climate changes spatial planning

Commissioned projects

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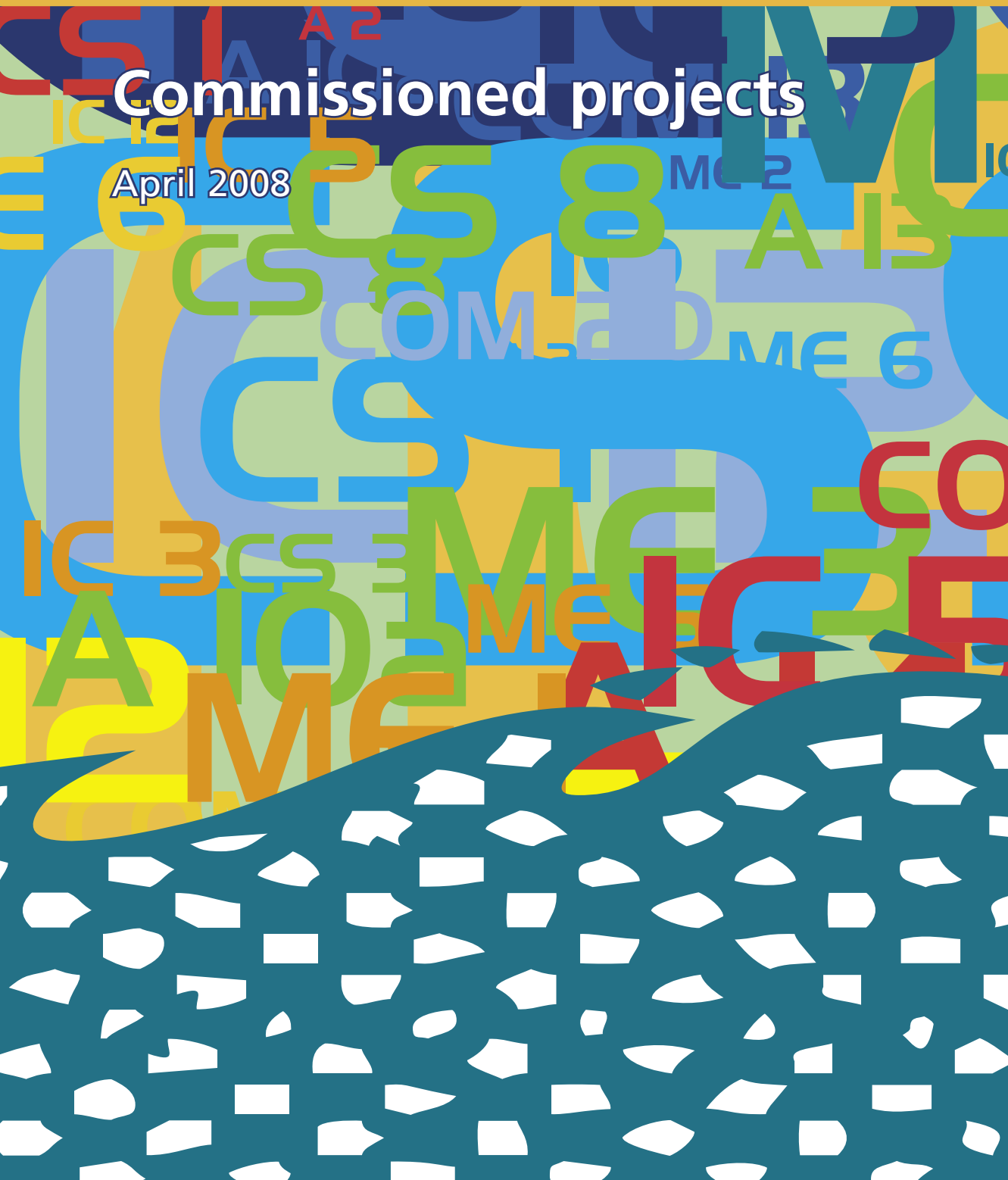

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Introduction

Climate changes Spatial Planning, a programme under the BSIK[1] subsidy scheme, conducts research into ways of dealing with climate change and its effects, with a focus on land use. It tries to answer the question of what can be done to curb greenhouse gas emissions, particularly in sectors with a significant land use component. A consortium of government agencies, scientific institutions and business partners from across society are working together in the programme in search of solutions. The knowledge gained will allow us to make better decisions on the future spatial development of the Netherlands, because climate is an increasingly determining factor in the spatial planning of the country.

The existing Dutch knowledge infrastructure fails to meet the increasing demand for usable knowledge of the relations between climate change and land use. The programme aims to fill this gap and focuses on five main themes:

- Climate Scenarios
- Mitigation
- Adaptation
- Integration
- Communication

Work on setting up the programme has been progressing since 2000, coordinated by Wageningen UR (WUR), VU University Amsterdam, Royal Netherlands Meteorological Institute (KNMI), National Institute for Public Health and the Environment (RIVM), Energy Research Centre of the Netherlands (ECN) and Netherlands Organisation for Scientific Research (NWO). A broad range of parties have played an active part, including government departments, the business community, civil society organisations, provincial executives and other regional authorities. The final consortium has been assembled so that the expertise of the various members covers the full complexity of the climate problem and related land use issues. The participating institutes are nationally and internationally renowned, ensuring that the consortium occupies a prominent international position.

The programme consists of a coherent package of research projects, structured under the five main themes, which are being carried out in close consultation with interested parties from the public and private sectors. The programme therefore provides a cross-sectoral knowledge base. This collection of fact sheets provides brief descriptions of all the research projects.

More information: www.climatechangesspatialplanning.nl

[1] BSIK is the Dutch programme for investments in knowledge infrastructure. It runs until 2011. The total budget is 80 million euros, half of which is available as BSIK subsidies.

Contents

Climate Scenarios

This theme will build a core knowledge base of mainly regional climate data and scenarios, compiled to match the needs of the users.

It addresses issues such as:

- Which climate scenarios will Dutch society have to contend with?
- How can regional climate scenarios focus on spatial planning?

CS 01 North Atlantic Ocean modelling and monitoring

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Project website			
Starting date	1 January 2005	**Completion date**	30 June 2009

Context / Social problem
The North Atlantic Ocean is of crucial importance for the climate in Europe. To make predictions about changes in the European climate, we need measurements (temperature, ocean currents) from various locations in the North Atlantic Ocean and a better understanding of the processes that control heat transport in the ocean.

What do we know/not know?
In qualitative terms we know that the North Atlantic Ocean has a large impact on the climate in Western Europe. However, there is much debate about the importance of the ocean in quantitative terms (in comparison to the atmosphere) and about which mechanisms in the ocean are important. Are changes in deep-ocean circulations important, or is everything determined by the Gulf Stream? Is vertical mixing indeed a crucial element in maintaining the major ocean flows? The BSIK-CS01 project is the Dutch contribution to an international research effort to resolve these and other questions.

What is being studied?
The BSIK-CS01 project contributes to the monitoring of the North Atlantic Ocean by conducting biennial hydrographic surveys of an area between Ireland and Greenland. Measurements are taken of the water temperature, salt content, currents, oxygen content and nutrient content through the whole water column at a monitoring points about 50 km apart. At two characteristic sites water temperature, salt concentration and currents are continually measured by self-registering anchored instruments. The north–south heat transport in the ocean is being investigated further in a modelling study and the outcome compared with these measurements. In addition, detailed studies are being made of the internal waves in the ocean. These waves are very important because they cause vertical mixing, which in turn is crucial for heat transport. The current generation of models still use simplified parameterisations of this vertical mixing, despite the fact that the model results are highly sensitive to this parameter.

What are the results, and who are they for?
The result will be a recognisable Dutch input to international efforts via the World Climate Research Programme (WCRP), the CLImate VARiability and predictability programme (CLIVAR), and other bodies to improve climate models so that their margins of uncertainty can be reduced.

CS 02 The CESAR Observatory: climate monitoring and process studies

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Project website	www.cesar-observatory.nl
Starting date	25 November 2004 **Completion date** 30 June 2009

Context / Social problem

Considerable progress has been made with research into the behaviour of the climate system. Although the situation is still subject to uncertainty, we can state that human activities during the last 50 years have led to a warming of the earth. However, more research is needed to reduce the remaining uncertainties. In particular, there is need for systematic and long-term observation in order to identify and understand the often slow climatic fluctuations.

What do we know/not know?

The atmosphere is an important component of the climate system. The interaction between radiation, dust and clouds, rain formation and the water balance, and energy exchange at the earth's surface are all insufficiently understood facets of the climate, and can only be studied in relation to a wider interconnected whole.

What is being studied?

The Netherlands has a world renowned atmospheric observatory at Cabauw near Lopik: the CESAR Observatory. It has a 213 metre high measuring mast, ground measurement equipment and remote sensing apparatus has been erected to map the atmosphere to a height of 15 kilometres. The objectives within the Climate changes Spatial Planning programme are to:

1. develop essential infrastructure and measurement strategies for climate monitoring;
2. measure aerosols, clouds, radiation, turbulence, land-atmosphere exchange, precipitation and soil moisture in the context of climate and weather modelling;
3. contribute to the reduction in uncertainties in climate scenarios.

What are the results, and who are they for?

The CESAR Observatory is a leading international institution in its field. It sits comfortably in a global network of climate stations and contributes to improving satellite observations. The goal of the observatory is to conduct long-term observations and make the results available to the international research community.

CS 03 Representation of soil moisture and root water uptake in climate models

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Project website			
Starting date	24 October 2004	**Completion date**	31 December 2008

Context / Social problem

The previous generation of climate models predicts too high temperatures for dry summers for certain regions in Europe. The main reason is the desiccation of the soil during summer when transport of moist air from the Atlantic is blocked.

What do we know/not know?

The above mentioned problem has prompted a number of research questions:

1. Which of the soil-water-atmosphere processes will have to be incorporated into an improved soil/ vegetation module for a new generation of climate models?
2. What influence will this have on the prediction quality of the climate models?
3. How can we obtain the data required for the calculations on a European scale more quickly?

What is being studied?

This study uses a more detailed soil/vegetation module as benchmark. Systematic sensitivity analyses are used to select the aspects to be incorporated. On the basis of the sensitivity analyses groundwater depths, shallow soil profiles and deep and shallow root profiles are incorporated in the soil-vegetation module. Satellite images are used to obtain input and test data. At this moment a soil-vegetation-module is being tested using data derived from satellite images.

What are the results, and who are they for?

The project will deliver several versions of a soil/vegetation module to KNMI. The outcome of the research will be a model for KNMI that produces at the European scale the best predictions. More extensive use of satellite images is an additional expected outcome.

CS 04 The regional climate impact of aerosols

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Project website	http://bsikaerosol.wetpaint.com/
Starting date	1 January 2004 **Completion date** 30 June 2009

Context / Social problem

'Aerosol' is the term given to minuscule solid or liquid particles suspended in air. We breathe them in on a daily basis. Particulate matter (PM), as these aerosols are called in relation to air pollution, is harmful for health. Their high concentrations are a major problem in the Netherlands. Aerosols also reflect sunlight, which makes them an important agent in atmospheric cooling. The air in the Netherlands contains the highest concentration of aerosols in Europe and the cooling effect of these aerosols should therefore be greatest in the Netherlands. The droplets in clouds are formed around aerosols and the degree to which they reflect sunlight is determined in the first instance by the aerosols themselves. As clouds are the source of precipitation, this is also influenced by aerosols.

What do we know/not know?

The reflection of sunlight has become better understood in recent years, but it is not known how aerosols affect clouds and the regional climate. This requires the use of a regional climate model which incorporates aerosols and their effects. Moreover, the composition of the aerosols above the Netherlands is different than in other regions because of the combination of high population density and intensive cropping and livestock farming. The aerosols produced by these sources are not well known, but include ammonium nitrate, for example.

What is being studied?

The project investigates the effect of 'national' aerosols on the regional climate, based in the first instance on measurements designed to determine the composition of the aerosols in a cloud chamber. These facilities are right next to the sea so that aerosols produced naturally from the sea can also be measured. The measurements will be made with specially developed new instruments, which will also be used at the CESAR Observatory (project CS02). The differences between the marine and inland measurements will be used to derive the effects of the additional aerosols produced in the Netherlands. The data and knowledge gained about aerosols will be used to develop a module for the new national climate model RACMO-2, following development of a model to describe the aerosol fields.

What are the results, and who are they for?

First, the results will be incorporated as a module into the RACMO-2 regional climate model for a study of the impacts of aerosols on the regional climate. The data will also be used for an evaluation of the modelled aerosol fields and sources, particularly agricultural emissions. In turn, this can be used to estimate the effects of changes in land use on aerosol emissions. This in an important spin-off from the research into local sources of aerosols in air pollution. The results will be disseminated to international groups working on quantifying the global role of aerosols in the climate and in air pollution.

CS 05 Remote influences on European Climate

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Project website			
Starting date	1 July 2005	**Completion date**	31 December 2007

Context / Social problem

The direction of the wind is of the utmost importance for the European and particularly the Dutch climate. Easterly winds bring relatively dry, warm summers and relatively cold winters. Possible changes in these wind directions must be considered when making statements about future changes in the Dutch climate. It is also in the public interest to obtain an understanding of possible extreme weather events that we have not experienced in recent history, such as an exceptionally powerful storms or an extremely dry or wet season. Climate studies can provide the first indications of such events.

What do we know/not know?

It is known that different global climate models show a variety of changes in the European climate as a reaction to increasing concentrations of greenhouse gases in the atmosphere. To an important extent these reflect the degree to which the models produce changes in wind direction statistics. We know little about how these statistics will change, or the chances of easterly winds increasing, for example. There are indications that changes in tropical precipitation could play a role. If so, it could be an important source of uncertainty because the climate models produce a wide range of patterns for the warming of tropical oceans and associated changes in precipitation.

It is known that the climate can fluctuate considerably in the absence of increasing concentrations of greenhouse gases and that a coincidental chain of events can cause record-breaking conditions. We have little idea what form an extreme weather event that has never occurred before in the Netherlands might take.

What is being studied?

Changes in the wind climate across Europe in relation to the warming of tropical oceans are being surveyed in recent simulations with various climate models. The research is investigating how the uncertainties in the warming of tropical oceans affect uncertainties in the expected future climate in Europe. In addition, various extreme events are being selected from a large set of existing simulations made using global models with a limited spatial resolution. These will then be run through a regional model with a high level of spatial detail.

What are the results, and who are they for?

Information on the possible distribution in the future climate and on the selected extreme events will be used as an input to CS07 for the construction of scenarios.

CS 06 Refinement and application of a regional atmospheric model for climate scenario calculations of Western Europe

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Project website			
Starting date	1 October 2004	**Completion date**	1 July 2009

Context / Social problem

Developing mitigation and adaptation strategies that prepare for the anticipated consequences of climate change only makes sense if we know how and to what extent the climate is going to change. KNMI has recently presented several climate scenarios for the Netherlands. They paint consistent and plausible pictures of a possible future climate and were built on results from a large number of climate models used in international climate research. The degree of uncertainty has been reflected by constructing several climate scenarios, each of which is equally plausible based on current knowledge and scientific understanding. Improved climate models will help to reduce the uncertainty margins in future climate scenarios.

What do we know/not know?

Climate scenario calculations are made using coarse-grained global climate models (General Circulation Models, GCMs) with a horizontal resolution of about 150 km. One of the goals of the CS06 project is to perform climate scenario calculations for the European continent (1950–2100) with the current version of the KNMI RACMO-2 regional climate model. The advantage of reducing the size of the spatial domain is that a fine grid can be used with a horizontal distance of approximately 25 km. This type of zooming in is called 'dynamic downscaling'. The forcing at the edge of the regional model domain is taken from a GCM.

What is being studied?

The focus of the climate scenario calculations in the CS06 project is on generating the spatial and temporal distribution of precipitation in the river basins of the Rhine and the Meuse. The model results for the present climate are evaluated using observations of various parameters such as precipitation, temperature, cloud cover and radiation.

The project also aims to improve the description (parameterisation) of a number of processes in the regional model relevant for precipitation. They are the representations of i) boundary layer clouds, ii) cumulus convection, iii) the role of soil water in the land-atmosphere interaction (with CS03), and iv) the effect of clouds and aerosols on radiation and the formation of precipitation (with CS04).

Once the model components of RAMCO-2 have been adapted, the new model will be evaluated against numerous observations, derived partly from the CESAR project (CS02). Finally, the CS06 project will perform another climate scenario calculation with the improved RACMO-2 model.

What are the results, and who are they for?

The outcome of the multi-year model integration with the current version of RACMO-2 is the input to the CS07 project. A further input to CS07 are the climate scenario calculations with the new RACMO-2, which will be conducted in the final stage of the project. If requested, the direct model output can be delivered, for example multi-year and/or high frequency time series of meteorological parameters at designated model grid points.

CS 07 Tailoring climate information for impact assessment

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Project website	http://www.knmi.nl/klimaatscenarios/maatwerk/index.html
Starting date	25 November 2004 **Completion date** 30 June 2009

Context / Social problem

Climate scenarios are consistent and plausible pictures of a possible future climate. Climate scenarios are used by various sectors in society, which means that a wide range and type of climate information must be provided. 'General climate scenarios' (for example the average summer temperature in 2050) are hardly ever sufficient. As a rule, they have to be tailored to the question at hand, gearing the nature and form of climate information to each particular user. That is what this project does.

What do we know/not know?

In the Netherlands (and beyond) the process of 'tailoring' is not new. From as early as the beginning of the 1990s there has been intense cooperation between KNMI and RIZA in the field of climate information for use in calculating discharges in the Rhine and Meuse. Of key importance is estimating extreme river discharges with recurrence intervals much longer than the length of the data series, by means of statistical extrapolation and precipitation generators. The resulting climate scenarios are applicable to the present (reference) climate. The influence of climate change on these extremes has recently become a topic for research.

KNMI has published its new 'generic' climate scenarios, the KNMI'06 scenarios (see www.knmi.nl/klimaatscenarios). These new scenarios will serve as a blueprint for tailoring climate information required for project CS07 and other CcSP projects.

What is being studied?

Tailor made scenarios will be prepared for six case studies, which together cover a large proportion of the relevant social sectors:

- A project on the discharge of the Rhine (and Meuse)
- A project on rural water management and an inventory of drought risks
- A project to assess the consequences of the KNMI'06 scenarios at the scale of the water boards
- A project on extreme wave formation in the North Sea
- A project on agricultural yield predictions in the Netherlands and Europe
- A project on renewable energy

The case studies will be implemented with government agencies and private companies, who will make use of the scenarios. A working method has been chosen that involves the exchange of as much information as possible 'on the workfloor', in other words, between climate researchers and executive staff of the agencies. Besides the usual progress meetings, this working method requires the introduction of an internship system.

What are the results, and who are they for?

The main result so far has been the production of the generic KNMI'06 scenarios. In addition, initial surveys have been made of the implications of the new scenarios, compared with the old WB21 scenarios, for the three water-related case studies. The final outcome of the project should be useful information on climate change for the six sectors participating in the case studies.

CS 08 Time series information

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Project website			
Starting date	1 March 2005	**Completion date**	28 February 2009

Context / Social problem

Data sets including long time series of meteorological variables form the basis for studies into climate change and its effects. These datasets, and the infrastructure to make them available electronically, are needed to obtain an understanding of the current state of the climate, including its extremes. We use this knowledge, for instance, to understand and describe the consequences of climate change for land use or water management. This includes the calibration, verification and tuning of (impact) models suitable for describing climate change.

What do we know/not know?

Datasets with long time series are scarce. This especially holds when one is interested in extremes because these need high quality data. The Netherlands is one of the few countries for which data of sufficient length and spatial and temporal resolution are available. However, a large proportion of the data is only available as hard copy and therefore not readily available to researchers and the wider public. The CS08 project aims to rectify this situation.

What is being studied?

The project covers the following three sources of data:

1. Time series with daily precipitation for the period 1850–1950
2. High resolution (5 minute) precipitation totals derived from pluviograph records from the stations at De Bilt (1897–1993), Eelde (1954–1993), Den Helder/De Kooy (1954–1993), Vlissingen (1954–1993), Beek (1954–1993) and Amsterdam (1920–1983)
3. Multi-day weather forecasts for various locations in the 18th and 19th centuries

The data sources will be digitised, checked for quality and where necessary homogenised. Relevant statistical parameters will also be determined and used to describe the present climate, including extremes.

What are the results, and who are they for?

The project will produce new datasets of historical climate data which at the moment are only available as hard copy documents. The datasets contain long series of high-resolution observations from a dense network in the Netherlands. The new datasets will be made available free to everyone. Where relevant, they will be linked to the corresponding modern digital data in the Netherlands. The goal is also to make the latter datasets freely available, particularly for the scientific and impact communities in the field of climate change and its consequences.

CS 09 Modelling and reconstructing precipitation and flood frequency in the Meuse catchment during the late Holocene

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Project website	
Starting date	25 November 2004 **Completion date** 30 June 2009

Context / Social problem

The climate displays a natural tendency to change. This has happened on various occasions in the distant past. About 11,500 years ago, after the last Ice Age which lasted almost 100,000 years, the earth rapidly began to warm up and entered the warmer period we are now in. Most climate scientists no longer have any doubts that the rate of change in the climate has accelerated during the last few decades and that human activity has a part to play in this (IPCC, 2001). The climate system is highly complex and displays chaotic behaviour. which is why it took such a long time before climate scientists made unequivocal statements about human influence on the climate.

What do we know/not know?

Climate reconstructions are a prominent component of both the scientific and social debate about climate change. In the journal Geophysical Research Letters the Canadian researchers McIntyre and McKitrick criticised one of these temperature reconstructions of the last millennium (the 'hockeystick'). Their article caused considerable public consternation and uncertainty, and therefore agitation among those responsible for climate policy (Ministry of Housing, Spatial Planning and the Environment and others). The public commotion was largely unjustified because the IPCC's conclusion is based on various climate reconstructions, supplemented by scientific insights based on observations and modelling studies. However, it does show the importance of continually verifying climate observations and scenarios against reconstructions, and of improving these reconstructions. One of the areas for improvement is the reconstruction of precipitation characteristics from the past and the interaction with the hydrological cycle and land use. Given the geographical position of the Netherlands, below sea level in the delta of the Rhine, Meuse and Scheldt rivers, these types of reconstructions are particularly relevant.

What is being studied?

Within the Climate changes Spatial Planning programme, project CS09 aims to compare climate scenarios with past fluctuations in the climate (especially precipitation). It will also examine the role played by changing land use and land cover in the climate system, and the effects on the hydrological cycle and water management. An important question arising from this is how can we apply the lessons learned to the possible implications of future changes in land use and climate change for water management?

What are the results, and who are they for?

Under the EU Water Framework Directive (FWD), water managers have to provide reference frameworks for the 'good ecological status' of water bodies in their river basin management plans. Until now these have been derived from reverse calculation and forecasting models using historical measurements. The use of paleoclimatological data (derived from reconstructions and models), the aim of the project, may provide water managers with a new instrument and a new source of knowledge in this field. The river basin plans, including the definition of good ecological status, must be ready in 2009, which matches the delivery date for results from this research.

Mitigation

Research under this theme is about slowing down the speed and scale of climate change. Studies will be made of renewable energy carriers and measures to reduce emissions of terrestrial greenhouse gases.

It addresses issues such as

- How can our spatial infrastructure be designed and adapted for low emissions?
- What are the spatial implications of renewable energy carriers such as biomass and wind energy?

ME 01 Integrated observations and modelling of greenhouse gas budgets at the ecosystem level in the Netherlands

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Project website	www.climatexchange.nl/projects/bsikme1/index.htm
Starting date	1 January 2004 **Completion date** 30 June 2009

Context / Social problem

Under the Kyoto Protocol the Netherlands is bound to report its national greenhouse gas emissions. The uncertainty in these figures is still very high. The Netherlands is also committed to reducing the size of its greenhouse gas emissions; the effects of the measures taken will have to be established objectively.

What do we know/not know?

A significant part of our national greenhouse gas emissions are from the land surface. In contrast to industrial emissions, these terrestrial emissions depend strongly on a large number of highly variable environmental factors, such as the weather, biological processes, soil conditions and rural land management. The exact influence of these factors is poorly understood and estimates of the terrestrial component of greenhouse gas emissions are inaccurate at present. Many are based on global trends, and the extent to which these apply to specific areas like the Netherlands is not known. These estimates do not meet the future demands that will be made of these reports and accompanying uncertainty estimates after the end of the 'Kyoto period'. By influencing factors like the management practices of the land areas it is possible to reduce terrestrial emissions of greenhouse gases, but our knowledge of these processes is inadequate for developing tailor-made area-based measures. The lack of background knowledge is partly due to a lack of suitable observations and measurements.

What is being studied?

The project is investigating the influence of environmental factors and agricultural and conservation management on greenhouse gas emissions. Innovative measurement methods, partly under development, are being used. The selection of methods was also partly based on the suitability of the techniques for future reporting objectives. Methods are being developed to improve estimates of greenhouse gas emissions in rural and natural areas in the Netherlands, and to determine their uncertainty margins. Ways of mitigating greenhouse gas emissions or promoting their uptake through changing land use management are also studied.

What are the results, and who are they for?

With ME02 and ME03, ME01 lays the foundation for future reporting obligations to be met by local and regional authorities and various government agencies. This basis consists of a combination of measurements and modelling which makes it possible to obtain realistic estimates of greenhouse gas emissions from rural areas and to monitor emission reduction measures. Insight into the workings of emissions will point managers of agricultural and nature conservation areas towards optimal combinations of functions in rural areas that will reduce national greenhouse gas emissions. The results will also be an important input to estimates of future trends in greenhouse gas concentrations in the atmosphere.

ME 02 Integrated observations and modelling of greenhouse gas budgets at the national level in the Netherlands

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Project website	www.climatexchange.nl/projects/bsikme2/english/Welcome.html
Starting date	1 January 2004 **Completion date** 30 June 2009

Context / Social problem

Many countries, including the Netherlands, have committed themselves under the Kyoto Treaty to reduce their emissions of greenhouse gases. This has generated demand for an independent review of the effectiveness of emission reduction measures; in other words, determining the degree to which they contribute to a real reduction in greenhouse gas concentrations in the atmosphere.

What do we know/not know?

Survey methods exist which allow us to calculate emissions from the measured concentrations of greenhouse gases. For these to work we need to know the relation between the greenhouse gas concentrations in the atmosphere at certain times and places and the emissions of these greenhouse gases from human activity and from nature. This relationship is determined by horizontal and vertical atmospheric transport under the influence of the weather. We know the emissions from human activities (energy, industry, transport and agriculture) quite well at the level of national annual totals. For inversion calculations we need to have a better idea of the spatial and temporal distribution of the emissions. The current inversion methods were developed for use on the global scale and will have to be made suitable for use on a much smaller scale.

What is being studied?

ME02 will increase the capacity for monitoring greenhouse gases in the Netherlands through the addition of two high towers which can 'see' a considerable proportion of the country. The spatial variation will be studied with the additional help of aircraft measurements and the variation in time will be studied using tower measurements from ME01. Together these data will lead to improved emission models. The dynamics of the boundary layer will also be intensively studied. For the first time differences across the land surface will be measured to enhance model representations. Various models and the different existing and upgraded inversion methods will be compared and evaluated.

What are the results, and who are they for?

A key objective of this project is to develop a system for quantifying the greenhouse gas budget at the national and regional scale. Moreover, a protocol will be developed for making reference estimates to be used in verifying national emissions, which will in time open up the possibility of verifying the accuracy and credibility of the UNFCCC and Kyoto reports.

ME 03 Soil carbon dynamics and variability at the landscape scale: its relation to aspects of spatial distribution in national emission databases

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Project website			
Starting date	1 January 2005	**Completion date**	30 June 2009

Context / Social problem

An important part of the carbon cycle is the storage of carbon in the soil in the form of organic matter. Compared with vegetation, the soil can absorb far more carbon and fix it for a longer period. For mitigation of climate change, therefore, it is interesting to know exactly how carbon storage in the soil works. Moreover, under the Kyoto Treaty the Netherlands is obliged to report each year on the carbon store in the soil, surface and underground biomass, dead wood, litter and organic matter in the soil.

What do we know/not know?

The biggest component of the carbon store is organic matter in the soil, but this is also the component with the highest level of uncertainty. A global estimate has been made of the carbon store in the Netherlands and an initial estimate of the changes in the carbon store. The top 30 centimetres of mineral soil in the Netherlands contain 210 to 310 Mt carbon and the agricultural soils in the Netherlands emit 0.7 Mt carbon per year. These figures are based on a few hundred measurements. It is not clear where in the Netherlands organic matter is stored in the soil and how much of it is stored, how much is added or disappears each year, and what the stock and the increase or decrease are influenced by. Increasing insights into the spatial and temporal variation in the soil carbon store and into the processes influencing the soil carbon store can help to reduce this uncertainty.

What is being studied?

ME03 is investigating how the carbon store is affected by agricultural management methods (for example, ploughing or not ploughing, breaking up grassland or not, amount of fertiliser), by land use history and by forest management. We are currently conducting research into how forest management can influence the storage of carbon in the soil in the forest are of Speulder- en Sprielderbos. We are also researching the influence of land use changes in the past on the carbon store now present in the soil. In a case study area to the south-west of Meppel, we are investigating in two places whether reclaimed heathland of various ages have different soil carbon stores.

What are the results, and who are they for?

The result of the two cases studies will be greater insight into the factors that influence the soil carbon store and better understanding of the spatial variability of the soil carbon store in our case study areas. We can then use these data to make better estimates of the soil carbon store throughout the Netherlands. This improved understanding can in turn be used to produce better national reports, survey systems and estimates at the European scale in relation to land use changes.

ME 04 An integrated framework to assess spatial and related implications of increased implementation of biomass delivery chains

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Project website			
Starting date	1 January 2007	**Completion date**	31 December 2010

Context / Social problem

Though the global biomass potential is large, the bulk of this potential awaits active development. The actual volume of biomass supply will vary with the timing in adoption of efficient agricultural management rate of population growth and other trends. Also, changes in land use, land use management and sustainable production and integration of biomass production for energy (and biomaterials) need to be aligned with regional conditions. Therefore the selection and implementation of biomass production and utilisation chains (both regional and world market) is a regional issue.

What do we know/not know?

At the regional level understanding about biomass potentials and biomass production and utilisation systems is less well developed. This is particularly true when a variety of sustainability criteria (with ecological, economic and social dimensions) need to be taken into account. Most studies focus on biomass potential but do not specify how to turn potentially available biomass into actually available biomass. Tapping into the national and regional potential is quite difficult. We suggest that the biomass potential can be mobilized if innovative regional biomass delivery chains are designed.

What is being studied?

The overall objective of the ME04 research project is to develop an integrated framework to assess and analyse the spatial implications and related opportunities and consequences of an increased implementation of biomass delivery chains for energy, biofuels and biochemicals at different geographical levels.

What are the results, and who are they for?

- A design of sustainable regional biomass delivery chains and assessment of their spatial implications including their effects on land use, social and economic development, environment and landscape
- An integrated framework and related analysis tools in WP2 will identify and quantify uncertainties that result from competition for biomass or land, national and international developments and trends. It can be used to facilitate realistic designing, planning and incorporation at a regional level
- A strategic scenario analysis that will address the national and supranational developments that affect the performance, potential and impacts of biomass production. Scenarios will serve to determine the uncertainties, variability and potential choices that can be made when incorporating European and national agricultural policies, nature conservation, environmental standards, developments in the energy system and various markets for biomass conversion. 'Biomass maps' will be produced indicating the main land use changes to take place when implementing these chains at the national level
- Key to successful implementation is information and integration. This will be achieved through stakeholder involvement, viz a collaborative effort and interaction with stakeholders in a joint process

ME 05 Optimisation of the spatial arrangement of Dutch fen meadows for multifunctional use: knowledge base development and participatory decision support

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Starting date	1 January 2006 **Completion date** 1 January 2009

Context / Social problem

Reed marshes are used around the world for waste water purification, tertiary treatment of treated sewage and filtering nutrients from eutrophic surface water. Artificial reed marshes (helophyte filter) are designed to maximise the contact between the flowing water and the biological filter consisting of sediment, helophytes (e.g. reed) and micro-organisms. In the fen meadow areas, ditches, banks and marsh fragments can fulfil a comparable function because the surface water in these polders often contains high concentrations of nutrients (N and P). These fen mire fringes may also be able to absorb large quantities of carbon. Eutrophic reedbeds have a high net primary production and much of this accumulates in the soil.

What do we know/not know?

Nutrient retention and carbon sequestration depend heavily on water level fluctuations and the relative importance of various elements in the water, nutrient and carbon balances. The specific distribution between these elements probably differs considerably from polder to polder. It is therefore unclear how important banks and littoral zones and their spatial configuration could be, and exactly what the influence will be of predicted climate changes. Climate change will probably lead to greater fluctuation in water levels rather like those in historical regimes: more fluctuation, higher winter levels and lower summer levels. Such fluctuations in levels are also desirable from a nature conservation perspective. The rate at which nutrient retention and carbon fixation can take place, however, also depends on the length and amount of shoreline, the spatial configuration of the water body in the polder, how the water is routed through the polder and the amount and quality of the water.

What is being studied?

It is still unclear what the optimal ditch pattern for retention and carbon fixation will be. Because it is not easy to set up experimental trial polders at field scale, the present research will collect empirical data on several parameters, as a multivariate problem, for a large number of polders in the Dutch fen meadow areas. Once the polders have been selected, carbon fixation will be measured in situ on a small scale.

What are the results

The project is still in the start-up phase. Agreements have been made with most of the water boards. During the course of the summer the polders will be identified and the initial set of data collected in an iterative process with the water boards. Database development, GIS and balance modelling (with input from annual balances from Duflow, SOBEK or comparable document) will run concurrently. The outcome will be of primary importance for water managers, but the Netherlands Environmental Assessment Agency (MNP) has also expressed interest in national assessments. Collaboration is being sought with potential interested parties.

ME 06 Spatial decision support for management of Dutch fen meadows

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Context / Social problem

There is a growing awareness that fen meadow areas will face major changes in the near future. Under current conditions agriculture will face increasing difficulties to produce in a cost-effective way. Also as a result from current water management the ground level will continue to drop and the peat layer will slowly oxidize.

What do we know/not know?

Under current conditions the agricultural sector will find it increasingly difficult to keep production costs down to a reasonable level. Continuation of current water management practices will cause ground levels to fall and the peat will gradually oxidise and disappear. Radical changes in land use are inevitable. This project is aimed at everyone involved in the spatial and land use panning of fen meadow areas. Its goal is to structure and present the available information in such a way that it can be used by all concerned when making planning decisions.

What is being studied?

The project intends to design, evaluate and compare future development paths for these areas in the context of the multiple, consistent or conflicting, long term policy objectives that may affect these areas. This approach combines policy objectives dealing with water retention/ storage, carbon sinks, nature conservation/development, spatial planning and transition of agriculture. This project will focus on development and use of presentation, visualization and evaluation techniques in participative planning processes of Dutch fen meadow areas. Bodegraven/Zegveld is used as a case study to test the approach. As part of the planning process for this area of the province of South Holland three types of workshops are organized: workshops aimed at design, workshops aimed at analysis and workshops aimed at negotiation. Interaction in these workshops is facilitated by the use of the 'Touch table'. This table includes a large set of digital maps. The 'Touch table' makes it possible to draw maps using for example a historical map, an aerial picture or a soil type map as background. Different people can draw simultaneously; the table records which stakeholder makes which addition to the map. It is clear that this step involves a process of giving and taking by the various groups. Spatial decision support methods are used to structure, transform and present information in such a way that the trade-offs between objectives linked to the various stakeholders is made explicit and opportunities for improvements are made transparent.

What are the results

Result will be a design for the three types of workshops supported by GIS software implemented in the 'Touch Table' that is tested within an actual land use planning project in a fen meadow area. If the planning process runs smoothly the project could also contribute to a better plan for the area and better communication with the stakeholders.

Adaptation

This theme encompasses research into limiting the negative consequences of climate change and exploring options to offset the effects of climate change, particularly through spatial and land use planning.

It addresses issues such as:

- How can we ensure the safety of infrastructure?
- What design criteria should we use for the National Ecological Network to take account of climate change?

A OI Biodiversity in a changing environment: predicting spatio-temporal dynamics of vegetation

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Project website			
Starting date	1 January 2004	**Completion date**	30 June 2009

Context / Social problem

In a world heavily influenced by climate change and other human interventions, knowledge of the responses to these changes by ecosystems is essential for making correct estimates of their impacts. Predictive models do not yet exist for vegetation responses, whereas such models are important for the development of national policies that cater for and anticipate the changes.

What do we know/not know?

In the past, various models have been developed to predict vegetation composition from the relations with environmental factors. Many of the current models, however, are either based on empirical relations that will probably not remain valid under climate change, or have many input parameters which are not readily available on a national scale. As a compromise between empiricism and predictability on the one hand and data availability on a large scale on the other hand, we are explicitly incorporating those plant characteristics that can be directly linked to environmental factors. This avoids having to make predictions at the level of individual plant species, which would be impossible at the national scale, while retaining the link with processes. Such models did not exist at the start of the project.

What is being studied?

This project aims to develop a set of models based on plant characteristics that can be used in various climate scenarios. The set of models can be applied on a national scale and linked to existing national models at MNP to:

1. Identify biodiversity hotspots
2. Develop an early warning system for climate change, and
3. Achieve optimal spatial planning for biodiversity conservation

What are the results, and who are they for?

National maps are being developed showing the probability of the presence of certain vegetation types under different climate scenarios. Hotspots and expected changes can be identified by comparing these maps with the probabilities of these vegetation types in the present situation. Collaboration with MNP in the consortium will ensure that the results can be efficiently translated into national policy.

A 02 Strategies for optimising the nature conservation potential of the Dutch Ecological Network and the surrounding multifunctional farm landscape under predicted climate

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Starting date	26 November 2004 **Completion date** 31 December 2010

Context / Social problem

Given that climate is a driver of ecological processes, it is to be expected that climate change will have considerable impacts on biodiversity. A temperature rise will have a direct effect on the ranges of species, and more frequent and heavier extreme weather events will lead to greater fluctuations in population numbers.

What do we know/not know?

Indications of the effects of climate change have already been found in many species, spread over a broad range of taxa (Parmesan and Yohe, 2003, Thomas et al., 2004). There is concern that nature will not be capable of adapting to the changes (IPCC, 2001). Not only is the pace of climate change unprecedented, but the effects of climate change will also be aggravated by deterioration in habitat quality and fragmentation of habitats (Opdam and Wascher, 2004). There are indications that only mobile species and/or species with a broad habitat requirements (generalists) will be capable of reaching the Netherlands as the result of a temperature rise. (Warren et al., 2001).

What is being studied?

1. Is it possible to identify risk groups in response to climate change using species and ecosystem characteristics?
2. Where can we expect bottlenecks in the National Ecological Network because a suitable habitat is in danger of being lost or because the suitable habitat will become inaccessible?
3. Which (spatial) adaptation strategies offer the best opportunities of making nature in the Netherlands climate-proof?

What are the results, and who are they for?

The results from a number of subprojects will be used to determine which species and ecosystems are sensitive to climate change and what effects can be expected. How do these effects relate to national and European biodiversity objectives? Where are the weak spots in the NEN and where are the potential opportunities for nature? Spatial adaptation strategies are being developed, both within and outside the existing NEN. Examples within the NEN include the construction of robust ecological links, expanding nature conservation areas and increasing the internal heterogeneity of conservation areas. In addition, the multifunctional land uses around the NEN increase the permeability of the landscape (interlacing green/blue networks) and improve abiotic conditions (groundwater level, nitrogen deposition).

Stakeholders will be consulted regularly during the course of the project on the feasibility and desirability of certain adaptation strategies. The results will be of value to anyone involved in nature policy and its implementation at the national and regional levels. The multifunctional mantel around the NEN is the area where synergy is sought between climate adaptation strategies for nature and other landscape users, such as water boards, farmers and recreationists.

A 06 Climate related shifts in the NCP ecosystem and consequences for future spatial planning

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Project website			
Starting date	1 January 200	**Completion date**	31 December 2009

Context / social problem
The North Sea itself is one of the most intensely used shelf seas in the world. With oil and gas exploration, shipping, fishing, wind-farming and natural conservational issues knowledge on the effects of climate change for these user functions needs to be assessed.

What do we know/not know?
From numerous timeseries it is evident that rather large scaled changes take place in the North Sea ecosystem. There are all kind of speculative reasons for the observed changes. Probably, a large part of the observed changes seem to be linked to climate related factors. However, overview and insight on what these time series tell is to a large extent lacking.

What is being studied?
The project will aim to get insight in the effects of climate change on important aspects of the ecosystem of the Dutch Continental shelf. Additional field measurements and integration of measurements in an dynamic ecological model (ERSEM) will, together with statistical modelling, be used to relate environmental variables with ecological variables.

What are the results and who are they for?
The research will yield insight in the steering factors of the North Sea ecosystem. Results comprise of satellite derived estimates of primary production and its spatial and temporal distribution in the North Sea. Moreover estimates of the spatial distribution of important components of the benthic ecosystem will be determined. Additionally insight will be obtained on the trends in acidification of the North Sea. All results will be integrated in an adapted ecological model of the North Sea (ERSEM) to obtain insight in the consequences of climate change on various aspects of the ecosystem. With the aid of such model estimates governmental organizations and ministries will be better equipped in decision making because they can incorporate natural variability in a better way. To get overview in the enormous data sets a newly developed tool will be used. Herewith management can take account and get overview of the complexity and dynamic nature of the ecosystem this to enable the optimization of decision making reconciling the various stakeholders involved. The management-tool will be developed as a user friendly interface of a database which contains long term trends of the ecosystem and its steering variables.

A 07 Developing Adaptive Capacity to Extreme events in the Rhine basin (ACER)

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Project website	
Starting date	1 January 2004 **Completion date** 30 June 2009

Context / Social problem

For some years the Dutch government has been busy with flood protection measures in the floodplains of the main rivers. The floods in the 1990s and new insights into climate change have fuelled debate about the sustainability of current measures. Plans for emergency water retention areas and associated measures have been stalled by a lack of support among the population and local authorities.

What do we know/not know?

The debate has exposed the rapidly shrinking amount of land remaining for large-scale interventions in the Netherlands, and has revealed the country's growing dependency on what happens upstream. The Netherlands is very active in the Rhine Commission, in which all the countries in the Rhine river basin are represented. What is lacking is an integrated instrument for calculating measures to be taken throughout the whole Rhine drainage basin, for both extreme dry conditions and for flooding.

What is being studied?

Since 1997 the Dutch-German Arbeitsgruppe Hochwasser NiederRhein has been working on cross boundary flood protection policies for the transboundary area of the Rhine. This working group contains representatives from organisations like the government authorities for the Province of Gelderland and NordRhein-WestFalen and the water boards and municipalities in both countries. An important question facing the working group is how to anticipate future climate change, and particularly how to make current policies climate-proof. The goal of the ACER project is therefore to determine climate effects in the Rhine river basin and the effectiveness of new adaptation strategies in the transboundary region of Germany and the Netherlands. Assistance will be obtained through cooperation with the EU project NEWATER.

What are the results, and who are they for?

The expected results are:

A. An integrated model for the whole Rhine to simulate the effects of various flood protection measures over the long term (hydrology, hydrodynamics, atmosphere)
B. The development of cross-border adaptation measures against flooding
C. Determination of the effectiveness of these adaptation measures under different climate scenarios
D. A focus on the regional water managers and the relation between regional water management and management for the whole Rhine basin

The Dutch-German working group, the Dutch Ministry of Transport, Public Works and Water Management, Rivierenland water board and Gelderland Provincial Council are the endusers of this project.

A 08 Spatial choice, transport and environmental consequences

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	RIZA		
Project website	www.feweb.vu.nl		
Starting date	1 January 2004	**Completion date**	1 January 2009

Context / Social problem

Besides the need for mitigating climate change, realisation has dawned that certain changes can no longer be prevented. There is a demand for better understanding of the possible consequences of climate change for various sectors of the economy. Adaptation policies can then be built around these insights. Project A08 investigates possible effects of climate change for the transport sector, with an emphasis on inland shipping and road transport.

What do we know/not know?

Little or nothing is known about the effect of weather and climate change on the inland shipping sector. There is much to be learned in this area. The literature on the effects of climate change and weather conditions on road transport is also limited. A reasonable number of studies have been done on the effects of weather (especially precipitation) on road accidents, some of which have also examined the influence on weather on cycling behaviour. Less is known about the effects of the weather on the choice of transport mode and the effect on congestion (directly and indirectly via accidents).

What is being studied?

Current research is examining the welfare effects of low water levels on transport by inland shipping. The core factors are reliability of transport by inland shipping and the effects on the generalised transport costs. Also, the potential loss in market share of inland navigation in various markets is analysed, using the transport model NODUS. Another line of research is into the value of time and the value of reliability in the inland navigation sector. Considering the research on other transport modes, with a focus on road transport, a first objective is to assess the existing knowledge on the relationship between climate change / weather and transport by performing a literature survey. We furthermore analyse changes in mode choice decisions due to changes in weather conditions. Historical weather and mode choice data may reveal such shifts, and possible consequences for future transport patterns are assessed by using climate change scenarios. We also aim to analyse the complex relationship between weather, congestion and traffic accidents. Using predicted changes in future weather conditions we assess the potential consequences of climate change for the road network.

What are the results, and who are they for?

Besides the scientific interest in the various branches of the research in this project, other parties have expressed interest. The research on inland shipping may be of interest to the sector itself and to policymakers (inland shipping sector, Port of Rotterdam). In the latter case, it could be relevant for decisions on building new locks and upgrading certain harbours (e.g. infrastructure) if the demand for transport grows. The road transport study has attracted the attention of organisations like AVV Transport Research Centre. This organisation is responsible for warning and information systems on the roads, which could be used to prevent problems during bad weather. Also the SWOV (Dutch national road safety research institute) and the Ministry of Transport and Public works (knowledge centre KiM) have shown substantial interest in our research.

A 09 Financial arrangements for disaster losses under climate change

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Project website	
Starting date	1 January 2004 **Completion date** 30 June 2009

Context / Social problem

Research has shown that direct economic damage from weather-related natural disasters worldwide has risen in recent decades. Extreme precipitation events, river floods and drought cause considerable damage, particularly in low-lying deltas like the Netherlands. If climate change leads to more extreme weather, especially intensive rainfall, we can inspect more damage in future.

What do we know/not know?

Insurance for damage caused by heavy rainfall is generally available for households and recently also for the agricultural sector (Aquapol). Since the 1953 flood disaster in the Netherlands, no more insurance policies have been offered for damage resulting from the breach of dikes. Damage from disasters that cannot be prevented, is not covered in any other way, is uninsurable or is only insurable at prohibitive premiums, can be covered by central government under the Disasters and Serious Accidents (Compensation) Act. In such cases the government has to have declared the event a disaster. In both the Netherlands and the EU, thought is being given to improved coverage of risks and damage. However, little research has been done into financial and insurance arrangements that can alleviate the negative effects of climate change and extreme weather, and how efficient they are.

What is being studied?

Alternative insurance packages are being assembled to cover the risks of climate change. An inventory will be made of national and international policies for compensation for flood damage. Possibilities for the private sector absorbing some of the risk will be explored. Spatial differentiation in insurance will be examined as a possible option. It could make the risks for the participating parties (government, insurers) more manageable and give citizens and businesses an incentive to make more sustainable use of land. The effects of climate change and new insurance arrangements on supply and demand on the capital and insurance markets will be modelled and the economic and social costs and benefits of the insurance packages evaluated.

What are the results, and who are they for?

The outcome of the project will be better insight into the damages that can be caused by extreme weather under climate change. It will also improve expertise with insurance arrangements and the roles of the private sector and central government in covering risks. This information is crucial for both government and the insurance sector and for spatial planning and water management in the Netherlands.

A IOa Hotspots definition study

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Project website			
Starting date	1 February 2006	**Completion date**	30 June 2006

Context / Social problem

A hotspot is a pilot project in a sector, place or region where spatial planning and climate change have important implications and where these are at odds with other factors. The hotspots are areas where every effort will be made to find spatial adaptation possibilities. It is important that most of the work in this project is carried out by practitioners.

What has been studied?

The definition study identified and described a number of potential hotspots. The following activities were carried out:

1. *Determination of selection criteria*
   The following selection criteria for hotspots were adopted:
   - Climate change must have an important influence on the development pattern of the area or sector
   - There is a demonstrable link with spatial planning and regional planning
   - Practitioners must support the project
   - There is interest from government and society
   - Every effort is made to draw from and build on current CcSP projects
   - The project must have a demonstration function for how spatial planning can help to embed adaptation measures
   - It has communicative appeal to a broad public
   - It fills in gaps in the CcSP programme
2. *Identification of hotspots: workshops en interviews*
   During the definition phase two workshops were held in which participants could propose potential hotspots. This identification process was supplemented by in-depth interviews with key people.

What are the results, and who are they for?

- A list of criteria that the hotspots must satisfy
- A list of potential hotspots
- A report containing descriptions of the potential hotspots, the results of the workshops, the selection criteria and the scores given to the potential hotspots, and recommendations on hotspots to be investigated further

Following this definition stage, the selected hotspots are being worked up into project proposals by a consortium of various parties, with and emphasis on stakeholders and implementing parties with a clear demand for knowledge flowing from the CcSP programme, such as local authorities. The consortia are developing adaptation strategies for the hotspots and step-by-step action plans that should in time lead to the implementation of the spatial visions developed for the hotspots. A subsidiary goal for the longer term is to create greater awareness of the problems, both within the hotspots and in the wider area.

A II Routeplanner 2 2010 - 2050

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	Wageningen - UR, Alterra	RIZA	
	Erasmus Universiteit Rotterdam	STOWA	
	Grontmij	Brinkman Climate Change.	
	KNMI		
Project website			
Starting date	1 January 2006	**Completion date**	31 March 2007

Context / Social problem

The project aims at making the existing knowledge on the effects of climate change and adaptation measures in the Netherlands available for the national programme 'Adaptatie Ruimte en Klimaat' (ARK). This national governmental programme is carried out by the ministry of spatial planning and environment. See for information on the website: www.programmaark.nl. Goal of the ARK programme is to make the spatial planning for the Netherlands climate proof.

What do we know / not know?

This project translates the results of existing relevant research on climate change and adaptation executed by the different research programmes and knowledge institutes so that they can be used for policymaking in ministries and lower governments. The project focuses on the knowledge gaps and the need for extra knowledge and instruments to set up adaptation policy and strategy, resulting in a national adaptation agenda. Especially in the field of cost-benefit analysis of adaptation strategies not much is known. When this study started, there were no data available on this subject.

What is being studied?

First result is that the available knowledge will be summarised in the Quickscan. The knowledge gaps will also be described. These missing links will be integrated in CcSP research. Secondly, research on the resilience, resistance and adaptive capacity of the Netherlands to climate change will be put in the 'Baseline monitoring document'. Besides this the potential adaptation measures will be described for their effects, costs and benefits. These studies will be classified by sector. As final subproject potential hotspots will be identified, which can serve as an example for how to deal with climate change in other areas of the Netherlands.

What are the results, and who are they for?

The project has produced four subreports, Baseline monitoring document, Quickscan, Adaptation strategies, Case studies and hotspots, including a summary in Dutch and English. These reports are available on the website: www.klimaatvoorruimte.nl. The ARK programme will use the results in preparing the national adaptation strategy and agenda. And they are also used in European projects on the effects on climate change.

A 12 How can agriculture adapt to changes of both climate and market; NL-North as a pilot region

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Project website			
Starting date	1 January 2006	**Completion date**	31 December 2007

Context / Social problem

Agriculture in Europe is an economic activity providing incomes and jobs in the agribusiness complex. The sector responds strongly to market forces and changes in policy. This is clearly visible in the impact of the Common Agricultural Policy (CAP) on farming in the European Union (EU). Policy reforms leading towards the abolition of subsidies and tariffs - which currently protect farmers against internal and external competition - will change the options and opportunities available.

Currently, decisions are based mainly on market pressures and policy outlooks. Climate change, which imposes an additional stress on agriculture, is not usually included in decisions on whether or how to continue. This may lead to inappropriate or belated decisions and investments, which could prove very damaging, or even fatal, for the future of many farmers. This would also affect the industries involved in processing and delivery and also, eventually, regional economies.

What is being studied?

In this project changes in both market and climate are considered, in order to provide information for predicting which parts of Europe are most likely to remain agrarian, and for which regions non-agrarian land uses are likely to become more important. A selection of contrasting market and climate scenarios were therefore chosen for consideration, involving two time slices i.e. 2020 and 2050. The focus is on wheat and potatoes as arable crops and dairy farming is addressed via grassland.

What are the results, and who are they for?

The results are presented in a series of maps and provide information to both policy makers and farmers on prospects for agriculture in the near future.

In order to determine which regions are likely to remain agrarian in the future and what their associated production levels will be, the following steps were adopted:

1. Estimation of the achievable supply (in tons) of wheat, potatoes and milk in 2020 and 2050, based on the estimated productivity (tons/ha) in 2020 and 2050 and the agricultural production areas (ha) in Europe in 2005
2. Estimation of the production demand from Europe (in tons) for wheat, potatoes and milk in 2020 and 2050, based on global trade and production, population dynamics and economic growth
3. Adjustment of the achievable supply for wheat, potatoes and milk to the production demand, in 2020 and 2050, by adjusting the agricultural production areas in Europe; based only on competitiveness of regional agriculture in the global food market (2020, 2050), and on the competitiveness of regional agriculture within global food markets and regional land markets (2050)

These steps are executed for two scenarios (A1 and B2), each for EU27 and EU-Ural. In case of EU27, we calculate and present results at NUTS 11 level. In case of EU-Ural, we calculate and present results at NUTS0 level. Data on crops and farms at NUTS1 or NUTS0 level are obtained from Eurostat (2007).

The general picture that emerges is that gradual changes in climate are of minor importance for changes in productivity. Technological development is the key driver in productivity increase and given enough time will compensate for possible adverse effects of climate change or exploit opportunities. This is especially true for the A1 scenario. In this scenario all results indicate that agricultural land is abundant and actually land can be used for non-agricultural purposes. For the B2 scenario the picture is slightly different, because of a slower technological development the productivity increase is less than in A1 scenario. For B2 there is a need for additional arable land to fulfil the production demand. Whether agriculture can remain viable in the future when faced with changes in both climate and the market largely depends on the scale the answer is required. At the

European level food production is secure, even in the most extreme climate scenario and in a free market. However, at a lower scale, consequences could be serious for individual regions and farmers.

A 13 The Coastal Zone: Definition phase

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Project website	
Starting date	1 November 2006 **Completion date** 31 December 2007

Context / Social problem

The Coastal Zone project (in Dutch: Aandacht voor Veiligheid, AVV) is about the effects of long-term changes in climate, land use, governance and socio-economic trends on flood safety in the Netherlands. The project will deliver a decision support system (DSS) that will show, using maps and images, how spatial adaptation responses can make the Netherlands climate-proof in the long term, which is why water management expertise and spatial planning are central to the study.

What is already known, and what is not?

The following questions are being explored during the definition phase:

1. Which changes in climate and land use are expected in the Netherlands over the long term (50–100 years) and how will they influence flood risks?
2. What administrative, social and economic conditions are necessary for protection against flooding and water damage?
3. What safety strategies can we devise to deal with these changes?

What is being studied?

The definition phase first examined the currently available methods. The advantages and disadvantages of these methods are being discussed in a series of workshops and their application will be demonstrated in a prototype DSS (November 2007). The core activities are:

1. *Scenario analysis*: Besides the existing WLO scenarios, we are examining more extreme developments and radical shifts
2. *Safety strategies*: We are reviewing existing and new safety strategies that may be effective in the long term
3. *Vulnerability*: To evaluate the safety strategies we are investigating the degree to which each strategy reduces the vulnerability of the Netherlands to flooding
4. *Appraisal*: Thought will be given to evaluation methods, such as SCBA and MCA, and how they can be used in evaluations of long-term investments (adaptation) in the safety system
5. *DSS*: The DSS is a spatial planning tool for supporting policymakers when designing and evaluating alternative land use planning options at the national scale. The tool will be based on existing models such as Blokkendoos, WV21 and the Land Use Planner (Ruimtescanner)

What are the results, and who are they for?

The final goal of the Coastal Zone project is to develop a methodology for use in regional pilot studies (hotspots). The analysis of pilot areas will clarify what adapting to climate change will mean for these areas in concrete terms. Any missing information and knowledge that is required to develop adaptation strategies ('safety options') will be revealed. The project attempts to support national government and decision-makers at regional level and to identify cross-connections between scales by conducting pilot projects.

A 14 Hotspot Zuidplaspolder

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Project website	www.xplorelab.nl
Starting date	1 December 2006 **Completion date** 1 December 2008

Context / Social problem

The Zuidplaspolder lies to the west of Gouda. It is one of the deepest polders in the Netherlands at 6 metres below Amsterdam Ordnance Datum. In the National Spatial Strategy the polder is designated a development area to meet the need for urban expansion (including greenhouse horticulture) in the southern half of the Randstad. Parts of this reclaimed lake are subject to land subsidence, and the polder is situated next to the Hollandse IJssel river, which is connected to the major rivers in the delta and via them to the sea. A breach of the dike would therefore have serious consequences. In addition, climate change will increase the likelihood of flooding and high groundwater levels caused by intensive rainfall, of drought and of upward seepage of partly saline groundwater. The polder will have to be laid out in such a way that future residents and businesses are not negatively affected by any of these processes. For these reasons the provincial council took the initiative, together with the Climate changes Spatial Planning programme, in setting up this hotspot project. The steering committee responsible for coordinating the development of Zuidplas fully supports the project.

What is already known, and what is not?

The Zuidplaspolder project has been running for several years and an intermunicipal masterplan (structuurplan) for the whole area has already been adopted. This plan already takes the risk of flooding into account through the use of the 'layer' or 'strata' planning methodology. A 'climate appraisal' was performed using the latest climate scenarios, in particular for the longer term (to 2100).

What is being studied?

The Hotspot project consists of three phases. In phase 1 the long-term effects of climate change will be presented in the form of risk maps for the province of Zuid-Holland, and specifically for Zuidplaspolder. In phase 2 solutions for making Zuidplaspolder climate-proof will be proposed and incorporated into the ideas which have already been developed during the preparation of the plans for Zuidplas. The proposals will probably include innovative building forms and smart measures for limiting the impacts of potential disasters. In phase 3 these design solutions will be subjected to a cost-benefit analysis.

What are the results, and who are they for?

The Zuidplaspolder Hotspot project is being implemented by a consortium and will run for one year. Schieland en de Krimpernerwaard regional water board and ConSept will work alongside Zuid-Holland provincial council on substudies within the project. Wageningen, Delft and Amsterdam (VU) universities will provide the academic input. The provincial council's input will be made by Xplorelab, a laboratory for innovative learning and working established in 2007 as a unit within the council's Green Space, Water and Environment division. The final product will consist not only of a final report, but also a covenant or declaration of intent between the Zuidplas parties on the use and implementation of the ideas generated and the knowledge acquired during the project.

A 16 Hotspot Tilburg

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Project website	www.hotspottilburg.nl		
Starting date	1 January 2007	**Completion date**	31 December 2008

Context / Social problem
Tilburg is situated in a higher part of the Netherlands and will therefore not be directly affected by rising sea levels caused by climate change. However, the city will feel the effects of climate change on many other fronts, including the design of the built environment, groundwater levels, sewers, flora and fauna, water discharge problems in regional tributaries of the Meuse, recreation, etc. Tilburg will therefore serve as an example of the issues that will affect large parts of the Netherlands.

Tilburg municipal council pursues an active energy policy, supported by the BANS (new style administrative agreement) climate subsidy programme, an energy programme that ran until April 2007. Tilburg wants to continue this programme beyond this date and expand it with an active climate policy. This ambition has been adopted in Tilburg's Environmental Policy Vision 2006–2010. Tilburg is actively participating in various discussions and negotiations on the follow-up to the BANS regulation. The municipality's aim is to develop adaptation as well as mitigation strategies for climate change.

In general, there are two key questions to be answered when developing a regional climate policy. First, what is going to change in and for the region (content)? Second, how are we going to deal with these changes, and with whom (process)? This project will cover all aspects of these questions.

What is already known, and what is not?
Interviews have already been held with stakeholders and a first mini-conference with stakeholders has been held. The results of these activities indicate that the parties involved clearly feel the need for a joint approach to climate change. What is not known is whether the proposed methodology and approach is feasible in practice, whether it is capable of producing results, and if so, if it is applicable elsewhere.

What is being studied?
1. Development of a generally applicable working method for coping with climate change at local/regional level:
   a. testing the usefulness of the existing literature
   b. communicating experiences

2. Formulation of a long-running climate programme in the Tilburg region and assembling a strong local grouping of parties who are both willing and able to implement the programme:
   a. describing the risks and opportunities associated with climate change in the Tilburg region
   b. the local grouping

What are the results, and who are they for?
In general terms, a method will be developed for coping with climate change which will be applicable to other regions and municipalities. The intended result for the Tilburg region is a local grouping of stakeholders who will implement a regional climate programme.

A 17 Dialogue climate change and cities

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Project website			
Starting date	1 June 2007	**Completion date**	1 April 2008 (phase 1)

Context

Climate change has various effects on urbanized regions, but sofar this has received little attention. The EU Green paper, for example, was based primarily on direct effects and forgot about the urban environment. However, most economic and social damage from extreme events has to be expected in urbanized areas. Urgencies – between brackets - seem to pop up all over the urban regions and can be regarded as indirect as well as direct effects of climate change. There is a difference in perspective between the approach of risks and hazards on one hand and the occurrence of emissions on the other hand.

What do we know/not know?

Temperatures in urban areas rise much more than in the periphery, due to the heat island effect. Heat waves make more victims in urban areas than in peripheries, due to the lack of "cooling down options". Urban water systems do not have the capacity to deal with dynamics in the water cycle – whether it is due to extreme rainfall, upcoming groundwater, rising sea levels or extreme water use and extreme droughts. Sustainable building has been focussed on reducing energy consumption (mitigation efforts). The use of air conditioners is rising because most buildings tend to overheat in summer – they are too well insulated. It is often not clear whether changes in urban regions are the result of urbanization itself (compact city policies and the heat island effect), from growing mobility (bad air quality and loss of public green space, due to parking), or from degradation of neighbourhoods (liveability, poor spatial quality and neglected management). All of those changes in urban regions seem to be intensified through the process of climate change. What we do not know either is which measures should or can be taken to make urban regions "climate friendly".

What is being studied?

In phase 1 we studied through workshops and interviews with public and private stakeholders what the prime urgencies are in urban areas and which questions should be dealt with in the near future. An analysis has been made on what happens in other countries – and foreign universities - especially concerning urban areas with a less moderate climate. The most important effort of the activities was to integrate fragmented approaches that we found both in the urban institutions and in the scientific community.

What are the results, and who are they for?

The results are targeted on those NL urban regions that already show major spatial developments and will grow in the next generation (Nota Ruimte Key projects). The cities of Arnhem, Nijmegen, Groningen, Amsterdam, Rotterdam, Utrecht and Maastricht have been involved in the dialogue. A first set of tools for analyzing problems and solutions will be the outcome of this first phase. Phase 2 of the dialogue project aims to cooperate with the cities in project teams (community of practice CoP). Phase 3 will contain the analysis of the actions and publication of good practices – about the do's and don'ts.

A 18 Hotspot Groningen

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	Municipality of Groningen	Tauw
	KNMI	Energy Valley
	WUR (Alterra, Governance & Landscape Architecture)	
Project website	www.klimaatbestendiggroningen.nl & www.popgroningen.nl	
Starting date	1 December 2007 **Completion date** 1 July 2009	

Context / Social problem

The province of Groningen currently works on its regional plan, in which the integrated policy on the fields of spatial affairs, traffic and transport, environment and water is connected and formulated. Moreover, economic and social policies are integrated as well.

At the same time the province is confronted with the effect of climate change, such as coastal defence, storage of water, a changing nature and agriculture and heat problems in cities.

Beside this, within the province research is carried out on the supply of sustainable energy, mostly regional produced (Grounds for Change). Thus, the level of climate proofing of the regional plan needs to be enhanced.

What do we know/not know?

The results of the Grounds for Change project and the energy-analysis within the boundaries of the regional plan offer the insight, that a substantial part of the required energy can be produced sustainable and local. Besides that, the analysis of adaptation measures showed us more about the changes and effects on different functions. However, spatial steering based on climate and energy is not as good as it could be. The way how spatial changes and impacts are positioned in the new regional plan are by currently unknown.

What is being studied?

The research focuses on two elements:

1. Knowledge about the spatial possibilities and consequences of a sustainable energy production and adaptation to climate change are deepened. In the fields of ecology, energy, water, the coast and agriculture further spatial insights are developed. These insights are integrated and spatial translated by means of the Adaptationscan (project COM15). Finally, designs for (parts of) the province are being made.
2. A method is been developed, which will give insights in how long term developments (like a sustainable energy supply and climate change) can be implemented in the short-term world of today. This method makes it possible for regional authorities to develop climate proof regional plans.

What are the results, and who are they for?

The outcomes of the project are on one hand the contribution to the regional plan in order to make it as climate proof as possible, which is good for our citizens and companies. On the other hand, the methodology can be used by regional authorities, like provinces, water boards, city-regions or the north and south wing of the Randstad.

Integration

The knowledge gained from the programme must be integrated in projects specially designed for this purpose. This integration takes place from several disciplinary perspectives, for example spatial/geographical, economic and administrative.

It addresses issues such as:

- How can we weigh up various adaptation and mitigation options?
- How should we communicate uncertainties about climate change to various sectors in society?

IC 02 Integrated analysis of emission reduction over regions, sectors, sources and greenhouse gases

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Project website			
Starting date	1 June 2006	**Completion date**	31 December 2010

Context / Social problem

Second to energy-related CO_2 emissions only, the net greenhouse gas emissions from Land-Use, Land-Use Change and Forestry (LULUCF) activities are the most important contributor to global climate change. By contrast, typical emission reduction strategies pay little or no attention to the LULUCF options. Among others because relatively little is known about their exact origin and causes at the detailed process level. Nonetheless, on the basis of tentative top-down analysis it is shown that including LULUCF on the menu of integrated strategies can add decisively to reaching ambitious reduction targets at lower costs than the energy sector alone. In addition, land-based mitigation options like bio-energy, carbon plantations, forest management and reducing emissions from deforestation are receiving increasing attention in the climate policy arenas.

What do we know/not know?

At the more aggregate level many LULUCF related sources of GHG emissions are estimated at some level of accuracy, but more detail by sector, region, activity and key process is extremely uncertain and poorly understood. A complicating factor is that multi-scale connectivity play an important role: besides growth in agricultural output to feed more and increasingly effluent people, changes in EU agricultural policies and global trade policies (e.g. WTO) shape the volume and composition of agricultural output in the EU and the Netherlands. And by implication the baseline GHG emission profiles and mitigation potential and – cost.

What is being studied?

Main thrust is to improve and extend modelling of land-use, associated emissions and mitigation potential at the global scale, with more detailed zoom-in on EU member states. The stylized representation of LU processes and their emissions is confronted with more detailed databases and models at EU and Dutch scales to investigate if and to what extent the cross-scale approaches hold up to consistency requirements. The model framework will be used to explore and test multi-scale scenario applications.

What are the results, and who are they for?

Ultimate goal is to establish, starting from integral global climate strategies, what could be the contribution of Dutch land-using sectors in reaching that goal. In order to cover the entire spectrum, a variety of subsidiary results is foreseen in the fields of process models, spatial allocation schemes, LULUCF scenarios associated with future consumption patterns, production systems and trade flows as well as databases and decision tools for mitigation actions.

On the one hand results can help to inform national and international policy making in assessing the potential role for the LULUCF options in overall climate strategies. On the other hand, representatives from agriculture, forestry and nature conservation van evaluate their position and contributions relative to other sectors and regions with respect to their contribution to the climate problem as well as to reducing climate risks.

IC 03 National adaptation strategies

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Project website	www.spinlab.vu.nl/lands
Starting date	1 July 2004 **Completion date** 30 June 2009

Context / Social problem

A core idea behind the Climate changes Spatial Planning programme is that climate change will lead to changes in land use. For the Netherlands this is a question of considerable public interest, given its low elevation in relation to the sea and the high pressures on land in many parts of the country.

What do we know/not know?

The Climate changes Spatial Planning programme investigates what the consequences of climate change could be for various sectors, such as water management, transport, agriculture and nature, and their impacts on the land use of these sectors. Because these are sectoral projects, the various outcomes from the projects will not yet be correlated in any way with each other. The spatial mitigation and adaptation measures from these projects will be integrated in the LANDS project.

What is being studied?

Central to the LANDS project is the spatial dimension of climate change. It involves question such as:

- What changes in land use may be expected in the Netherlands over the next few decades as a consequence of climate change?
- What adaptation and mitigation measures could prepare us for these changes?
- Do the ways different sectors respond to the changes in the climate provoke conflict or open up opportunities?

To integrate knowledge from the various projects, and therefore answer the above questions, work is progressing on the following elements:

- A scenario framework that describes assumptions about the climate, population, economy and society in a consistent manner as a basis for the various adaptation and mitigation studies
- A detailed, calibrated and validated land use model capable of making integrated simulations of future land use
- A set of indicators and visualisation applications useful in tracing opportunities and conflicts in (combinations of) land use developments
- A definition in spatial terms of areas suitable for water storage in combination with other land uses
- Adjustments in the spatial definition of the current NEN to create a coherent, climate-proof network of nature conservation areas

What are the results, and who are they for?

One of the objectives of this project is to deliver integrated land use images that demonstrate how the Netherlands is contemplating dealing with the expected changes in the climate. The project output will also consist of a large number of methodological publications in various national and international journals.

IC 05 Cost-benefit analysis of adaptation and mitigation strategies

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Project website			
Starting date	1 January 2004	**Completion date**	31 December 2010

Context / Social problem

A fundamental problem is estimating the costs and benefits of different mitigation and adaptation strategies for climate change and land use in the Netherlands. The uncertainties and irreversibilities of climate change create new challenges for policy and for a good appraisal of the various strategies.

What do we know/not know?

Adaptation and mitigation strategies for climate change are a part of both the Climate changes Spatial Planning programme and earlier studies. However, to deal effectively with the consequences of climate change it is important that we can clearly and consistently compare various strategies and identify the best ones. Any relevant information held by the stakeholders should be made available for this.

What is being studied?

This project concentrates on innovative methods for evaluating the costs and benefits of various strategies in relation to land use and spatial planning, taking into account the consequences of the strategies for different sectors and policy domains. A central element in all this is the role of uncertainty: how can we make the best decisions with insufficient information? The project focuses on the development of decision support tools based on social cost-benefit analysis (SCBA) under uncertainty. It aims to evaluate mitigation and adaptation strategies related to spatial planning in the Netherlands. Methodological innovation is concentrated mainly on spatially explicit and dynamic aspects, and on the issue of how to deal with the side-effects of strategies on other sectors and policy domains.

What are the results, and who are they for?

An important result of the project will be an SCBA and multicriteria analysis for appraising various strategies with regard to climate change. This tool will be applied in various case studies. A further outcome of the project will be several well-trained PhD candidates capable of performing such analyses in a complex context.

IC 08 PRObing a method to Facilitate the Interactive Linking of Expert knowledge to Stakeholder assessment (PROFILES)

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Project website			
Starting date	1 January 2004	**Completion date**	30 June 2009

Context / Social problem

One of the cornerstones of the Climate changes Spatial Planning programme is the integration and communication of the knowledge gained during the programme. In recent decades, participative processes in 'integrated assessments' have attracted increasing interest. The PROFILES project starts from the observation that the quality of these participative processes can be greatly improved, particularly the evaluation of conflicting knowledge and ideas in integrated assessments. Stakeholders with different views and interests tend to want to reach a consensus and avoid any evaluation of conflicting opinions. It has also often proved difficult to bring scientific knowledge into the process in a way that enhances dialogue. Social stakeholders and scientific experts appear to use different arguments and lines of reasoning. Social stakeholders tend to focus on the feasibility of the options, whereas scientific experts usually talk about options in terms of models and scenarios – which often underlines the element of uncertainty when it comes to implementation. While social stakeholders are inclined towards taking decisions, scientific information is often presented in a way that does not directly support the process of policy-making.

What is being studied?

The goal of the PROFILES project is to provide a sounder theoretical basis for participative methods and improve these methods to support dialogue processes within the BSIK CcSP programme. The PROFILES project concentrates mainly on methods and tools that use the available scientific information to provide structured and transparent support for evaluating conflicting lines of reasoning. The research question for the PROFILES project is: Which method is most suitable for structuring the interaction between scientific experts and social stakeholders so that the articulation and evaluating of conflicting arguments in their 'integrated assessment' becomes a learning process? Various methods in various stages of the dialogue process were applied in a field experiment and compared.

What are the results, and who are they for?

The project aims to bring about an improvement in methods for participative 'integrated assessments' often used in climate and environmental policy. The PROFILES project will make a methodological contribution to CcSP project ME04. The final deliverable will be a doctoral thesis. Several papers will also be published in international journals.

IC 10 Communicating climate change: methods for revealing risks and opportunities

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Project website			
Starting date	1 May 2004	**Completion date**	1 January 2009

Context / Social problem

Communication about climate change is unique in many ways. It concerns a long-term problem, but is sometimes highly relevant today. It receives widespread attention in the media, with considerable coverage given to critics and doom-mongers alike. The debate is not just about the facts of climate change, but also the interpretation of the facts and how they are presented. The Royal Netherlands Meteorological Institute (KNMI) for example, receives many questions about how much of what is claimed in the media is actually true. The fact that the enhanced greenhouse effect is a result of human activities, play an explicit and implicit part in these discussions. And all this influences the many decisions by policymakers in government, the corporate sector and civil society organisations, including decisions concerning the spatial development of the Netherlands.

What is already known, and what is not?

From the social science literature (psychology, sociology, policy sciences) we know that the process of communication about risks and opportunities depends heavily on the underlying conceptual frames held by those concerned. These determine how people interpret new information, such as climate scenarios, and how they integrate this information into existing ideas. In discussions between government, the corporate sector and civil society organisations, scientists and policymakers automatically assume their own conceptual frames and approach the issues involved from these particular perspectives. The process of communication can be impeded if these conceptual frames are not sufficiently in tune. We do not know the specific implications of this for the field of climate change.

What is being studied?

A multidisciplinary study has been set up with the aim of removing any blocks to communication and promoting an appropriate exchange of ideas and understanding. This will be carried out with the Netherlands Environmental Assessment Agency (MNP) and the Royal Netherlands Meteorological Institute (KNMI). The research will focus on the conceptual frames that come into play when dealing with minor opportunities and uncertainties relating to climate change. The question is: what are these frames, how do they influence each other, and how can this process be improved?

What are the results, and who are they for?

Methods for revealing and explaining the risks and opportunities in a scientifically sound manner, and one that is also in tune with the way people and organisations with a stake in climate change communication actually think.

IC II Socio-economic scenarios for climate change assessments

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Starting date	1 September 2006 **Completion date** 31 December 2007

Context / Social problem

Most climate studies are about the future. But it is not just the climate that is changing; society is changing too. It makes little sense, therefore, to project future climate effects onto the current socio-economic situation. We can explore these situations by conducting scenario studies. Scenarios are descriptions of possible future developments and trends. They consist of storylines, which are usually based on quantitative models.

The project will generate socio-economic scenarios for climate studies, including storylines, models and instructions on how to use them, in collaboration with future partners.

What is already known, and what is not?

The study on 'Prosperity and Living Environment' (Welvaart en Leefomgeving, WLO) by CPB, RPB, MNP and others describes four different scenarios for the Netherlands to 2040. Two 'key drivers' are decisive in determining the outcomes of these four scenarios: the degree of individualisation in society and the degree of international cooperation. The implications of these two drivers are translated into socio-economic trends, such as employment and population size, and also into spatial trends, such as available housing in various regions.

The time horizon of the WLO scenarios and their relation to climate change may limit the value of the WLO study for use in climate studies. Project IC11 will investigate whether there is a need for scenarios to 2100 and whether the BSIK researchers consider that the scenarios diverge sufficiently from current practice – in other words, that the degree of international cooperation, for example, is extreme enough. The WLO study has been published in book form, but it would be better if the scenarios were made available in a digital format so that BSIK researchers could work with them directly.

What is being studied?

In IC11 we will establish whether the above-mentioned limitations are significant, and if so, what we can do about it. Workshops will be held with potential users of the scenarios, the suitability of the scenarios will be tested in a case study, and we will explore, with three WLO authors from CPB, RPB and MNP, how the underlying models can be made available for use by other researchers.

What are the results, and who are they for?

The main products of IC11 will be:

1. A literature review of relevant scenarios
2. A report on the results of the workshop on user requirements
3. A report containing storylines and relevant data
4. A report and website containing 'instructions' on how to use the scenarios and providing access to the scenario models

The main target group for the project consists of CcSP researchers.

IC 12 Institutions for adaptation: Is the Dutch institutional structure capable of adapting to climate change?

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Project website			
Starting date	1 May 2007	**Completion date**	1 October 2010

Context / Social problem

The research will investigate, in a variety of ways, how Dutch society can adapt to climate change. Ecosystems and wildlife may need another type of National Ecological Network; more space is needed for water, and building plans may have to be moved to different areas. It is one thing to think of solutions, but will the Dutch authorities, companies and other organisations be able to carry them through?

What is already known, and what is not?

The climate problem has several specific characteristics:

- It has implications on all scales: global, EU, national, regional and local
- It has implications over very long time horizons, such as 50, 100 or 200 years into the future
- There are still uncertainties about the scale of the impacts of climate change

Can the present administrative structure in the Netherlands cope with these issues? Many public authorities are trying to shape their policies in greater consultation with a range of civil society organisations ('from government to governance'). Does this interactive policy style lend itself to a problem such as climate change? Moreover, we know that it is not easy for different ministries and policy departments to work together on the development of an integral policy, whereas this seems to be an indispensable requirement for adapting to climate change. For example, adaptation of the water management regime will require so much land that proposed measures will have to be drawn up in consultation with other social sectors. What administrative arrangements have already been made to do this?

What is being studied?

The project is working on the concept of 'institutions', which we understand to mean the rules and principles for conducting public life. Institutions can be organisations, but also laws and informal codes of conduct. The study will first develop a framework for assessing the adaptive capacity of a system of national institutions. This framework will then be applied to the Dutch administrative system. The research will look at four sectors: nature, water, agriculture and spatial planning.

What are the results, and who are they for?

The result will be a diagnosis of the adaptive capacity of Dutch institutions. The main problem areas have been described and some initial solutions have been identified.

Communication

The communication activities in the programme contribute to its general goals: strengthening the Dutch knowledge infrastructure by advancing our understanding of climate change in relation to spatial planning, transferring knowledge to target groups in society, and disseminating practical expertise to scientific target groups.

COM OI A virtual data portal for CcSP projects

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Project website			
Starting date	spring 2006	**Completion date**	spring 2007 (phase 1) spring 2008 (phase 2)

Context / Social problem

Many CcSP projects produce large quantities of data. These data are important for the project itself, but will be even more valuable if made available to all potential users (not only other CcSP projects but others as well). In many cases the CcSP projects themselves do not possess the expertise and/or resources available to make their data more accessible. Project priorities typically lie with the acquisition of data and translating it into knowledge, and less on making it more accessible to others. A comparable problem is found in the field of software tools to process the data (such as models, conversion of formats, visualisation). Here, too, the exchange and reuse of existing resources can make a valuable contribution to the collaboration between projects within (and outside) the BSIK CcSP programme.

What do we know/not know?

Sectors like aerospace, genomics, astrophysics and nuclear physics often have to deal with enormous streams of data and need extremely high processing capacity and highly specific tools to process it. To deal with this effectively it would be ideal if everyone could make use of each other's knowledge and computing capacity, but in practice this runs into all sorts of technical and administrative problems. The worldwide effort on developing Grid Technology and Service-Oriented Architectures (SOA) aims to resolve this problem by linking computer systems across the world without hindrance and in a transparent and user-friendly way – and without any complicated and compulsory exchange of algorithms, models and/or source code. Within Climate changes Spatial Planning use is made of several highly data-intensive subprogrammes, for which this technology could be very important. However, the best form in which this modern information technology can be applied will depend on the specific characteristics of the projects (both as producers and consumers of data).

What is being studied?

The core concept is the 'virtual data centre'. The goal is to create a central portal for project managers and external users that gives access to (consolidated) data products from selected projects within the Adaptation, Mitigation and Climate Scenarios themes. An infrastructure will be developed that will link together widely dispersed data sources and computer platforms in a type of cooperative network. It will allow the exchange of data and sharing of knowledge between participants (and if necessary, each other's computer systems and tools). At the same time, the project groups will retain control over their own specific algorithms and data collections. The first stage of the project is an inventory of user requirements. Then a start will be made with the development and construction of the prototype central portal through which the various parties can communicate.

What are the results?

The idea is to upgrade the CcSP virtual data centre into a portal. CcSP participants will not only be able to exchange information and knowledge through this portal, but also make collective use of the available knowledge and expertise: knowledge exchange – on a highly distributed basis – and intensively across the full scope of the programme. The COM01 project will concentrate on the integration of the ICT structures at the various partner organisations to permit the efficient and effective integration and communication of knowledge, information and services. The system is expected to become operational by the end of 2007. Members of the oil exploration and genomics sectors have also expressed an interest in the grid technology being developed partly by BSIK projects.

COM 03 Platform Communication on Climate Change (PCCC)

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Project website	www.klimaatportaal.nl		
Starting date	1 April 2005	**Completion date**	31 December 2007

The Platform Communication on Climate Change (PCCC) was established by the Dutch climate research community to improve the quality, efficiency and effectiveness of the communication of Dutch climate research. PCCC is a collaborative venture by MNP, KNMI, CCB Wageningen UR, VU University Amsterdam / CCVUA, Utrecht University and NWO. It is supported by the Ministry of Housing, Spatial Planning and the Environment (VROM) and is implemented in collaboration with the BSIK Climate changes Spatial Planning programme.

The activities of the PCCC include:

1. Providing actual and background information via the portal www.klimaatportaal.nl
2. Making materials and knowledge available for communicating the science of climate and climate change to target groups by
   - writing popular science reports
   - organising annual climate updates and climate days
   - organising ad hoc symposia and dialogue workshops on topical issues
3. Informing the public through contacts with the media
4. Maintaining and publishing a climate diary on www.klimaatportaal.nl
5. Supplying information on international activities (IPCC, Kyoto and Montreal Protocols)

The institutes making up the PCCC are:

- Netherlands Environmental Assessment Agency (MNP)
- Royal Netherlands Meteorological Institute (KNMI)
- Climate Change and Biosphere Centre, Wageningen UR (CCB)
- Energy Research Centre of the Netherlands (ECN)
- Climate Centre VU University Amsterdam (VU University/CCVUA)
- Utrecht University
- Netherlands Organisation for Scientific Research (NWO)

The PCCC secretariat is managed by KNMI.

COM 04 Network project

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Project website			
Starting date	1 January 2005	**Completion date**	30 June 2011

Context / Social problem

Climate change and adaptation to its effects are moving in fits and starts up the policy agendas of provincial and municipal councils and water boards. Despite this, it is not a popular topic among many organisations responsible for initiating and implementing policies (provinces, municipalities, water boards and the private sector). This can be attributed in part to the long-term nature of climate change compared with the shorter-term vision of many of these organisations. Because current policies, particularly on spatial planning, have long-term consequences, it is important that these bodies think now about the consequences of climate change, attempt to avoid problems in future and exploit the opportunities that climate change may present.

What do we know/not know?

The provincial and municipal councils are the crucial players in physical planning in the Netherlands. Several provinces are already aware of the fact that the climate is changing and will have an impact on spatial development in the Netherlands. Some are now actively involved in research and reviewing plans against possible climate-related issues. Especially the municipalities still have little time for the topic. The corporate sector is busy with the implementation of the Kyoto commitments and does not yet recognise climate change as an issue requiring a response from companies, except for a few beneficial adjustments. The relatively low level of interest in the subject makes it difficult to bring science and practice together. The topic first has to be raised as an issue, and then research questions may arise from practical situations.

What is being studied?

An important part of the programme is the dialogue between the scientific community and civil society parties that have a role to play in the spatial development of the Netherlands. The goal of the dialogue is to combine timely dissemination of climate knowledge to stakeholders with promoting demand-driven research. This is done by issuing specials in professional magazines about climate change, by organising workshops and debates between scientists and stakeholders about research questions that are relevant for both groups, by conducting master classes and courses for stakeholders on results of the research and by bringing together science, governmental bodies and the business community to start projects around their demands. A special member of staff at the programme provides structural support for this dialogue (network manager).

The research projects must combine knowledge and expertise from both science and practice, which requires intense contacts between the parties concerned. Therefore, the project managers of the various BSIK CcSP projects have been instructed to seek contacts with civil society organisations for which they can ask support from the 'network manager'.

What are the results?

The final goal of the project is that stakeholders use the results of the CcSP research in their practical work. Therefore the projects aims to involve regional governments, societal groups and the business community more closely in CcSP research through dialogue and in participative methods for defining research questions.

COM 06 Nature's Calendar

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Project website	www.natuurkalender.nl		
Starting date	1 January 2004	**Completion date**	29 December 2007

Context / Social problem

Nature's Calendar monitors, analyses, predicts and communicates the effects of changes in weather and climate on the annual cycle of natural phenomena. Examples of these annual recurring events are flowering, the emergence of leaves and leaf fall in plants, the beginning of bird migrations and the appearance of butterflies and other insects. These events depend strongly on the weather and can be followed by everyone every day 'in their own backyard'. The scientific discipline concerned with study of the times of recurring natural phenomena is phenology. Phenological changes have many ecological and socio-economic consequences.

Activities and results of Nature's Calendar

Expansion of the monitoring programme: During the project period more plants and animals were added to the observation programme. In addition to an increase in the number of species, we also aim to recruit as many volunteers as possible to send in observations.
Collection and digitisation of historical observations: Nature's Calendar uses historical phenological observations from 1868 and continually acquires new records. The database already contains 160,000 observations.
Scientific analysis: The participating researchers are working on a number of questions, including:

1. How is the timing of the annually recurring natural phenomena under study influenced by climate factors?
2. What changes in timing have occurred in recent decades?
3. What will the timings of the processes mentioned be in future? Both short-term (days, weeks) and long-term (years, decades) changes will be of interest.
4. How will the variation and changes in timing affect the relevant socio-economic sectors?

Feeding observations and results back to the target groups: This includes the following activities:

1. Publish a weekly review of developments in the natural world on the website
2. Regular feedback via radio, TV and the print media
3. Technical development of the information system
4. Production of PR material
5. Publication of a Nature's Calendar guide

Development of an educational programme: Nature's Calendar has teaching material available which supplements primary and secondary school education with information on the relation between nature and climate change. Under this work package, assignments are being prepared on topics within ecology, agriculture and public health in relation to climate change. Pupils make their own observations and analyse them.

Nature's Calendar in various sectors: The Nature's Calendar project focuses on four socio-economic sectors. Agriculture, human health (hayfever, ticks and Lyme disease and Oak processionary Caterpilar), nature management and gardening. Together with stakeholders a selection of plants and animals is made to be included in the monitoring programme. We gather available historic phenological observations with which we analyse the relation between changes in weather and climate on the timing of relevant life cycle events. Based on this information we determine what the (potential) consequences of changes in climate are for the sector. More specifically we look at the ways the different stakeholders in these sectors should or could respond to the phenological changes.

COM 07 Summer Course on Climate and the Hydrological Cycle

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Project website	http://hydroclimate.geog.uu.nl
Starting date	4 July 2005 **Completion date** 31 December 2006

Social problem and communication objective

A good description of the climate system depends strongly on a good understanding of the distribution of water and energy across the earth's surface. That is why meteorologists are working more closely with hydrologists. Research on the climate system and the part played by the hydrological cycle has progressed to such an extent and attracts so much interest that it justifies a national/ international course on the topic.

Objectives:

- The course provides in-depth knowledge on the interactions between climate, land use and the hydrological cycle
- The course cuts across disciplines from climate science, the earth sciences, hydrology and water management, the main integrating variables being present and future land use and climate change
- For some years to come the course book will be a source book for MSc hydrology courses, a study book for future summer courses and a reference work for PhD students and professionals

Target groups

The course is intended for final year MSc students, PhD students, postdocs and professionals interested in climate issues. More than 50 students are expected to take part in the summer school, including 15 from outside the Netherlands.

Activities and products

The course is given by 17 specialists from the Netherlands in the fields of surface water hydrology, groundwater hydrology, ecohydrology, climate hydrology, climate modelling, boundary layer meteorology, hydrometeorology, climate impact studies, geomorphology and remote sensing. A course workbook is available which contains materials used by the lecturers. These will be reworked and expanded to produce a textbook for use in new courses to be held in subsequent years.

COM II Deltas in times of climate change

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Project website	
Starting date	1 December 2005 **Completion date** 1 June 2006

Context / Social problem

Deltas are attractive settlement sites. Their fertile soil, presence of fresh water and the proximity of transport routes over river and sea make them an ideal place to live and for economic activities. However, there is a downside: lying in the low coastal zone makes deltas vulnerable to all kinds of disasters like hurricanes and tsunamis. This vulnerability will only increase because of sea level rise as a result of climate change. Till this day we countered the sea and rivers mainly by technical measures. On the short term they are effective but on the long term they have many unpleasant side effects, because they block the natural processes in the delta.

What do we know/not know?

The recent study 'Changing estuaries, changing views' (2004) shows that our Delta Works should not be judged an unqualified success. Given the consequences of the flood disaster of 1953, and seen in the context of the time, the decision to build it was certainly understandable. However, the Delta Works have had major social, economic, financial and ecological consequences, while question marks can be raised about the sustainability of the protection against flooding in the long term. It appears that 'soft' interventions that use the natural dynamics of deltas to respond in a flexible manner to the changes offer greater prospects than 'hard' measures in the form of dams, dikes and flood defences.
To this day the Delta Works still a source of new understanding and experience. This knowledge and expertise is unique in the world. In future many countries will have to contemplate what the right answer is to the upcoming climate changes. The challenge for the coming decades is to market Dutch knowledge worldwide.

What is being studied?

System-based measures, using the natural and dynamic forces in a delta, seems to be a more flexible way to cope with climatic changes. Only then can a delta adjust to changing circumstances. We explored the potential for soft system-based measures in deltas all over the world and developed a system that allows interactive exploration of deltas and measures.

The goal of the study is to gain insight into the potential of soft interventions that can respond flexibly to change as an alternative to the harder measures in the form of dams, dikes and flood defences. This potential is illustrated for rich and poor countries, including both ecological and socio-economic aspects, in the following three steps:

1. An inventory of deltas that will in future face the consequences of climate change
2. A review in general terms of how deltas can respond to the expected changes with a 'soft' strategy and what opportunities this presents to nature and the people living there
3. Selection and further study of a few deltas where the Netherlands will seek apply its expertise in soft solutions (marketing)

What are the results?

The result is the development of a number of successful strategies that can be applied in a range of deltas to link economic development to ecological goals. Results are available in the report: "Deltas on the move" to be downloaded from the DELTAS website (http://ivm10.ivm.vu.nl/deltas/). In addition the website gives an accessible overview of compiled information on deltas across the World. From this website you can retrieve information on

deltas, on their physical vulnerability to climate change, societal stocks at risk, and potential for 'soft' system-based measures. The interactive DELTAS tool makes it possible to rank deltas for many indicators so that it can be used for innovative system-based delta management.

COM 12 PhD programme

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Project website			
Starting date	1 August 2006	**Completion date**	31 December 2009

Three international summer schools will be held for PhD students:

1. S310: Understanding Global Environmental Change, providing an overview of the key processes in the climate system for PhD students from the natural sciences (see www.sense.nl/courses/cours/S310)
2. S460: Earth System Governance, providing an overview of the subject matter relevant for policies for the earth system for PhD students from the social sciences. Besides policy aspects, attention is given to the economics/environmental economics of adaptation and mitigation (see www.sense.nl/courses/cours/S460)
3. S340: Integrated Assessment of Global Environmental Change, integrating natural sciences and social sciences through the study of the causes and possible responses and practical training in making an Integrated Assessment

The three summer schools are run by the SENSE Research School for Socio-Economic and Natural Sciences of the Environment. At the moment, SENSE PhD students come from eight participating Dutch universities (see www.sense.nl). Their disciplinary backgrounds vary from the 'pure' natural sciences to the social sciences.

The summer schools are international in nature. They are open to PhD students and researchers from the Netherlands and abroad.

COM 13 Check it out! Tools for a sustainable world

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Starting date	1 January 2006 **Completion date** 31 December 2008

Context / Social problem

Climate change is an urgent social issue. Young people in particular will have to deal with the consequences. With an eye to their future, we must act now, both to avert the effects of climate change as much as possible and to adapt to the consequences. A good way of reaching out to young people is through the education system.

Check it out! Tools for a sustainable world is a three to five year teaching programme focusing on the climate problem and energy saving. The core of the programme consists of advice on how to improve energy performance through technical measures and behavioural change, involving the whole school community, and raising awareness of the global and local impacts of climate change. Check it out! will be offered to all schools in the Netherlands. To this end the consortium is working with national education organisations, research and educational institutions and other organisations that provide education on climate topics.

The main objectives of the project are:

- To disseminate knowledge of climate change and concrete best-practice approaches for pupils, teachers and managers in primary education, secondary education and senior secondary vocational education
- To present the themes of climate change, mitigation and adaptation primarily in relation to the use of space and in the context of the related problem of sustainable development
- To link the teaching programme to scientific research programmes, thus involving schoolchildren in the work of research institutes and data collection

Target groups and intended scope

Check it out! tools for a sustainable world is a programme for all those involved in education: pupils, teachers, school governors and directors, and the wider school environment. The project intends to reach 150 primary schools, 70 VMBO schools (preparatory secondary vocational education), 30 HAVO/VWO (secondary education) and 8 MBO/AOC colleges (senior secondary vocational/agricultural education), but may reach out to more schools across the Netherlands – and Check it out! will also be starting in Spain, Bulgaria, Hungary and Germany in the 2007/2008 school year. A further goal is to get local politicians more involved in the climate problem via presentations of the results by pupils as part of the educational programme.

Intended results and products

The expected results are:

1. Teaching materials, partly linked to research programmes and relevant to local climate policies
2. A website
3. Local partnerships between government authorities, schools and research institutes on the themes of climate change, adaptation and mitigation

COM 15 Adaptation scan for local governments

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Project website			
Starting date	1 May 2007	**Completion date**	31 December 2008

Societal problem and communication goal

Reduction of CO_2 will most likely not prevent the climate from changing. Therefore, it becomes necessary to take adaptive measures. Local governments are often lagging behind in awareness and knowledge about climate change, especially concerning the areas of land use planning and water management.

The adaptation scan for local governments is meant to provide insight in the following issues:

- What problems, opportunities and risks are to be expected for local governments due to climate change?
- What measures can be taken by local governments to mitigate the negative effects of climate change and to make the most of the opportunities?
- How can local governments manage their adaptation policy?

The adaptation scan is an addition to existing instruments that have already proven their usefulness in practice, such as the sustainable energy scan and the climate scan (both oriented on CO_2 reduction, not adaptation).

Target groups

The adaptation scan is developed for local governments: municipal and provincial governments, water boards and regional cooperative organisations.

Activities and products

The project is developed in two directions:

- A web-based adaptation scan for local governments will be built. The adaptation scan will provide measures to mitigate the negative effects of climate change and to make use of the opportunities
- An awareness process is started for local governments, to show the necessity of taking adaptive measures for becoming climate proof at the local level

The following activities are part of the project:

- Building a database with all effects of climate change and possible adaptive measures
- Developing a web-based application of the scan
- Running a pilot version of the scan at the Province of Groningen
- First evaluation round
- Testing the scan at a minimum of six local governments
- Second evaluation round
- Search for other interested local governments
- Perform the scan at thirty local governments

COM 20 Animation films on climate buffers

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Project website			
Starting date	1 January 2007	**Completion date**	31 December 2007

Social problem and communication objective

The project 'Noord, Zuid, Zoet, Zout' (North, South, Fresh, Salt) came to the conclusion that Dutch nature will also have to adapt to climate change. Starting from this conclusion, Vogelbescherming, ARK, the National Forest Service, Natuurmonumenten and the Wadden Sea Society, in collaboration with HIER, developed a vision on nature's place in climate change and adaptation. A central element in this vision is that nature is capable of changing in response to climate change, but this requires climate buffers. Climate buffers are spatial adaptations in conservation areas for the revitalisation of natural processes that are capable of developing at the same pace as climate change; they also allow for potential housing, employment and recreational uses. (see the report Natuurlijke Klimaatbuffers, Stroming, 2006 at http://www.hier.nu/site/art/uploads/files/klimaatbuffers.pdf).

Objectives

The goal is to use animation films to inform a broad public about climate change and the possibilities for adapting to its consequences. The core message is the explanation of the concept of adaptation using a concrete example involving ecosystems, water and spatial planning.

Target groups

- Members of the public and anyone interested in the climate issue
- Pupils, young people and students
- Visitors to nature information centres and museums

Activities and products

Short, entertaining and engrossing animation films on television and internet will be used to stimulate the target groups to think more about climate change, adaptation to its consequences and the role of climate buffers. The animation films for use on the internet will be 'triggers' to entice the viewer to visit other web pages and programmes with more information on the subject.

The films will be made in two ways:

- In a competition between students at art schools and schools for new media
- By one or two professional studios which, if necessary, will prepare the products of the winners for broadcasting, and will make short films themselves

Distribution will be via websites, mass media and email.

COM 21 Climate change sketchbooks

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	KNMI		Province of Noord-Brabant
	VU University Amsterdam		Province of Drenthe
	Province of Zuid-Holland		Province of Gelderland
	Province of Utrecht		Province of Noord-Holland
Project website			
Starting date	1 May 2007	**Completion date**	1 June 2008

Social problem and communication objective

In order make climate proof investment decisions, Provinces are aiming to take climate change into account into the spatial planning processes. However, Provinces often lack adequate, consistent and up to date information of climate change effects, to take the adaptation problem into account. The objective of this project is to provide the Provinces with this information. The project goal is threefold:

- To draw Provincial climate change sketchbooks, or first generation Provincial climate change atlas, containing information of the possible effect of climate change
- To form a lasting consortium of knowledge institutes, consultancies, and Provinces for a frequent up date of the climate change atlas
- To increase the climate change adaptation awareness of politicians, the Province administration and other institution

Target groups and intended scope

The primary target group of this project is the Province administration. Subsequently also all other organisations involved into the special planning process coordinated by the Provinces come into view.

Intended results and products

The project will gather up-to-date information on climate change effects and elaborate this information into provincial consequences. If possible the project will draw provincial maps. An important aspect of the climate change sketchbooks is the information on the relevance of the effects for provincial spatial planning.
Beside the sketchbooks the project will make a GIS system for the exchange of information. This system will be used in coming years for up dates of the sketchbooks.

COM 22 Heat in the city, definition study

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Project website	
Starting date	1 September 2007 **Completion date** 1 July 2008

Context / Social problem

Climate change causes rising temperatures. In cities, the Urban Heat Island Effect contributes to a further increase. The overheated environment reduces the thermal comfort and the functioning of human beings. Especially older and infirm people suffer an increased risk of premature death. The 2003 heat wave has caused between 22.000 – 35.000 additional loss of life in Western Europe of which about 1.000 occurred in The Netherlands. Inhabitants of urban areas tend to compensate for the temperature increase by installing cheap air conditioning units, that enhance global warming. This effect may be strengthened when Dutch building practices continue to focus on low energy or CO_2 neutral buildings and houses. This includes a high degree of insulation and high air tightness of buildings to reduce the heat demand and improve thermal comfort in winter time. If not addressed properly, this will result in further health en thermal comfort problems during warm periods and more high energy cooling devices. A vicious heat spiral develops.

What do we know/not know?

Several factors in spatial design and building design are known to affect outdoor and indoor temperature in urban areas. The urban structure can be used to create breezeways; green areas are useful to diminish the Urban Heat Island Effect. At the level of individual buildings, shading, reflective materials, building mass, orientation, insulation, ventilation and window openings are relevant parameters. And last but not least: people tend to operate their shading and ventilation devices ineffectively. For 6.6 million existing houses and 80.000 new houses annually it has to become clear which measures, both on the spatial planning and building level, are effective to cope with heat waves at the lowest costs. Addressing spatial planning and building measures simultaneously is crucial, as they interact especially in urban areas.

What is being studied?

Important research questions relate to the seriousness of the heat problem in the Netherlands, the level of temperature rise, the level of acceptance of overheating, effectiveness of measures and methods for dissemination of knowledge to the stakeholders.

What are the results, and who are they for?

The first result is a set of preliminary rules of thumb for urban spatial planners and for building designers, indicating how to cope with heat waves cost effectively. The second result is a proposal for a scientific study to increase understanding of the urban heat mechanism and to validate the rules of thumb.

COM 23 Water resilient building

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Consortium	Grontmij Witteveen+Bos Deltares TU Delft SBR	Sterk Consulting In cooperation with the Ministry of Transport, Public Works and Water Management (V&W) and the Living with Water project (bridge project)	
Project website	www.bouwrijp.nl		
Starting date	1 September 2007	**Completion date**	1 May 2008 (phase 1)

Context / Social problem

The implications of climate change, such as more extreme rainfall and droughts, make an alternative way of building and managing our urban areas necessary. Streets will not be able to handle increasingly heavy rains. Societies should defend themselves against these future risks. The main question of the project 'Water resilient building' is: how can we manage, build, plan and design our urban and suburban areas in a way that make them more resilient for floods and droughts?

What do we know/not know?

First aim of the project is to produce an overview of relevant measures for waterresilient building, technical, process and institutional measures, and their connection with daily building practice. Measures not only focus on flooding problems and houses, but include droughts and other infrastructure. In the spring of 2008, the result of this research will be an overview of measures and practices from The Netherlands and the rest of the world to combat floods and droughts.

What is being studied?

The project team will integrate all these measures and practices in a framework which was made by the Technical University of Delft. This framework is based on the term ´vulnerability´, which is linked to four ´capacities´. The more capacities an urban society can use, the more it is resistant to floods, droughts or their impact. The vulnerability of urban societies is linked to four types of capacities:

- *Threshold capacity*: to prevent floods, droughts
- *Coping capacity*: to minimise the impact of occurring floods and droughts
- *Recovery capacity*: the ability to recover quickly after a flood or drought
- *Adaptive capacity*: the ability to adapt to a changing environment by considering rare and probably never occurring disasters

Societies create their own capacities with lots of technical measures and practices. On the other hand, institutional, planning and other measures and concepts are also important.

What are the results, and who are they for?

Recent findings from the project:

- Almost all countries have a focus on technical measures and practices to raise their threshold capacity. Bigger and higher dikes, 'mega dunes', houses on poles, and floating cities are commonly named but not so often practiced solutions
- Institutional measures and practices offer different ways to oppress the impact of floods and droughts. For example, the UK, France and Germany are working on and practicing planning concepts in which they incorporate the flooding sensibility of areas
- Project investors and building companies often opt for the cheapest way of making parcels ready for building. Local authorities may try to set higher requirements on the way investors and builders deliver parcels and houses to consumers

After finishing part 1 of 'Water resilient building', the project team launches a research agenda for part 2, in which the investigated measures, practices and concepts will be practiced, tested, evaluated and refined.

COM 25 Definition study: Biesbosch in times of Climate Change

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Project website			
Starting date	1 September 2007	**Completion date**	15 December 2008

Social problem and communication objective

In the lower parts of the Netherlands, at the mouth of the rivers Rhine and Meuse, important urban and economic centres exist. The centres will be affected by the consequences of climate change and in the long run even the security of the inhabitants is at stake. The challenge is, in addition to other measures (such as energy saving measures, CO_2 sequestration and energy production form renewable sources), to anticipate the upcoming changes in a spatial manner. In the highly urbanised areas space is scarce and expensive, certainly if one realises how much space is necessary to buffer the (hydraulic) consequences of climate change. For this purpose, other areas, where space is less scarce and less expensive, will have to be found. The sparsely populated Biesbosch area is one of the areas qualifying as a "climate buffer", absorbing the consequences for a much larger region. The question is which role (both quantitatively and qualitatively) the Biesbosch are can play and to what extent the existing functions in the area (agriculture, drinking water production etc) are compatible with this – also in the light of the "autonomous" changes these functions will undergo of climate change. Complex spatial issues like these present themselves in many other places in the Netherlands and it is therefore interesting to investigate whether it is possible to use the Biesbosch area for the development of a strategic concept which can be applied in other places as well.

Target groups and intended scope

Principal target groups for the definition study are the existing users and functions of the Biesbosch area and the wider surrounding: agriculture, nature, recreation, drinking water production, flood control, urban development, energy production and navigation. Representatives of these sectors will be involved in the study.

Intended results and products

- A deskstudy will generate information on the effects of climate change in downstream sections of the Dutch rivers, with a focus on the Biesbosch area. In addition an inventory will be made of existing studies on the effects of climate change and the models needed. What is known, what is yet unknown? The information will collected on basis of the knowledge of each of the team members and literature research. On the basis of this information a discussion paper will be drafted.
- Organisations involved (directly or indirectly) in the Biesbosch area will be interviewed on what questions they have with relation to climate change and how it will affect their modus operandi. The discussion paper, outlining the issue and some possible directions developments could take, will be the basis for the discussion and should encourage the people interviewed to take a long term perspective. The interviews will not only collect questions but also give insight in the forecasts used by the various sectors, the time horizon used and possible actions already undertaken or planned to anticipate climate change.
- The different climate scenarios (drought, floods, sea level rise) will be linked to the wishes and expectations of the different functions in the region. This will generate crude adaptation strategies and spatial scenarios for the Biesbosch region, which will serve as a basis for the generation of targeted research questions (research agenda) for future research programs.

COM 26 Scoping study comparative assessment

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Context / Social problem

The Netherlands are a densely populated country where 16 million inhabitants share scarce room and face climate change. The responsible authorities are confronted with decision making under uncertainty on physical planning for a long time horizon with great consequences for present investments. The present study deals with the comparative assessment of decisions for physical planning at different institutional levels. What competences to act exist and how may they interact for optimal solutions?

What do we know/not know?

There exists relatively little experience with the implementation of policy instruments to make a specific area climate proof or to consider in this respect a sector of economy or the living environment. In the Netherlands there is only little experience with legal aspects related to climate proofing. This study presents a reconnaissance of relevant issues with respect to that issue. Particular notice has been taken of other sectors where decision making with uncertainty plays an important role.

What is being studied?

The study defines the goals and scope of the comparative assessment. This encompasses the justification, legislative environment and assessment methods for similar decision making processes. Terms of reference for assessment instruments at different policy levels are formulated taken notice of landscape types, consequences of climate change and institutional setting. The national government, provinces, communities and water boards are actively involved in the study and frequently consulted. The relevant legal framework and institutional organization with their foreseeable or expected developments are presented.

What are the results, and who are they for?

The results of the present study are relevant for decision makers. It describes the scope of the comparative assessment and the terms of reference for assessment methods for climate proofing. Not only the physical issues are considered such as sea level rise but also the economic, institutional and behavioural aspects are taken into account. The focus is on adaptation but mitigation aspects are considered as well.

Project in preparation

COM 19 MSc programme on Climate Change

There is a demand for higher education programmes in the field of climate change, both from students and from different fields of practice. On the practical side, the greatest demand is for a broad range of expertise relating to climate change and the skills to apply it. Research on these topics is currently underway in the Netherlands, but government has noted a knowledge paradox: research results do not filter through to the workplace and practical experience is not being fed back adequately into research. When government turns to research institutes for the knowledge and expertise it needs to put policy into practice, what it gets is not always fit for purpose. A new educational programme on climate change will therefore not only help to raise the general level of our knowledge in this field, but will also help to develop a common conceptual framework for both the research community and those working in the field. This will make it easier to exchange knowledge and experience within a wider community of practice.

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