but it can be assumed that consumption of CFCs in these countries is close to zero.

In response to international agreements to reduce the emissions of this type of substances, the Netherlands have in fact reduced consumption to almost zero. The international co-operation to reduce use of substances that deplete the ozone layer has often been mentioned as a successful example. However, even in this case it took more than 20 years between the first scientific publications and the moment that CFC production was significantly reduced. Because of the longevity of CFCs the peak of ozone depletion is still to come and it will take another 20-100 years before the ozone layer has fully recovered (RIVM, 1997).

Figure 15.8: Depletion of the ozone layer and consumption of ozone depletion substances in the Netherlands



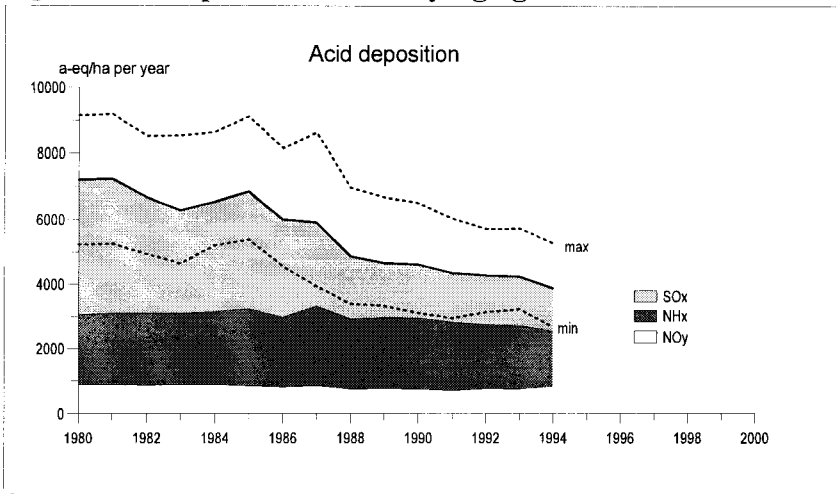
Source: RIVM, 1996

Consumption of ozone-depleting substances in the Netherlands has been reduced strongly.

15.4 Acidification

The emissions of sulphur dioxide, nitrogen oxide and ammonia have especially attracted the attention of policy makers in the Netherlands due to resulting acidification of soils and water bodies. Acidification is an important factor in the reduction of forest vitality and quality loss of wet lands. Again, only data was available for the Netherlands.

Figure 15.9: Deposition of acidifying agents



Source: RIVM, 1996

Sulphur dioxide emissions are decreasing sharply, those of other compounds to a lesser extent

15.5. Other forms of air pollution

During the 1960s ambient air quality became of a topic of concern in the Netherlands. Since that period, large progress have been made with regard to sulphur dioxide and lead. However, concentration for other substances such as carbon monoxide, nitrogen oxides, benzene, other aromates and black smoke - especially in cities and near roads - still exceed health standards on a regular basis. Incidents of summer and winter smog persist, on average 15 days a year for summer smog and two days for winter smog (OECD, 1995)).

In the other three countries air pollution is relatively uncommon. The most important risk has been discussed earlier in the chapter on urbanisation: poor indoor air quality due to heating and cooking. In the most important cities urban air pollution occurs: in San José (Costa Rica) transport is one of the main causes of air pollution and emissions of nitrogen oxides and particulate matter continue to increase. In Timphu (Bhutan) burning of fuel woods for heating and cooking creates visible air pollution. In Benin in addition to direct emissions from transport and urban dwellings also the unpaved roads might be an important cause of urban air pollution.

15.6 Conclusions

Available data on air quality and quality of the atmosphere in Benin, Bhutan and Costa Rica is at the moment limited to data on climate change. The most important reason is that many 'pollution'-related problems that are important in the Netherlands such as emission of ozone-depleting substances, acidifying compounds etc. are either non-existent or not very relevant in the other countries.

The risk of climate change is still increasing as a result of increasing emissions of greenhouse gases. The Dutch contribution has not been reduced, despite the policy goal set for this topic. If carbon dioxide emissions from land-use changes are included, the contributions of Bhutan and Costa Rica can most probably not be ignored.

The consumption in the Netherlands of CFCs has been significantly reduced. The emissions of acidifying compounds have been reduced too, but further reduction is required to reach the policy goals and prevent environmental degradation. With regard to other substances, the overall quality of the air has been improved since the 1970s.

Local urban air pollution is a relatively unknown phenomenon in Benin, Bhutan and Costa Rica but may increase in seriousness when transport and industrialisation increase.

16. Overview

16.1 Introduction

This report overviews basic data considered to be relevant in view of the project. It was collected in Benin, Bhutan, Costa Rica and the Netherlands from reports by international organisations (e.g. World Bank and World Resources Institute) and occasional national information sources. Some national data was added, if available.

There are three questions to be answered: a) How complete is the information found in international data sources? b) How accurate is this information? c) What does the information tell us on the current situation in each of the four countries with regard to sustainable development, in particular, similarities and differences between the four countries ?

The report is meant to provide a basis for discussion. The observations have been limited by: 1) the availability and reliability of international (secondary) data sources, 2) the choices made to select certain information, and 3) the fact that it has been written by authors from just one of these countries (with a certain cultural background).

This chapter will be divided into two sections. The first section (16.2) provides an overview of the methodological aspects of the report and discusses (as far as possible) questions a) and b). The second section (16.3) will summarise a few observations based on the information presented in the preceding chapters (question c).

16.2. Methodological aspects

Data were mainly collected from reports of international institutions (e.g. OECD, World Bank, World Resources Institute, FAO, etc.).

Structure

The overview of data and indicators for each of the four countries of the Sustainable Development Agreements has been divided into social, economic and environmental domains. In addition, the PSIR framework was used in each chapter to show some of the relationships between the data. Some information, especially that on cross-cutting issues such as poverty, could not be unambiguously placed into one chapter or domain. Practical decisions had to be made: for instance, nutritional information is discussed in the chapter on 'land' in view of its direct relationship with agricultural output, although it could just as easily have been discussed under human development.

Obviously, every structure will have its limitations and - as for indicators - it can only be 'optimally inaccurate' (Bakkes, 1997). The division into three important domains has the advantage of being used often in decision-making and is simple to understand. The PSIR framework might offer some assistance in integrating information.

Data availability and reliability
Although a lot of data on many issues are available, there are large differences in the availability of data for the various issues. In many cases, data on specific issues, such as population density, educational parameters or unemployment were sufficiently available for Costa Rica and the Netherlands but were lacking or scarce for Benin and Bhutan. Nevertheless, indicators were available for several issues and much data could be retrieved.

The reliability and accuracy of data were sometimes problematic, especially for Benin or Bhutan. In a few cases data from one source was contradicted by data from another source (e.g. access to safe drinking water, forest areas). Also the quality of the data could not always be traced or confirmed, casting some doubt on the value of the data.

The set of indicators presented in this report does not uniformly cover all domains (human and social; economic and ecological) and their interactions. Relatively many indicators are available for the economic and human domains, including some of the interactions between these domains (labour etc.). However, only a few indicators and data are available for the environment, and for cultural and societal issues, and the interactions between the environment and social and economic domains.

There are almost no data and indicators available for such issues as well-being, security and the influence or role of culture and religion in sustainable development. The topic of poverty is at the moment also poorly covered. Issues related to the human well-being, social capital and culture suffer from the fact that at present there are no universal definitions for these concepts. Moreover, these issues are difficult to capture in a few quantitative indicators. It may be easier to characterize the status of a community in terms of a pattern rather than a number (Bakkes, 1997). At the moment, there are almost no data available, apart from some anecdotal material. If indicators are available, data are sometimes missing, such as the poverty measures as included in the UN.CSD list (CSD, 1997).

Culture (including religion) strongly influences the perception of issues such as welfare and well-being, and even issues education and (un-)employment. Comparing issues sensitive to influences of culture and religion development, e.g. the critique on the Human Development Index by Bhutan, is still difficult (see section 4.5).

Many of the data shown are 'averages'. This may sometimes hide distributional questions, both among groups in society and geographically.

To date, no choice has been made for a limited set of indicators that could present a useful view on sustainable development.

Comparison of the data presented with the CSD list of sustainable development indicators
Table 16.1 shows the indicators from the CSD list (as percentages) included in this report. In total, this report shows that 31% of the indicators are found in each of the four countries, and 21% in fewer than the four countries (The Netherlands showing the most). A relatively large number of indicators of the human and social, as well as economic, domains have been included. Only for a few of the indicators in the environmental and institutional domains could information be found in the data sources.

Table 16.1: CSD Indicators included in this report

		CSD Indicators included in this report					
	Total CSD indicators	Included		Partly included		Not included	
Social domain	39	18	(46%)	9	(23%)	12	(31%)
Economic domain	23	9	(39%)	5	(22%)	9	(39%)
Environmental domain	54	9	(17%)	12	(22%)	33	(61%)
Institutional domain	14	4	(29%)	1	(7%)	9	(64%)
Total	130	40	(31%)	27	(21%)	63	(48%)

Finally, in spite of the shortcomings, the data do allow some comparison between the four countries.

16.3 Conclusions on the state of the four countries

Some preliminary conclusions based on the information presented in the previous chapters are discussed below. Table 16.2 shows (as background information) the sustainable development problems reported by each country in its national reports to UNCED (1992).

Table 16.2: Sustainable development problems in national UNCED reports

Benin	Bhutan	Costa Rica	Netherlands
Soc. Hum	**Soc. Hum**	**Soc. Hum**	**Soc. Hum**
Demographic pressures	Demographic pressures	Rapid urbanisation	
Urban stress (housing)		Shortage of housing	
Poor health		Poor working conditions	
		Vector-carried diseases	
Economic	**Economic**	**Economic**	**Economic**
Low economic growth			
Negative trade balance			
Foreign debt			
Environmental	**Environmental**	**Environmental**	**Environmental**
Land scarcity	Land scarcity	Climate change	Quality of fresh water
Soil degradation/erosion	Erosion	Inadequate sanitation and	Quality of forests
Degr. of forest cover	Forest stress	water supply	Loss of biodiversity
Degr. of vegetation	Degr. of vegetation	Erosion	Soil pollution
Freshwater problems	Water pollution	Sea pollution	Climate change
Coastal erosion	Non-biodegrad. waste	Pesticide consumption	Fossil energy use
Waste management		Solid waste production	Specific problems from transport and agricultural sectors

As concluded earlier from its definition in Chapter 2, sustainable development in the Netherlands is primarily applied to the environmental domain. Of the four countries, only Benin reports on economic issues.

Human and social domain

Bhutan and Benin are currently facing an accelerating *population growth*, which can easily result in increasing environmental pressures. In relative terms, population growth is much slower in the Netherlands. However, in terms of absolute numbers population growth is highest in Benin and the Netherlands (due to its large population). Combined with the high

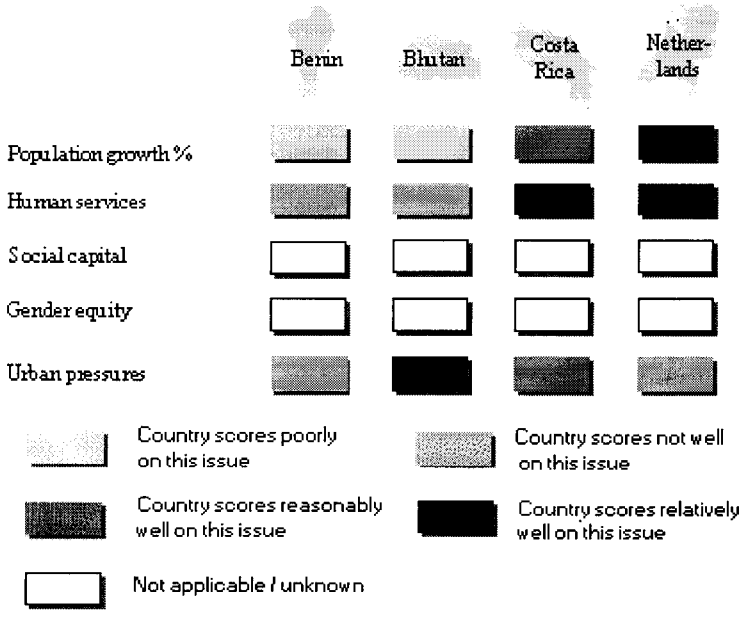
consumption patterns, population growth in the Netherlands is currently increasing pressures on the global environment much more than in any of the other countries. In each of the four countries, population is unevenly distributed over the total area.

With respect to the selected data on *human development* (education and health), the four countries may be divided into two pairs. The parameters used for life expectancy, sanitation and hygienic conditions, and educational levels in the Netherlands are similar to those in Costa Rica, forming one pair, while these parameters in Benin are similar to those in Bhutan, forming the second pair. Health parameters - such as life expectancy - and educational parameters - such as literacy rate - are relatively high in Costa Rica - especially in comparison with countries with a comparable average income. Although data is highly uncertain, there are signs that a lot of progress has been made in Bhutan in recent years.

The scarce data available on the issue of *'urbanisation'* showed urbanisation in Costa Rica and Benin to be currently taking place at a high rate. The Netherlands are already strongly 'urbanised'. In Benin, fast urbanisation seems to be causing several problems , such as poverty and housing in unsuited areas.

With respect to *social or cultural parameters*, the overview is still very incomplete.

Figure 16. 1: Indicative status overview for some of the issues within the human and social domain.



A score has been assigned to each issue on the basis of the information included in this report. The results should be regarded as indicative.

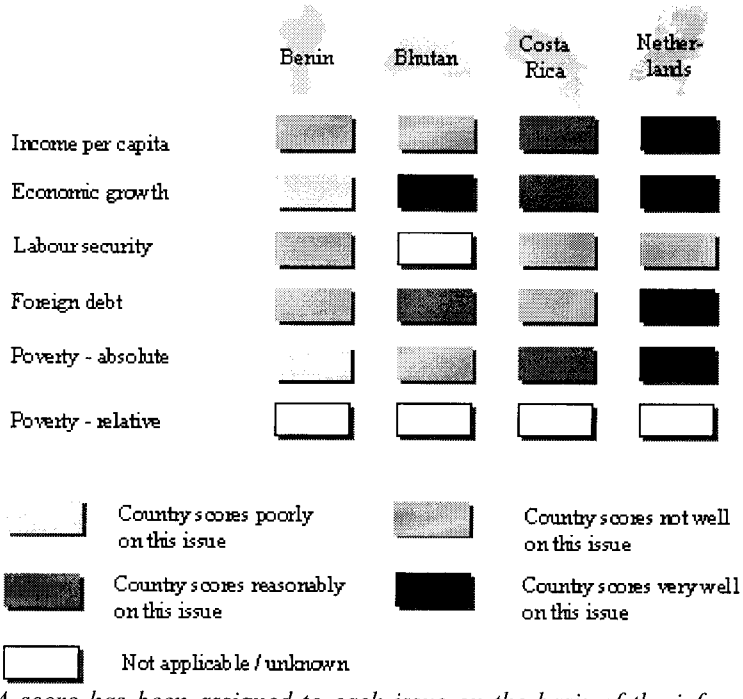
Economic domain

There are large differences in the *economic development* of the four countries, for example, with respect to the relative size of the different economic sectors and the average national income. The income per capita in the Netherlands is about four times higher than in Costa Rica and about 10 times higher than Bhutan or Benin.

All four countries are dealing with specific problems in the economic domain, related to the current economic situation (such as unemployment, high inflation rates, highly negative balance of trade, negative government budget) and that of the future (investments). Both Bhutan and the Netherlands have experienced a considerable economic growth since 1980. More recently, the economy of Costa Rica has shown recovery after the economic crisis in the early 1980s. The economy of Benin is struggling to attain any amount of growth in terms of income per capita.

International trade is gaining importance in each of the four countries. All four economies are dealing with the problem of under- and unemployment, although the severity of this problem differs (both actual rates and consequences for the under- and unemployed).

Figure 16. 2: Indicative status overview of the status for some issues within the economic domain.



A score has been assigned to each issue on the basis of the information included in this report. The results should be regarded as indicative.

The capital indicators recently developed by the World Bank allow visualisation of the different types of *wealth* in each of the four countries. Bhutan and the Netherlands can be found at the opposite side of the 'wealth-spectrum'. Wealth in Bhutan consists mainly of natural resources, in the Netherlands, largely of human resources. The economic wealth of produced assets represents only a minor fraction of total wealth in all countries.

The estimates of natural capital show the relative *wealth* of Bhutan and Costa Rica and the most important natural resources in each of the four countries (land in the case of the Netherlands and Costa Rica; forest in the case of Bhutan and land and forests for Benin). The 'genuine savings' figures show high savings for the Netherlands and Bhutan, indicating large increases in their capital.

Data on the issue of *poverty* is still insufficient, and provisionally monetary. Signs of absolute poverty (internationally defined as income below 1 US$ a day) were found for Benin, Bhutan and Costa Rica. However, actual values vary depending on the data source.

No data was found for the so-called *informal* sector. This is very relevant for countries such as Benin and Bhutan. For a good understanding of economic development, especially in Benin, it is imperative to have data on this issue.

Environmental domain

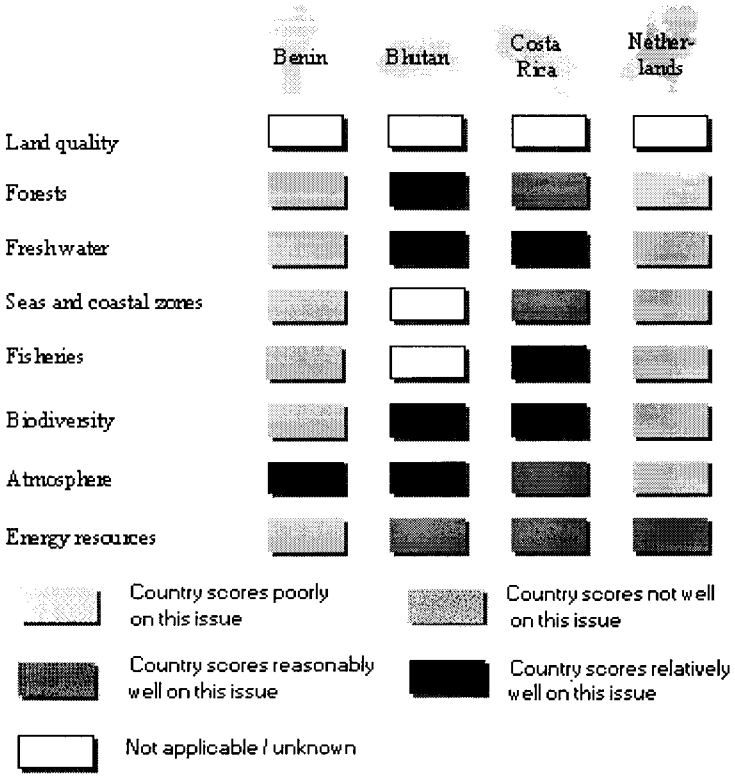
In each of the four countries, there are signs that scarcity of land for agriculture, cities, infrastructure or natural areas is increasing, and pressures are building up. Although the problems with regard to *agriculture* differ, the agricultural sector in Benin, Bhutan and the Netherlands seems to be at an important cross-roads: critical decisions will need to be made on how agricultural development is to proceed. Especially in Benin and Bhutan, the need for land for food production continues to increase, while at the same time available arable land is decreasing due to urbanisation and land degradation, or is just not available (Bhutan!) due to the physio-geographical location. The question is whether agriculture will be able to increase food production and at the same time prevent erosion and loss of soil fertility. In the period of 1960-1995, food production in the Netherlands rose; this was especially due to an increased agricultural productivity (per hectare). The increase in productivity in the Netherlands seem to have, however, taken its toll in terms of environmental pressures (RIVM, 1996). A transition might be needed to alternative forms of agriculture. In Costa Rica and Benin productivity has increased too (in the latter much slower), but here a considerable conversion of forest area to crop and pasture land has also taken place to increase agricultural production.

Bhutan is very rich in terms of *forest* resources; around 60% of the country is still covered with forest. Forests are considered to be a crucial asset for sustainable development in this country. During the last few decades, Costa Rica and Benin lost a considerable share of their resources. The Netherlands lost its forests almost completely, with less than 10% of the country still covered with forests. The remaining share has been increasing slowly over the last decades, but its quality is now endangered by a combination of air pollution, receding groundwater levels, expanding infrastructure and other factors (RIVM, 1996).

Bhutan and Costa Rica have large *water* resources. Both in Benin and in the Netherlands signs of local and seasonal water scarcity are reported. The causes and severity in these two countries differ (scarcity seems to be more serious in Benin). In the Netherlands, pollution, particularly that caused by agriculture, poses an actual threat to the quality of groundwater (an important source of drinking water).

Fisheries are an important source of protein in the Netherlands and Benin. In both these countries signs of overexploitation have been reported.

Figure 16. 3: Indicative overview of the current status of natural resources.



A score has been assigned to each issue on the basis of the information included in this report. The results should be regarded as indicative.

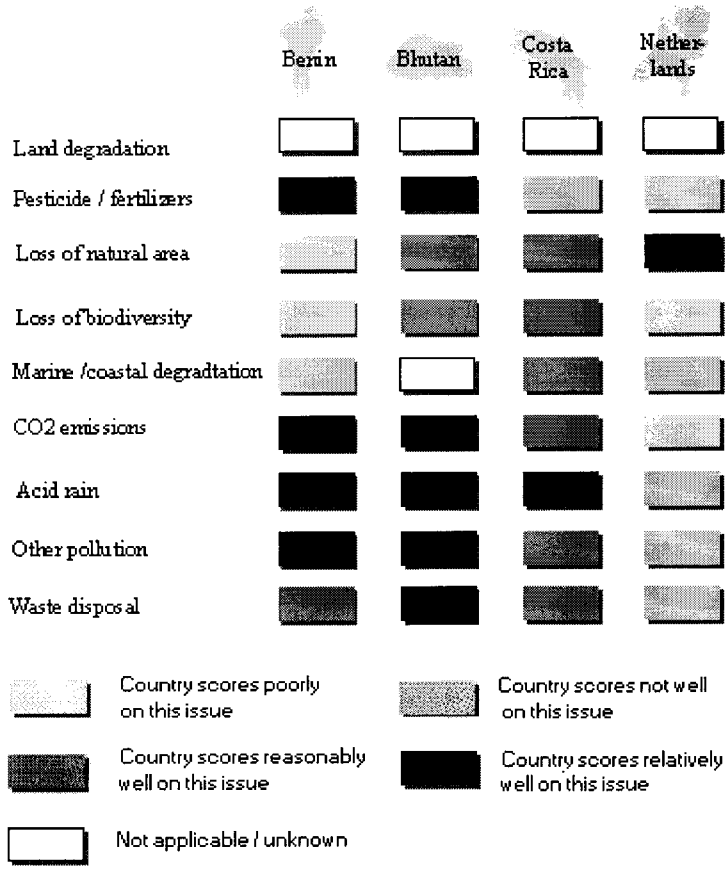
Costa Rica and Bhutan have a very high level of *biodiversity*. In fact, both have been internationally identified as 'biodiversity hot-spots'. The protection of biodiversity by means of establishing nature conservation areas is at the moment most successful in Bhutan. Nature reserves in Costa Rica and the Netherlands seem to be suffering from fragmentation.

The Netherlands consumes much more (commercial) *energy* per capita than any of the other countries. Emissions of pollutants caused by the combustion of fossil energy are therefore present mainly in this country. The other three countries do not use only less energy, but also more renewable energy (hydropower). Energy consumption in Bhutan and Benin consists mainly of traditional energy. The use of firewood and charcoal causes considerable pressure on remaining forest resources.

The Dutch economy also consumes the highest amount of materials per capita of the four countries. Not much data was available for the other three countries on this issue. The same is the case for waste production and treatment.

The risk of *climate change* is still increasing as a result of increasing emissions of greenhouse gases. The Dutch contribution has not been reduced, despite the policy target set. If carbon dioxide emissions resulting from land-use changes are included, the contributions of Costa Rica and possibly Bhutan can not be ignored.

Figure 16. 4: Indicative status overview of the four countries with regard to some of the environmental issues.



A score has been assigned to each issue on the basis of the information included in this report. The results should be regarded as indicative.

The Dutch consumption of CFCs has been significantly reduced. The emissions of acidifying compounds has been reduced too, but further reduction is required to reach the policy goals and prevent environmental degradation. With regard to the other substances, the overall quality of the air has been improved since the 1970s. Many 'pollution'-related problems important in the Netherlands such as emission of ozone-depleting substances, acidifying compounds etc. are either non-existent or not very relevant in the other countries. The other three countries are reporting signs of urban air pollution.

Four countries and the path to sustainable development

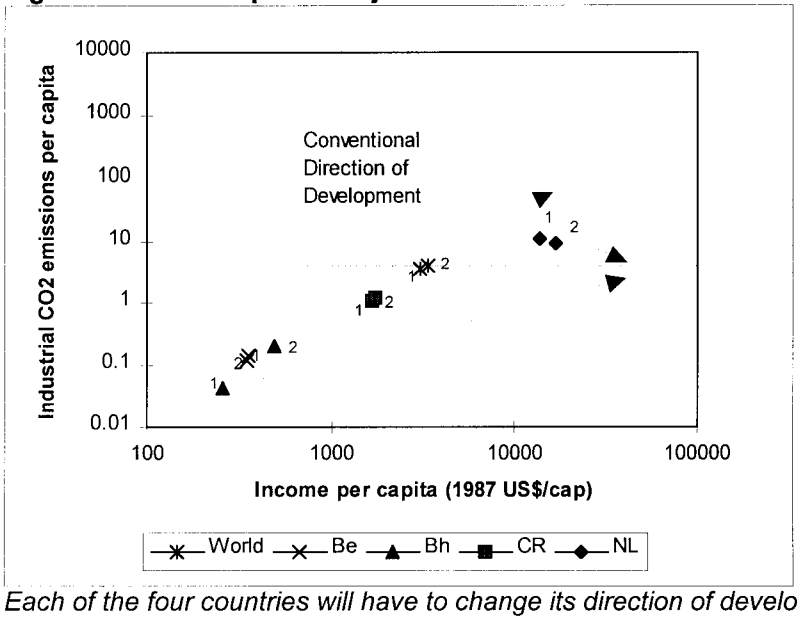
In this report some general trends in economic and social development, and environmental pressures, have been documented. In other reports such as the Global Environment Outlook (UNEP, 1997) similar trends are also found. This Outlook shows different profiles of concerns assume priority with time. The transition concept is frequently used to facilitate discussions in this context. In the most well-known transition, in demography, a decline in fertility follows the decline in mortality rates but with a delay, as a result of which a new stable population is only reached after rapid population growth. In Chapter 3, Benin and Bhutan are found in the 'take-off' phase of the demographic transition, while the Netherlands is found in the final stabilization phase. Other transitions are found, for example, for economic production (from agricultural-based societies to service economies) and energy

production (from traditional fuels to commercial fuels and, finally, renewable energy resources, as well as shifts towards greater efficiency). Many transitions are interrelated: environmental transitions, for instance, often emerge in concordance with development transitions. Policy responses are part of the dynamics that determine the eventual situation.

The concept of transition implies that current environmental problems in the Netherlands - for instance, those related to a high density of different functions in the same small area - might become important in several countries now experiencing fast economic growth. However, it should be clear that transitions do not represent rigid patterns for which the development in the Netherlands (or any other country) represents the only or even a typical template. In fact, many argue that by learning from experience in industrialized countries, regions that are currently in the early stages of industrialization can limit environmental degradation by adopting an appropriate combination of preventive policies. As such, these countries have the possibility of leap frogging the industrialized world.

For each of the four countries Figure 16.5 shows a GDP per capita and industrial carbon dioxide emissions for two points in time. The position of each country, and the conventional direction of development, suggest that all four countries will be moving to ever-increasing 'welfare' and environmental pressure[23]. However, to achieve a more sustainable global development, both highly industrialised countries (like the Netherlands) and more rural societies (like Benin and Bhutan) will have to change their current direction of development as indicated .

Figure 16.5: Development trajectories.



Each of the four countries will have to change its direction of development to attain more sustainable development.

[23] Between 1980 and 1992, the Netherlands had already diverged from the conventional development with respect to decoupling the increase in income and increase in carbon dioxide emissions. However, more recent data suggest that this might be only a temporarily trend, unless new policy is formulated (RIVM, 1997).

Finally, this exercise has shown that much data available is able to provide an interesting overview of differences and similarities between the four countries. However, as the summarizing remarks on methodological aspects have shown, there are still important limitations on accuracy, relevancy and especially the uneven distribution of information in geographical terms and with reference to the domains.

References

Adriaanse, A., Bingezu, S. Hammond, A., Moriguchi, Y., Rodenburg, E., Rogich, D. and Schütz, H. (1997) *Resource Flows, The material basis of industrial economies*, World Resources Institute, Washington D.C., U.S.A.

Agenda21 (1992). *Agenda 21, The United Nations Programme of Action from Rio*, Final text of agreements negotiated by Governments at the United Nations Conference on Environment and Development, 3-14 June 1992, Rio de Janeiro, Brazal

Amnesty (1995), *Overview of countries signing human right conventions*

Balaton Group (1996). Indicators and information systems for Sustainable Development, Report of the Workshop April 13-17, 1996 in Bilthoven, the Netherlands

Bakkes, J.A., et al. (1994), 'An Overview of Environmental Indicators: State of the art and perspectives', RIVM, Bilthoven, the Netherlands

Bakkes, J.A. (1997), *Research Needs* in Moldan, B. and Billharz, S. (1997), *Sustainability indicators, report of the project on Indicators of Sustainable Development*, SCOPE, John Wiley & Sons, Chichester, England

Bakkes, J.A. and van Woerden, J. (ed.) (1997). *The Future of the Global Environment: A Model-based Analysis Supporting UNEP's First Global Environmental Outlook'*, RIVM, Bilthoven, the Netherlands

Boer, M. de (1995). *Milieu, ruimte en wonen, tijd voor duurzaamheid* (Environment, space and living, it is time for sustainability), Minister of Spatial Planning, Housing and the Environment, The Hague, the Netherlands

Brink, B. J. E. ten and Bouma, W (1995). Biodiversity indicators for integrated environmental assessments at the regional and global level - discussion paper, National Institute of Public Health and the Environment, Bilthoven, the Netherlands

Bryant, D, Rodenburg, E., Cox, T. and Nielsen, D. (1995), *Coastlines at Risk: An index of Potential Development-Related Threats to Coastal Ecosystems*. World Resources Institute, Washington D.C., U.S.A.

CBS (1996). *Statistisch Jaarboek 1996* (Statistical Yearbook 1996), SDU Uitgeverij, `s-Gravenhage, the Netherlands

Chhewang Rinzin (1997), 'The Middle Path of Development', Royal Institute of Management, Thimpu, Bhutan *(draft)*

CIA (1995). CIA 95 Fact Book, Internet, http://www.odci.gov/cia/publications/95fact

Daly, H.E. (1991). *Elements of environmental macroeconomics*, in Constanza, R. (ed.) (1991). Environmental Economics, Columbia University Press, New York, U.S.A.

Daly H.E. and Cobb, J.B. (1989). *For the Common Good, Redirecting the Economy Toward Community, the Environment and a Sustainable Future*, Beacon Press, Boston

Driessen, P.M.M and te Molder R.A.B. (1996). *Indicatoren voor natuurlijke hulpbronnen - Deelrapport 4: Indicator voor de hulpbron bos* (Indicators for natural resources: Forests). Minstery of Housing, Spatial Planning and the Environment, Report series Environmental Strategy 1996/1, The Hague, The Netherlands

Driessen, P.M.M and Viergever A.L. (1996). *Indicatoren voor natuurlijke hulpbronnen - Deelrapport 1: Indicator voor de hulpbron zoet water* (Indicators for natural resources: Fresh water). Minstery of Housing, Spatial Planning and the Environment, Report series Environmental Strategy 1996/4, The Hague, The Netherlands

Ecooperation (1997) *Werkplan 1998-1999* (Programme of Action 1998-1999), Amsterdam, Netherlands.

EdlN (1995). *Estado de la Nacion en Desarrollo Humano Sostenible* (State of the Nation concerning Sustainable Human Development), Proyecto Estado de la Nación, San José, Costa Rica

Ekins, P. (1992) *A four-capital model of wealth creation* in Ekins, P. and Max-Neef M. (1992) *Real-life economics, Understanding Wealth Creation,* Routledge, London, U.K.

FAO (1995). FAO Stat PC, Computerized Information Series, Food and Agricultural Organization of the United Nations, Rome, Italy

FAO (1997). *State of the World's Forests 1997.* Food and Agricultural Organization of the United Nations, Rome, Italy

Figueres, J.M. (1994). Formulation of Costa Rica's government goals (May 8, 1994), President of Costa Rica

Flavin (1990). *Sustainable Development in the Kingdom of Bhutan* in 'Report on the Paro Workshop, Bhutan', UNDP/Royal Government of Bhutan, Q-Reprographics, Thimphu, Bhutan.

Greef, J. de and de Vries, B. (1991). *Duurzame Ontwikkeling als richtinggevend kader voor milieubeleid* (Sustainable development as orienting framework for sustainable development), RIVM, Bilthoven, the Netherlands, RIVM report no. 481501001.

Groot, R.S. de (1992). *Functions of Nature, Evaluation of nature in environmental planning, management and decision making*,Wolters-Noordhoff, Groningen

Hammond, A. et al (1995). *Environmental Indicators: A systematic approach to measuring and reporting on environmental policy performance in the context of sustainable development*, World Resources Institute, Washington D.C., U.S.A.

Hardi, P. and Zdan, T. (1997). *Principles in Practice.* International Institute for Sustainable Development, Winnipeg, Manitoba, Canada.

Hart, J. de (1995). *Tijdopnamen.* (Time balances). Social-Cultural Planning Bureau, Sociale en culturele studies-14, Rijswijk, The Netherlands.

Hilgen, P.R. (1994). *De vitaliteit van het Nederlandse bos 12. Verslag van de landelijke inventarisatie*, (The quality of Dutch Forest; Report of a national inventory), IKC Natuurbeheer, Wageningen, Netherlands.

IIIS (1996) *Steel statistical Yearbook 1995*, International Institute for Iron and Steel, Brussels, Belgium

IRI/LDEO (1997), *Climate Data Library - Hansen Global Temperature Indices,* International Research Institute for Climate Prediction, University of Columbia, San Diego, U.S.A.

IPCC (1996) *IPCC Second Assessment Sythesis of scientific-technical informational relevant for interpreting article 2 of the UN Framework Convention on Climate Change,* Cambridge University Press, Cambridge, UK.

Karma Ura (1997). Officer Sustainable Development Secretariat, Ministry of Planning, Royal Government of Bhutan, Pers. Com., November 1997

Kruijf, H.A.M. de and Vuuren, D.P van (1996). 'Following Sustainable Development in relation to the North-South dialogue: Ecosystem health and Sustainability indicators', *Ecotoxicology and Environmental Safety* (accepted for publication).

Meadows, D.H., Meadows, D.L. and Randers, J. (1991*). Beyond the Limits. Confronting Global Collapse; Envisioning a Sustainable Future*. Earthscan Publications Ltd., London. U.K.

Metze (1996) *De staat van Nederland - Op weg naar 2000* (State of the Netherlands - Going to 2000), Uitgeverij Sun, Nijmegen, Netherlands.

Mideplan (1996). *Panorama Nacional 1995, Balance Anual Social, Economico y Ambiental* (National Panorama 1995), Ministerio de Planificación Nacional y Política Económica, San José, Costa Rica

NEF (1995). *Accounting for Change - Indicators for sustainable development*, New Economics Foundation, London, UK.

Niesen, L.W. and Hilderink, H.B.M. (1996). *Roads to health. Modelling the health transition; the generic population and health modelling framework, version 1.0.* GLOBO Report Series no. 13. National Institute of Public Health and the Environment, Bilthoven, the Netherlands

OECD (1994). *Environmental Indicators: OECD Core Set*, Organisation for Economic Co-operation and Development, Paris, France.

OECD (1995) *OECD Environmental performance reviews.* Organisation for Economic Co-operation and Development (OECD), Paris, France.

Pezzey, J. (1992). *Sustainable Development Concepts, An Economic Analysis*, World Bank, Washington D.C., U.S.A.

Pojman, L.P. (1994) *Environmental Ethics - Readings in Theory and Application*, Jones and Bartlett Publishers, Boston, U.S.A.

RGB (1992). *Seventh Five Year Plan 1992-1997*, Royal Government of Bhutan, Timphu, Bhutan.

RGB (1992a). *Bhutan: Towards Sustainable Development in a unique environment,* National Report for the United Nations Conference on Environment and Development, Thimpu, Bhutan

RIVM (1996) *Milieubalans 96* (State of the Environment Report 1996), National Institute of Public Health and the Environment, Bilthoven, the Netherlands

RIVM (1997). *Milieuverkenning* (Environmental Outlook), RIVM, Bilthoven, the Netherlands

ROB (1991). Republic of Benin, Environment and Development., National Report for the United Nations Conference on Environment and Development, Republic of Benin, Cotonou, Benin

Rotmans and de Vries (1997), *Perspectives on Global Change*, Cambridge University Press, Cambridge, U.K.

Serageldin (1996). *Sustainability and the Wealth of Nations - First Steps in an Ongoing Journey*, World Bank, Washington D.C., USA

Serageldin and Steer (ed.) (1993). *Making Development Sustainable: From Concepts to Action*, Environmentally Sustainable Development Occasional Paper Series no. 2, World Banl, Washington D.C.

Swart, R.J., and Bakkes, J.A. (eds.) (1995). *Scanning the Global Environment: A framework and methodology for integrated environmental reporting and assessment*, UNEP/RIVM, Nairobi, Kenya

Thompson, M., et al (1990). *Cultural Theory*, Westview Press, Boulder, USA.

UN.DPCSD (1996). *Indicators of Sustainable Development Framework and Methodologies*, United Nations, New York, USA.

UNDP (1993). *Human Development Report 1993*, Oxford University Press, New York, U.S.A.

UNDP (1996). *Human Development Report 1996*, Oxford University Press, New York, U.S.A.

UNEP (1995) *Global biodiversity assessment.* Cambridge University Press, Cambridge, U.K.

UNEP (1997) *Global Environment Outlook*, Oxford University Press, Oxford, U.K.

USBC (1997) *International Database (IDB)*, International Programs Center of the Population Division, US Bureau of Census, Washington D.C., U.S.A.

Van Vuuren, D.P. and de Kruijf, H.A.M. (1996). *Following the Path to Sustainable Development, A proposal for the development of Multi-disciplinary indicators for Sustainable Development in Benin, Bhutan, Costa Rica and the Netherlands*, RIVM, Bilthoven, 29 pp.

Van Vuuren, D. P. and de Kruijf, H.A.M. (1996). *Connect Four; Existing data and indicators for sustainable development in Benin, Bhutan, Costa Rica and the Netherlands.* National Institute of Public Health and the Environment/Ecooperation, Bilthoven, The Netherlands.

Wackernagel, M and Rees, W. (1996). *Our Ecological Footprint: Reducing Human Impact on Earth*, New Society Publishers, Gabriola Island, B.C.

WEC (1993) *Renewable energy resources: Opportunities and Constraints 1990-2020.* World Energy Council, London, England.

WHO (1996). Health for All Global Indicators Database, World Health Organisation, Geneva, Switserland.

WMCM (1994) *Biodiversity Data Resource Book*, World Conservation Press, Cambridge, U.K.

Wolfers, I. and Drift, R. van der (1996), Health and Development in a comparative perspective; the cases of Benin, Ghana and Mozambique, Publication in the context of Dutch medical research programs in developing countries.

World Bank (1994a). *Bhutan: Country Economic Memorandum*, World Bank, Washington D.C., U.S.A.

World Bank (1994b). *Benin, Toward a poverty alleviation strategy*, World Bank, Washington D.C., U.S.A.

World Bank (1995a). *World Bank Indicators on CD-ROM*, World Bank, Washington D.C., U.S.A.

World Bank (1995b). *Social Indicators of Development,* World Bank, Washington D.C., U.S.A.

World Bank (1995c). *Global Approach to Environmental Analyses (GAEA),* World Bank, Washington D.C., U.S.A.

World Bank (1995d). *Monitoring Environmental Progress - A report on Work in Progress*, World Bank, Washington D.C., U.S.A

World Bank (1995e). *Staff Appraisal Report, Republic of Benin, Environmental Management Project*, World Bank, Washington D.C., U.S.A.

World Bank (1996). *Bhutan: Country Economic Memorandum*, Washington D.C., U.S.A.

World Bank (1997). *World Development Indicators*, Washington D.C., U.S.A.

WCED (1987). *Our common future*, Oxford University Press, Oxford, England.

Weterings, R.A.P.M. and Opschoor, J.N. (1994). *Toward environmental performance indicators based on the notion of environmental space.* Advisory Council for Research on Nature and Environment, pub. no. 96, Rijswijk, The Netherlands

WRI (1996). 'World Resources, Guide to the Global Environment 1996-1997', Oxford University Press, New York

Zweers (1995), 'Participeren aan de Natuur, ontwerp voor een ecologisering van het wereldbeeld' (*participation towards Nature - design to ecologise the world-view*), Uitgeverij van Arkel, Utrecht, the Netherlands

Annex A: Geographical context

In this appendix a rough sketch of the geographic context of the four countries is given.

1. Benin

The Republic of Benin is situated in sub-Saharan, west Africa and has borders with Nigeria in the west, Togo in the east and Burkina Faso and Niger in the North. The surface area is about 112.600 km^2. The country extends over 650 km from the coast line to the Niger river in the North. Benin consists of five natural regions. The coastal area is low, flat, and sandy and is backed by lagoons. The Ouémé river flows into one these lagoons and has a broad marshy delta with high agricultural potential. North of the coast is the barre country, a fertile clay plateau. North and west of the barre are the Benin plateaus, ranging in height from 90 to 230 meters. The Atakora Mountains in the north-west reach an altitude of 640 meters and have a length of about 150 km. In the north-east are the plains of the Niger River valley, an eroded savannah-like plateau.

Benin has a warm climate with an average rainfall of 1300 mm per year. Benin is divided into three climatic zones: the subequatorial zone in the south, the Guinean-Sudanian zone and semi-arid Sudanian zone in the North. In the North the rainfall is only 800 mm per year. Temperatures in the south range from 22 to 34°C. In the drier north they average 27°C. As a consequence of the relatively dry climate, Benin is not able to harvest tropical trade crops, such as coffee and cacao. In stead, cotton and to a lesser degree palm oil and peanuts are harvested as cash crops.

Porto-Novo is the official capital, but the port city of Cotonou serves as the nation's political capital and commercial centre.

2. Bhutan

Bhutan is a small landlocked kingdom located between India (in the west, south and east) and Tibet (in the north, Tibet is currently part of China). Its area is about 46.500 square kilometres. Bhutan is one of the most rugged, mountainous areas of the world, rising from about 300 meters elevation above sea level in the South to over 7.550 m in the North. Bhutan may be divided into three geographic regions the Great Himalayas, the Lesser Himalayas, and the Duars plain. The high peaks of the Himalayas extend along the whole of the northern border of Bhutan and large branches stretch southwards from the main chain crossing the country in the North-South direction and isolating the different valleys.

The Himalayas are a relatively young and active mountain range, causing frequent landslides and erosion. In the valleys, numerous rivers flow in a more of less southerly direction, all of which eventually find their way into the Brahmaputra river in India. In the Lesser Himalayas the fertile valleys of central Bhutan are relatively flat and broad and are fairly well cultivated and populated. At the Duar plains in the South of Bhutan a broad zone of almost impenetrable tropical forest is found. The presence of animals and illness has prevented human settlement for a long time in this area. The northern part of the Duars immediately bordering the mountains consists of a rugged, irregular, and sloping surface. At the foot of the mountains small villages are found in forest clearings, but most of the area is covered with dense vegetation.

Bhutan has a large climatic variation (three different climatic zones) as a result of the large differences in altitude, the effect of the Himalayas and the monsoon coming from the south. The first zone is the Southern tropical plain at the foot of the Himalayas. A more temperate climate in combination with monsoon rains is found till a height of about 3000m. The north of the country - above 3000m - is characterised by an alpine climate with monsoon rains. Valleys in the rain shadow of the foothills and inner mountains receive less than 600 mm of annual rainfall, while rainfall in the foothills may amount to 5.000 mm. Because of the wide variety in altitude zones and climate zones, Bhutan has many diverse types of ecosystems.

Bhutan has not had many contacts with the outside world until the beginning of this century, caused by the isolated position, and the large degree of autarchy. This position has recently been changed.

3. Costa Rica

The name of Costa Rica ("rich coast") was given by Christopher Columbus in 1502, because he expected that large gold mines were present. However, little gold and silver has been found. The republic of Costa Rica has a total surface area of 51,110 sq. km. Costa Rica is located in the very centre of the isthmus of Central America and is flanked to the south-west by Panama and by Nicaragua to the north. The country has long coastlines, being situated between two oceans, the Pacific Ocean and the Caribbean Sea. In combination with its complex, mountainous topography, this gives Costa Rica a wide variety of habitats and a diverse flora and fauna. They range from tropical dry forest to lowland rainforest to highland paramo, with a corresponding variety of climatic conditions. In general temperatures vary between 14 and 22 °C, in the high Central Valley and between 22 and 28°C in the lowlands. Temperatures in each region remain relatively stable throughout the year, although some slight changes occur in 'summer' (the dry season) or 'winter' (the rainy season). 'Summer' usually prevails from December to April and 'winter' from May to November.

The highest regions of Costa Rica are found in the centre of the country. The lowlands, which are more extensive and flat, extend to the Caribbean coast in the north-east. On the Pacific side, the marine shelf cuts sharply into the coast forming bays, capes, cliff faces and inlets. Three of the mountain ranges run roughly from north-west to south-east with a fourth crossing them at the widest part of the country and forming a huge cross.

Geographically, Costa Rica can be divided into four regions: the north-west, the central highlands, the Caribbean area and the south-west. The north-west (Guanacaste/Nicoya) is the southernmost tip of the Meso-American plain. The area is relatively hot and dry. In between the mountain ranges of the central highlands, lies the Central Valley (where the cities of San Jose, Alajuela and Heredia are located) and the Guarco Valley, in the province of Cartago. The majority of the population lives and works in the central highland. In this area of Costa Rica it is relatively cool. The Caribbean region is divided into two regions, Tortuguero to the North and the Talamanca region to the south, and is hot and humid. The South-west is with respect to its climate hot and relatively dry. Much of the region in unexplored. There are several large parks containing tropical wet forest with a wide array of flora and fauna.

4. The Netherlands

The Netherlands is situated on the south-east shore of the North Sea, at the downstream end of three international river basins (Rhine, Maas and Scheldt). The Dutch name of the country, Nederland, means 'low land'. About 30 % of the total surface area of circa 41.600 km^2 lies below sea level, protected from sea by barriers of dunes and dikes. Towards the east and south the elevation of the land is slightly higher; the country's highest point is only 321 m. A series of islands to the north encloses the Wadden Sea. The country's physiography has long been characterised by the shifting balance between land and water. Since the 13th century, several polders have gradually expanded the total land area.

The areas of the country originally under water have in general clay soils, good for the growing of grain and other crops. The landscape of the country is largely man-made. However, some areas of more or less natural areas (wetlands, forest and dune areas) are still left. The Netherlands has a moderate, sea climate. The average rain fall is about 700-800 mm per year.

Annex B: CSD-list of Sustainable Development Indicators

This appendix compares the information included in the total compendium with the list of sustainable development indicators as developed by the United Nations Commission of Sustainable Development (16). Three different types of printing have been used to indicate whether information was found on the specific indicator of the list as indicated below.

Indicator Included in the compendium for all countries
Indicator Included in the compendium for one, two or three countries
Indicator Not included in the compendium

Chapters of Agenda 21	Driving Force	State	Response
Category: Social			
Chapter 3: Combating poverty	• Unemployment rate	• Head count index of poverty • Poverty gap index • Squared poverty gap index • Gini index of income inequality • Ratio of average female wage to male wage	
Chapter 5: Demographic dynamics and sustainability	• ***Population growth rate*** • Net migration rate • ***Total fertility rate***	• ***Population density***	
Chapter 36: Promoting education, public awareness and training	• Rate of change of school-age population • ***Primary school enrolment ratio (gross and net)*** • ***Secondary school enrolment ratio (gross and net)*** • ***Adult literacy rate***	• Children reaching grade 5 of primary education • School life expectancy • ***Difference between male and female school enrolment ratios*** • Women per hundred men in the labour force	• ***GDP spent on education***
Chapter 6: Protecting and promoting human health		• ***Basic sanitation: percent of people with adequate excreta disposal facilities*** • ***Access to safe drinking water*** • ***Life expectancy at birth*** • Adequate birth weight • ***Infant mortality rate*** • ***Maternal mortality rate*** • Nutritional status of children	• ***Immunization against infectious childhood diseases*** • Contraceptive prevalence • Proportion of potentially hazardous chemicals monitored in food • National health expenditure devoted to local health care • ***Total national health expenditure related to GNP***
Chapter 7: Promoting sustainable human settlement development	• ***Rate of growth of urban population*** • Per capita consumption of fossil fuel by motor vehicle transport • Human and economic loss to natural disasters	• ***Percent of population in urban areas*** • Area and population of urban formal and informal settlements • Floor area per person • House price to income ratio	• Infrastructure per capita

Chapters of Agenda 21	Driving Force	State	Response
Economic			
Chapter 2: International cooperation to accelerate sustainable development in countries and related domestic policies	• ***GDP per capita*** • ***Net investment share in GDP*** • ***Sum of exports and imports as share of GDP***	• Environmentally adjusted Net Domestic Product • Share of manufactured goods in total merchandise exports	
Chapter 4: Changing consumption patterns	• ***Annual energy consumption*** • Share of natural-resource intensive industries in manufacturing value-added	• Proven mineral reserves • ***Proven fossil energy reserves*** • ***Life-time of proven energy reserves*** • Intensity of material use • Share of manufacturing value-added in GDP • Share of consumption of renewable energy sources	
Chapter 33: Financial resources and mechanisms	• Net resources transfer / GNP • ***Total ODA given or received as a percentage of GNP***	• ***Debt / GNP*** • ***Debt service / export***	• Environmental protection expenditures as a percent of GDP • Amount of new or additional funding for sustainable development
Chatper 34: Transfer of environmentally sound technology, cooperation and capacity building	• Capital goods imports • Foreign direct investments	• Share of environmentally sound capital goods imports	• Technical cooperation grants

Chapters of Agenda 21	Driving Force	State	Response
Environmental			
Chapter 18:Protection of the quality and supply of freshwater resources	• Annual withdrawals of ground and service water • ***Domestic consumption of water per capita***	• Groundwater reserves • Concentration of faecal coliform in freshwater • Biochemical oxygen demand in water bodies	• Waste-water treatment coverage • Density of hydrological networks
Chapter 17: Protection of the oceans, all kinds of seas and coastal areas	• Population growth in coastal areas • Discharges of oil into coastal waters • Releases of nitrogen and phosphorus to coastal waters	• Maximum sustained yield for fisheries • Algea index	
Chapter 10: Integrated approach to the planning and management of land resources	• ***Land use change***	• Changes in land conditions	• Decentralised local-level natural resource management
Chapter 12: Combating desertification and drought	• Population living below poverty line in dryland areas	• National monthly rainfall index • Satallite derived vegetation index • Land affected by desertification	
Chapter 13: Sustainable mountian development	• Population change in mountain areas	• Sustainable use of natural resources in mountain areas • Welfare of mountain populations	
Chapter 14: Promoting sustainable agriculture and rural development	• Use of agricultural pesticides • ***Use of fertilizers*** • ***Irrigation percent of arable land*** • Energy use in agriculture	• ***Arable land per capita*** • Area affected by salinization and waterlogging	• Agricultural education
Chapter 11: Combating deforestation	• Wood harvesting intensity	• ***Forest area change***	• Managed forest area ratio • Protected forest area as a percent of total forest area
Chapter 15: Conservation of biological diversity		• ***Threatened species as a percent of total native species***	• ***Proected area as a percent of total area***
Chapter 16: Environmentally sound management of biotechnology			• R&D expenditure for biotechnology • Existence of national biosafety regulations or guidelines
Chapter 9: Protection of the Atmosphere	• ***Emmissions of greenhouse gasses*** • Emissions of sulphur oxides • Emissions on nitrogen oxides • Consumption of ozone depleting substances	• Ambient concentration of pollutants in urban areas	• Expenditure on air pollution abatement
Chapter 21: Environmentally sound management of solid wastes and sewage-related issues	• Generation of industrial and municipal solid waste • Household waste disposed per capita		• Expenditure on waste management • Waste recycling and re-use • Municipal waste disposal
Chapter 19: Environmentally sound management of toxic chemicals		• Chemically induced acute poisonings	• Number of chemicals banned or severely restriced
Chapter 22: Environmentally sound management of hazardous waste	• Generation of hazardous waste • Imports and exports of hazardous waste	• Area of land contaminated by hazardous wastes	• Expenditure on hazardous waste treatment

Chapters of Agenda 21	Driving Force	State	Response
Institutional			
Chapter 8: Integrating environment and development in decision-making			• ***Sustainable development strategies*** • Programme of integrated environmental and economic accounting • ***Mandated environmental impact assessment*** • ***National concils for sustainable development***
Chapter 35: Science for sustainable development		• Potential scientists and engineers per million population	• Scientists and engineers engaged in R&D per million population • Expenditure on R&D as a percent of GDP
Chapter 37: National mechanisms and international cooperation for capacity building in developing countries			
Chapter 38: International institutional arrangements			
Chapter 39: International legal instruments and mechanisms			• ***Ratification of global agreements*** • Implementation of ratified global agreements
Chapter 40: Information for decision-making		• ***Main telephone lines per 100 inhabitans*** • Access to information	• Programmes for national environmental statistics
Chapter 23-32: Strengthening of the role of major groups			• Representation of major groups in national councils for sustainable development • Representatives of ethnic minorities and indigenous people in national councils for sustainable development • Contribution of NGOs to sustainable development

Annex C: Balance of Trade

Figure C.1 shows the balance of trade for each of the four countries (imports and exports as share of GDP). The data is for the latest available year, i.e. 1992 for the Netherlands, Bhutan and Costa Rica; 1980 for Benin. The economy of Benin has changed considerably since 1980.

Figure C.1: Balance of Trade (Monetary value of in- and exports of merchandise and non-factor services as percentage of GDP)

		Merchandise	Energy	Food	Minerals	Other raw materials	Manufactures	Overall
Benin	Exports	4.5%	0.2%	2.8%	0.0%	1.1%	0.4%	**23.0%**
(1980)	Imports	-23.6%	-2.0%	-6.2%	-0.2%	-0.3%	-14.9%	**-43.4%**
	BoT	**-19.1%**	**-1.8%**	**-3.4%**	**-0.2%**	**0.8%**	**-14.5%**	**-20.3%**
Bhutan	Exports	30.3%	7.9%	2.4%	2.9%	2.0%	11.9%	**30.9%**
(1992)	Imports	-39.9%	-2.5%	-1.1%	0.0%	0.0%	-30.2%	**-43.9%**
	BoT	**-9.6%**	**5.4%**	**1.3%**	**2.9%**	**2.0%**	**-18.2%**	**-13.0%**
Costa Rica	Exports	28.4%	0.1%	16.4%	0.2%	1.3%	8.9%	**40.3%**
(1992)	Imports	-37.9%	-3.3%	-2.9%	-0.6%	-0.5%	-30.6%	**-45.6%**
	BoT	**-9.5%**	**-3.2%**	**13.5%**	**-0.4%**	**0.8%**	**-21.8%**	**-5.3%**
Netherlands	Exports	43.9%	3.7%	9.3%	1.0%	1.9%	28.0%	**52.4%**
(1992)	Imports	-42.0%	-3.5%	-5.9%	-1.1%	-0.9%	-30.7%	**-48.0%**
	BoT	**1.9%**	**0.2%**	**3.4%**	**-0.1%**	**1.0%**	**-2.7%**	**4.5%**

Sources: WB, 1995a; WB, 1994a
(BoT = Net Balance of Trade)

The data show that of the four countries, the Netherlands is the only with a positive balance of trade. This is mainly a result of exports of merchandise and food. Costa Rica balance of trade shows large exports of agricultural products (food), but on the other hand large net imports of merchandise and manufactures. The net balance is slightly negative. Bhutan has a net positive export of energy (electricity to India), but as a small country it is dependent on imports of merchandise and manufactures. The data for Benin is outdated. However, the data shows large net imports of merchandise and manufactures.

Annex D: Main data sources

'World Resources 1996-97, A guide to the global environment',
World Resources Institute, United Nations Environment Programme, United Nations Development Programme and World Bank, 1996, Oxford University Press, Oxford, United Kingdom.

Data for selected years (most data for 1990-1995), with regard to the following topics:
Urban Indicators, Basic Economic Indicators, Population and Human Development, Forest and Land Cover, Food and Agriculture, Biodiversity, Energy and Materials, Water and Fisheries and Atmosphere and Climate.

Human Development Report 1996
United Nations Development Programme, 1996, Oxford University Press, New York, U.S.A.

Data for selected years (most data for 1990-1995) with regard to a wide variety of topics centered around the concept of human development and the human development index. Important topics: human development index, gender, health, food, economic data and others

FAO-Stat-PC
Computerized Information Series, Food and Agricultural Organizations of the United Nations, 1995, Rome, Italy

Data time series on the following topics: Population, Land use and agricultural inputs, Agricultural Output, Animal Husbandary, Food trade, and Fisheries

Social Indicators of Development 1993
World Bank International Economics Department, 1993, Washington, USA

Includes data for selected years. The most important indicators are: Priority Poverty Indicators, Human and Natural Resources, Expenditures and Investment in Human capital.

Socio-economic Time-series Access and Retrieval System (STARS) 1993
World Bank, 1993, Washington, USA

Includes time-series on a large amount of economic data, added with some data on development and environmental topics. Most important categories: National Accounts data, data on Debt, and Development and Environmental data.

Global Approach to Environmental Analyses (GAEA), 1995
World Bank, 1995, Washington, USA

Data on selected topics (selected years and time-series) as the basis for publication Measuring Environmental Progress. Topics included: CO2 emissions and other Greenshouse Gas emissions, Wealth of Nations Estimates, Genuine Savings, Tax and Subsidy Rates and Metals and Minerals

World Development Indicators 1997
World Bank, 1997, Washington, USA

Includes time-series on a large amount of economic data, added with some data on development and environmental topics. Most important categories: National Accounts data, data on Debt, and Development and Environmental data.

Annex E: Mailing list

1-5. Foundation Ecooperation
6 K. A. Koekoek, BZ, DGIS
7. B. Vereecken, BZ, DGIS
8. H. Th. H. Verheij, VROM, IMZ
9. H. Kroes, VROM, IMZ
10. E. Guttierez, Observatorio del Dessarollo, Costa Rica
11. Odservatorio del Dessarollo, Costa Rica
12. C. Herrera Amighetti, Fundecoperation, Costa Rica
13. Royal Netherlands Embassy, Costa Rica
14. Chhewang Rinzin, RIM, Bhutan
15. Royal Institute of Management, Bhutan
16. National Environment Commission, Bhutan
17. Karma Ura, SDS, Bhutan
18. Netherlands Volunteers Service, Bhutan
19. S. Adokpo Migain, ABE, Benin
20 Agence Beninoise pour l'Environment, Benin
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