
Klimaat voor Ruimte
Ruimte voor Klimaat
Climate changes
Spatial Planning
Thema 2 Ruimtegebruik
Klimaat en Ruimte
kennis
ruimte
netwerk
ACHT
VOOR
RUIMTE

Knowledge Project Plan

Climate *changes* Spatial Planning

Colophon

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Bsik / ICES-KIS-3 Knowledge Theme	:	"Hoogwaardig Ruimtegebruik"
Bsik / ICES-KIS-3 Focal area	:	"Klimaat en Ruimte"
Title	:	Climate *changes* Spatial Planning
Date	:	14 February 2003

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1 Summary

1.1 Background of knowledge project plan

Dealing with climate change and climate variability is one of the largest challenges for the coming years, both on a national and global scale. The Intergovernmental Panel on Climate Change (IPCC) presents increasing evidence of impacts of climate change and suggests that most of the warming observed over the last 50 years is attributable to human activities. In the Netherlands impacts of climate change are to be expected on land and water use, including infrastructure, water systems and agriculture. Illustrating the reciprocity of climate change and spatial planning, the IPCC warns that water and land uses may also add strains that heighten vulnerability to climate change. A broad recognition of climate change and its impacts on spatial planning is a *conditio-sine-qua-non* to develop an adequate and timely set of policies for mitigation and adaptation.

The NATIONAL ENVIRONMENTAL POLICY PLAN 4 (NMP4, Dutch Ministry of Housing, Spatial Planning and the Environment) highlights climate change as one of the seven most pressing environmental problems of today. Amongst these seven, climate change takes a special position, because it can intensify the other environmental problems and directly impact economic development. The NMP4 identifies a predominantly *sectoral* approach of climate change as the main barrier for a sustainable solution. Climate change requires *integral* and cross-sectoral policy development and a joint effort of policymaker, the private sector and science. The NMP4 continues that the knowledge (infrastructure) for approaching climate in an integrated, multidisciplinary and participatory way is largely missing.

The Netherlands play a prominent role in the international negotiations on climate change and Dutch science institutions are actively involved in most international research bodies. Internationally a number of countries has taken important steps to co-ordinate research and build awareness on climate change. Successful examples from the United Kingdom (Tyndall Institute) and Germany (Potsdam Institute for Climate Impact Research) have not been introduced in the Netherlands so far. The conclusion that the Netherlands should invest in integrated research and dialogue between science, politics and society was also voiced in Parliament during the discussion on the CLIMATE POLICY NOTATION PART II (Vaste Kamer Commissie VROM/EZ over Uitvoeringsnotitie Klimaatbeleid deel II, 2000).

Pre-consultation and Consortium building
Aiming to strengthen the Dutch knowledge infrastructure, a group of leading Dutch knowledge institutions initiated a broad consultation that lead to an Expression of Interest (EoI) for subsidy under the Decree on subsidies for investments in the knowledge infrastructure (Bsik, formerly ICES-KIS-3). The EoI, titled "Ruimte voor Klimaat | Klimaat voor Ruimte", was submitted in September 2001. The EoI got highest marks and the Dutch Government, as formulated by the Minister of Economic Affairs in a letter of March 23rd 2002, made 'Climate & Spatial Planning' one of the 21 areas of interest for which ICES-KIS3 funding will be available. Motivated by this recognition a consortium was formed to write this knowledge project plan[1], covering the prioritised area 'Climate & Spatial Planning'. The project plan was created in close collaboration with a wide range of stakeholders, including the Ministries of Housing, Spatial Planning and the Environment (VROM), Agriculture, Nature Management and Fisheries (LNV), Transport, Public Works and Water Management (V&W), Education, Culture and Science (OcenW) and Economic Affairs (EZ), regional and local governmental agencies, the private sector and NGOs. Consortium partners include nationally and internationally recognised institutes, securing the international position of the consortium.

The consortium combines suppliers of knowledge and expertise and knowledge users or clients. It does however not aim to discriminate between institutions or individuals based on this qualification. Rather it aims to breach the traditional roles of supplier and client and recognises that all partners hold valuable expertise on element of the system. Sharing information and dialogue are central to realising partnerships between divers project members. All partners contribute according to their own expertise and special interest. Internationally the knowledge project is supported by the world leading Tyndall Institute in the UK and the German Potsdam Institute for Climate Impact Research.

[1] Throughout this document '(knowledge) project plan' refers to the over all subsidy application under the Bsik. 'Project(s)'refers to the subsidiary elements of the knowledge project plan.

Mission, Main Objectives and Strategy

This knowledge project plan builds on the challenging interface of climate change, climate variability and spatial planning. The mission of the consortium is to face the challenges of living in a changing climate by fostering a dialogue between spatial planners and the climate community and making climate change and climate variability one of the guiding principles for spatial planning in the Netherlands.

The consortium recognises that the benefits of climate research arise from the application of its findings and not simply from its generation. Research on climate must be strongly coupled with research on applications science, and ultimately the measure of success of this project plan is the degree to which research findings are successfully implemented and strengthen the Dutch knowledge infrastructure.

The main objectives of this knowledge project plan are to:

- Offer the Dutch government, the private sector and other stakeholders a clustered, high-quality and accessible knowledge infrastructure on the interface of climate change and spatial planning.
- Engage in a dialogue between stakeholders to develop innovative integral approaches of spatial planning and land use that anticipate for climate change and contribute to a safe, sustainable and resilient socio-economic infrastructure in the Netherlands.

To realise these goals 'CLIMATE *CHANGES* SPATIAL PLANNING' knowledge project plan will:

- The creation of a multi-stakeholder *Network on Climate & Spatial Planning*
- A set of *projects* addressing interdisciplinary knowledge questions.

The *Network on Climate & Spatial Planning* will offer a unique environment for dialogue between scientists, policy makers, businesses and other stakeholders and will contribute to the co-ordination of their activities. It will offer a one-desk facility for all public or private actors that require information and function as a Centre of Excellence in an international context.

The projects explicitly address gaps in knowledge that have been identified by the consortium. These projects add to the knowledge infrastructure of the *Network on Climate & Spatial Planning* and offer its partners the opportunity to work together and strengthen public-private partnerships.

The knowledge project will be centred around four main knowledge themes:

- climate scenarios: climate scenarios & climate data management for decision support in spatial planning
- mitigation: decreasing greenhouse gas emissions in relation to land-use and spatial planning
- adaptation: dealing with the effects of climate change in spatial planning
- integration: methods for knowledge exchange and integration

Figure 1-1 illustrates the main themes, the knowledge project plan builds on. Projects are selected by the consortium to cover sectors that have been identifies as particularly relevant to climate and spatial planning. Sectors include biodiversity, agriculture, fisheries, fresh water, coastal areas, transport on land and water, land-use related energy production, business, finance and insurance, institutional setting. Although partners can table projects in later stage, a significant number of projects is already defined and offered as integral part of this knowledge project plan.

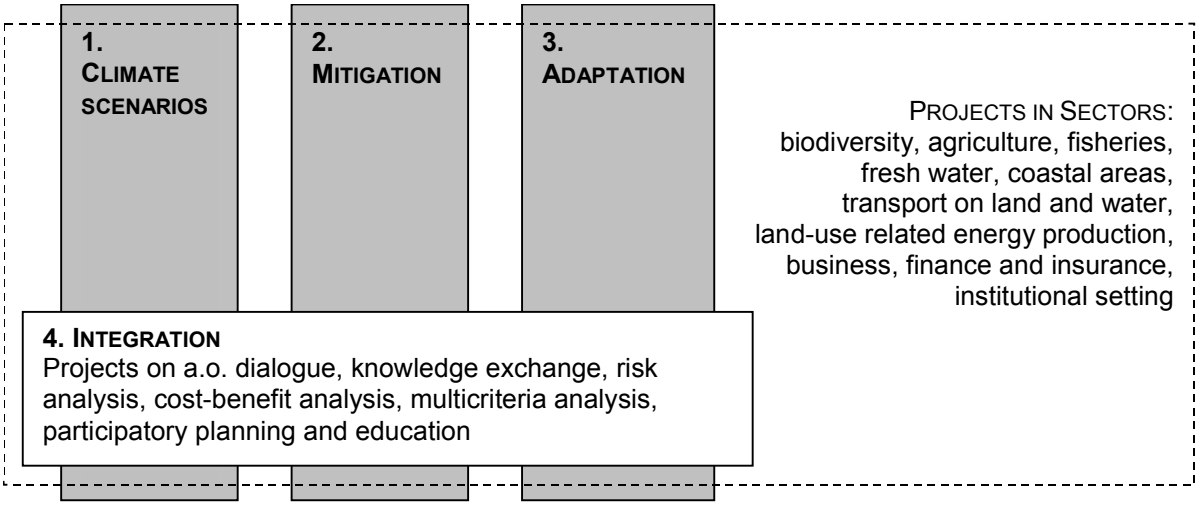


Figure 1-1: Main components of this knowledge project plan

1.2 Knowledge Project: Problem Definition and Key Questions

Although the co-dependency of spatial planning and climate change has largely been accepted, spatial planners and the climate change community have had mostly isolated (research) agendas so far. The existing Dutch knowledge infrastructure presently fails to meet the increasing demand for integration of climate change considerations into spatial planning. In addition chances are missed to cash the opportunities that the mutual supportiveness of climate change and spatial planning can offers to policy makers and businesses. At stake is to advance an emission-poor (re)development of our spatial infrastructure, to enhance land-use opportunities with respect to sources and sinks of greenhouse gases, to increase adaptive capacity in the management of agriculture, natural resources and water, and to enhance the protection of our infrastructure and thus the safety of our people. The challenge is to make climate change one of the guiding principles for spatial planning in the Netherlands and Europe. To meet this challenge the project plan identifies key research questions with each of the four main themes.

Theme 1: Climate scenarios: Tailor-made climate scenarios and climate data management for decision support in spatial planning

Spatial planning in a changing climate requires detailed knowledge about present-day's climate in north-western Europe and climate change. To respond adequately to the threats and challenges that come with climate change policymakers, businesses and the general public need to be informed about what lies ahead. Key research questions include:

- What climate scenarios are to be expected in the Netherlands?
- How can regional climate scenarios be used for spatial planning?
- How to design a user-friendly data centre for climate information that allows users to access different data formats and provide feedback on data provided?
- How do Dutch variability and weather extremes change as a function of greenhouse gas emissions?
- What role does the Atlantic Ocean play in the climate of Western Europe and the Netherlands?
- What influence do aerosol concentrations and clouds have on the Dutch climate?
- Will a new parameterisation of root water uptake improve modelling of the effects of crop choice and land use/groundwater management and what effects does the soil have?
- Can a regional climate model derive time series to drive models of river discharge or storm surge?
- How to provide high resolution precipitation & temperature time series from the 18th century up to present?

Theme 2: Mitigation and monitoring of greenhouse gases and aerosol emissions

Complying with emission reduction commitments following the implementation of the Kyoto protocol and future commitments under the UNFCCC requires a boost in knowledge and data infrastructure. Key research questions feeding the dialogue under Theme 2 include:

- How do transitions in land and water use affect short and long term greenhouse gas (GHG) emissions?
- What cost efficient and user-friendly information system be developed on GHG, aerosol emissions?
- How to increasing the share of renewable resources and carbon neutral fossil fuels in spatially differentiated energy scenarios?
- What are opportunities & threats of European biomass production and trade flows for the Netherlands?
- What comprehensive evaluation tools do regional planning and energy policy require?
- What are the economic and environmental benefits of climate neutral strategies and what tools assist the corporate sector in moving towards climate neutral undertaking?
- What is the potential of land-use related mitigation in the Netherlands looking at emission prevention, carbon sequestration and substitution?

Theme 3: Adaptation

This theme focuses on developing and assessing new adaptation strategies in the Netherlands. Research questions include:

- How to decide on alternative adaptation strategies in spatial planning?
- How do households decide on relocate and travel with respect to physical planning alternatives?
- What impacts are to be expected on the Dutch National Ecological Network? How will the abundance and distribution of plant and animal species, including invasive species change?
- How can agriculture adapt to brackish water conditions?
- What role can financial instruments play, like banking services and new insurance arrangements related to flood risks and land use re-allocation?
- What adaptation is needed in the transport sector? Can water related strategies be combined to enhance accessibility of Rotterdam Harbour under Climate Change?

Theme 4: Integration
The integration of project results, expertise and special demands of project partners is essential. Key research questions feeding the dialogue include:

- What theoretical framework can be used to select participatory approaches on the regional & local level?
- How do technologies and institutions interact in assessing the viability of management options?
- What are the socio-economic consequences of adaptation options in agriculture and forestry related to changes in temperature, precipitation and water regime, including salinisation?
- What materials for training and education will communicate the research findings under the project plan?
- What are cost and benefits of land use related mitigation strategies abroad both for the Netherlands and the partner country?
- What economic value can be assigned to the statistical lifetime of specific forms of land use and protection against flooding?
- How can adaptation be funded by bilateral development co-operation organisations and the UNFCCC on equitable use of Kyoto Protocol Adaptation Fund?

1.3 Scientific Relevance

Climate change is a problem with unique characteristics. It is global, long-term, and has complex interactions with climatic, environmental, economic, political, institutional, social and technological processes. This may have significant international and intergenerational implications in the context of broader societal goals such as equity and sustainable development.

In 2001 the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) was published followed shortly by a comprehensive synthesis report, that addressed policy concerns. These reports build on past assessments and incorporate new results from the past five years of research on climate change. They clearly show the enormous progress that has been made but simultaneously also conveys modesty because of the unknowns and uncertainties. Many gaps in information and understanding remain. Actions that are needed include:

- Expand the observational foundation for climate studies
- Improve the integrated hierarchy of global and regional climate models with emphasis on improving the simulation of regional impacts and extreme weather events.
- Quantitatively assess exposure, sensitivity and adaptive capacity and vulnerability of human and natural systems to climate change
- Look into the land/atmosphere interface in an integral approach, especially reinforcing the socio-economic component of both science and policy
- Initiate and strengthen cross-sectoral knowledge centres to guarantee adequate knowledge transfer and international imbedding.

Internationally the World Climate Research Programme (WCRP), International Geosphere-Biosphere Programme (IGBP) and the International Human Dimensions Programme (IHDP) have been designed to follow up on the IPCC recommendations. The key questions and themes addressed by this knowledge project reflect the Dutch priorities within the IPCC conclusions and the research programmes WCRP, IGBP and IHDP. Its major innovative character is an integrated approach that addresses the complexity of many components of the causal chain and their interactions. Additionally, it will initiate the much-needed dialogue on understanding of the climate system in relation to spatial planning, which will facilitate in the building of a shared knowledge infrastructure and knowledge based decision-making.

Referring to the four main themes of this knowledge project plan the following innovations are introduced:

- Climate scenarios: advanced methodologies to measure, analyse, model and verify GHG emissions and climate parameters, filling gaps in the international knowledge network. Development of innovative methods to assimilate and consolidate data. The downscaling of climate models to a regional scale with an improved spatial and temporal resolution. Reduction uncertainties by coupling monitoring of causes and effects. Design of advanced equipment in public-private partnerships. Social-economic indicators on the interface of climate and spatial planning.
- Mitigation: innovative methods to reduce emissions considering socio-economic conditions and land use planning. Prototype of a multi-platform monitoring system.
- Adaptation: integral assessment of adaptation options, adaptive strategy development, incorporation of multifunctional land use, company strategy development, legal and financial instruments applicable in spatial planning.
- Integration: new participatory methods and a dialogue platform aiming at synergy and integration between needs and demands different stakeholders. Translation of data requirements into integral policy support toolboxes.

The project plan is linked and tuned to the (inter)national programmes below. The apparent explosion of programmes illustrates the urgency of creating international alliances and networks. The proposed project plan connects the Dutch knowledge infrastructure to ongoing international consolidation.

Research programs the project plan ties in with		
Global	*European*	*National*
The scientific knowledge questions are tuned to international global change programmes: • World Climate Research Programme (WCRP), e.g. WOCE GEWEX/GABL • International Geosphere-Biosphere Programme (IGBP), e.g. i-LEAPS • International Human Dimensions Programme (IHDP). Monitoring under the project plan links to global initiatives, such as • Global Observing System (GCOS, GOOS, GTOS), • operational networks of the WMO and UNEP • Global Atmosphere Watch Significant contributions are to be made to the next IPCC assessment report on three of its prioritised areas: climate scenarios, mitigation and adaptation	The project plan ties in with the network of European knowledge centres and knowledge programmes financed by the EU 5th & 6th Framework Programme. E.g.: • CLOUDNET/CLIWANET on climate monitoring and processes • PRUDENCE on regional climate scenarios • DAEDALUS, EOROTRAC on aerosol and transboundary air pollution transport • CARBOEUROPE cluster; quantification & understanding of European carbon balance • GMES operational satellite information for environmental and climate studies • EnVISage on sustainability and integrated assessment • PEER, Biodiversity, Landscape planning, Aquatic ecosystems, pollution, Global Change, PA and DSS tools The project plan connects the Dutch knowledge infrastructure to European dialogues between science, policy and private sector: • *European Climate Forum* (ECF) on sustainable solutions to climate change; founded by the European Commission • *European Climate Change Programme* (ECCP) addressing cost-effective European emission reduction policies	The project plan pursues themes from: • Dutch Follow-up program on Climate research (NVKO), e.g.: improving climate scenarios; aerosol & clouds; weather extremes • Reduction Other Greenhouse gases (ROB), e.g. agricultural methane emissions • LNV-DWK climate research, e.g. sinks in forestry and agriculture, adaptation of nature and agriculture • NWO, earth observation , coupled Geo-Biosphere, climate variability • National Institute of Public Health and the Environment / VROM assessments of Climate Policy

The project plan safeguards its scientific relevance and quality by assigning each theme to a co-ordinating project partner. The co-ordinators are renowned scientist in their field. Their expertise and professional network is to guarantee the scientific quality and feasibility of individual projects. In addition the co-ordinator is responsible for the mutual supportiveness of projects and themes and their contribution to the overall knowledge infrastructure of the Network and the Netherlands. Independent scientific midterm and final reviews will be performed by the Netherlands Organisation for Scientific Research (NWO).

1.4 Economic & Social Relevance

The implications of climate change to the Netherlands and its economy can be significant. According to the implementation plan of the Dutch Climate Policy Plan, mitigation and adaptation measures require billions of Euros in the near future. In the long-term further reaching and difficult decisions will be required. Failing to integrate the implementation of climate change, spatial planning, water management and environmental policy, decisions will be sub-optimal and inefficient.

By ratifying the Kyoto Protocol of the 1992 United Nations Framework Convention on Climate Change (UNFCCC) the Netherlands committed itself to realising a 6% emission reduction, relative to 1990 levels. This emission reduction is aimed at stabilising human-induced greenhouse gas concentrations in the atmosphere at a level that will prevent dangerous interference with the climate system. In last years evaluation of the Dutch Climate Policy the National Institute of Public Health and the Environment (RIVM) (MILIEUBALANS, 2002) doubted the Kyoto target would be met by the present mix of policy instruments. It concluded that the implementation of new technologies, the start of a change in infrastructure and the introduction of new energy carriers requires a strengthening of policy instruments. The project plan is designed to offer this support.

Based on estimates of the integral costs of climate measures to be taken by the Netherlands (a.o. NMP 4, Implementation policy Climate 'UITVOERINGSNOTA KLIMAAT' I and II) an estimate was made of the potential direct benefits of the proposed project plan. Through a multidisciplinary approach and implementation of a high-quality knowledge infrastructure an average yearly saving of 100 to 800 million Euros can be realised in the long-term (estimated efficiency improvement between 5 – 15%). This can even be higher if different environmental problems are addressed integrally by mutually supportive policies.

The project plan addresses major socio-economic challenges on the interface of climate change and spatial planning, including:

SOCIO-ECONOMIC CHALLENGE	CORRESPONDING STRATEGY IN PROJECT PLAN
Governmental:	
A number of major national policy plans awaits implementation (VIJFDE NOTA RUIMTELIJKE ORDENING, WATERBEHEER 21STE EEUW, OVER STROMEN, KLIMAAT-NOTA II, NATUUR VOOR MENSEN-MENSEN VOOR NATUUR)	Sectoral policy goals and the corresponding knowledge questions are addressed simultaneously, resulting in new perspectives on integral policies and strengthening consensus on a shared policy
Dutch negotiators and researchers in the international climate change arena require support. The Netherlands are first in implementing the new Kyoto mechanisms	The Network on Climate & Spatial Planning will offer the knowledge infrastructure to answer or co-ordinate complex questions on the interface of climate change and spatial planning. The project plan specifically addresses IPCC prioritised topics
The public-private challenge:	
Compliance with the Kyoto Protocol requires a major investment, decoupling economic growth and greenhouse gas emission	The theme Mitigation identifies cost-efficient mitigation strategies in the Netherlands and abroad. Special attention is paid to collaboration between public and private consortium partners. In addition the project plan delivers an emission monitoring system, to assess emissions & emission reductions
Businesses want to look into new markets as flood risk insurances, renewable energy sources and the clean development mechanism	The Network offers an ideal environment for prototype development and interdisciplinary quick scans. New projects can be defined as contingency

Suitability and benefits of the application under Bsik
The major Dutch policy plans stress the need for an integral approach of climate change yet non of the ministries involved or funding mechanisms have sufficient financial, administrative and juridical means to initiate and realise an integral impulse of the size of the proposed project plan. Where as elsewhere in Europe both institutional and programmatic support of integral activities have already started (e.g. Tyndall Centre in the UK) the Netherlands still have to make this effort.

The Bsik grant offers a unique chance to initiate the co-ordinating Network on Climate and Spatial Planning and establish the basic knowledge infrastructure required for its work. This will give the Network the (inter)national position a Dutch network deserves and function of catalyst for future interdepartmental and inter-sectoral co-operation. The consortium is confident that after its head start the network will be fully equipped to generate income from other sources and sustain its existence. This approach is preferred over a more gradual building of the Network. International evidence suggests that a series of smaller and loosely connected initiatives cannot generate the snowball effect that a single, well co-ordinated and targeted investment will have in tying together different partners and becoming the obvious focal point for (inter)national co-operation.

1.5 Knowledge Project: Implementation

The knowledge project plan is built from a set of innovative projects, addressing the key knowledge questions under the four main themes: climate scenarios, mitigation, adaptation and integration. Each theme is supported by several projects, defined in the project plan. Next to these pre-selected projects, the knowledge project plan reserves 15% of its overall budget for new projects. These projects can be inspired by new insights gained implementing the project plan or answering scientific and socio-economic demands at the interface of climate and spatial planning, following the main themes of the knowledge project plan. Figure 1-2 summarises the expected project results. Scientific results will be published in books and articles and presented at conferences and workshops. To reach a larger audience the project plan aims to use radio, television and educational programs.

The project plan is implemented in phases. Projects that provide basic knowledge and input data to the Network are to deliver in the first half of the planning period 2004-2007. Other projects can build on these results, allowing them to be further tailored to the requirements of the Network. Users are actively involved from an early stage. Figure 1-2 illustrates how subsequent results lead up to integral knowledge products, that are at the heart of the knowledge infrastructure of the Network on Climate and Spatial Planning.

Consortium 'CLIMATE *CHANGES* SPATIAL PLANNING'..... Network on Climate and Spatial Planning

2004 2007

Theme 1: Climate scenarios: Tailor made climate scenarios and -data

- **Regional climate scenarios for the Netherlands, including extreme weather conditions, suitable for driving models of river discharge and storm surge**
- **Data centre for climate data and scenarios in standardised userfriendly data formats, easily accessible for diverse users**
- Model describing the relation of dominant circulation patterns & regional climate in Western Europe
- Model for surface fluxes of sensible & latent heat and greenhouse gases in middle part of the Netherlands
- new parameterisation of root water uptake, improving modelling of the effects of crop choice and land use / groundwater management
- Time series of precipitation and temperature from the 18th century up to present; time series of rare extreme events dating back millennia
- Trend of solar fluxes, aerosol, clouds and greenhouse gases in the Netherlands and Western Europe

Theme 2: Mitigation and monitoring of greenhouse gases and aerosol emissions

- **Integral analysis of solar, wind and biomass technologies, including space requirements**
- **Prototype operational information system to quantify a) the magnitude and associated uncertainties of the exchange of greenhouse gases and aerosols between the land surface and the atmosphere, and b) the main factors determining these fluxes**
- Field guide for multifunctional land use strategies with a focus on biomass production
- Comprehensive toolbox for regional planning and energy policy
- Toolbox & tailored knowledge infrastructure to assist the corporate sector in realising climate neutral undertaking; reducing GHG emission related to space use
- Clean Development Mechanism and inter-sectoral emission trading relating to land use in the Netherlands & abroad
- Assessment of biomass energy potential

Theme 3: Adaptation

- **Integral National strategies combining land use planning & adaptation to climate change; including coastal area & Dutch river system**
- Predictions & maps of bottleneck areas in National Ecological Framework (EHS): change of species and weak spatial distribution
- Model of relocation of households and travel behaviour as a function of physical planning alternatives that can be used for policy analysis
- Participatory spatial design techniques for adaptation to climate change in the Netherlands using Multicriteria analysis and Cost-benefit analysis
- Integrated eco-hydrologic-atmospheric model to evaluate Dutch water management policies
- Scenarios of changes in abundance and distribution of plant and animal species, disturbance in ecosystem function, loss of nature quality, invasive species affecting other species
- Adaptive measures in Dutch glasshouse horticulture; strategies for more sustainable and less climate change sensitive farming activities in the provinces Gelderland, Overijssel and Limburg
- Adaptation measures for agriculture in brackish water conditions
- Reliability of inland navigation relative to other transport modes and the position of Rotterdam port
- Banking services & new insurance arrangements related to flood risks & land use reallocation
- Economic assessment of the value of a statistical life related to the risks of specific forms of land use and protection against flooding
- Climate related shifts in benthic ecosystem of the Dutch Continental Shelf (NCP)
- Water quality indicators for the assessment of and adaptation to climate effects in Dutch coastal waters

Theme 4: Integration

Consortium 'CLIMATE *CHANGES* SPATIAL PLANNING'..... Network on Climate on Spatial Planning

- **Theoretical framework for selecting participatory approaches to plan for climate change at the regional and local level**
- **Participatory design of sustainable energy transition**
- Framework to assess the socio-economic consequences of adaptation options
- Materials for training & education to communicate the research findings under the project plan
- Cost-benefit analysis of adaptation options in water management
- Costs and benefits of land use related mitigation strategies abroad, both for the Netherlands and for the partner country
- Assessment of multi-level & multi-lateral governance and its implications for emission reduction projects
- Guidance to fund adaptation for bilateral development co-operation organisations and the UNFCCC on equitable use of Kyoto Protocol Adaptation Fund

..... Proposals for contingencies.....Deliverables contingencies

2004 2007

Figure 1-2: Overview of results of the knowledge project plan and timeline

Risks
The major risks that have been identified are addressed as follows:

- *Insufficient knowledge transfer and application of research findings*

In each project team a knowledge client will advise on knowledge demands and knowledge transfer. The project plan reserves financial resources to strengthen knowledge transfer if required. Knowledge transfer is actively monitored to enable an early response to deficiencies.

- *Scientific quality and beta-gamma integration is falling behind:*

Senior scientists are responsibly for integration within the different main themes. The Netherlands Scientific Organisation NWO will perform a scientific feasibility, midterm and final review of projects

- *New development in society and science impact project achievement:*

The project plan has made a financial reservation of 15% of the total budget for new projects.

- *Project partners fail to deliver*

All projects have specified detailed budgets, participation of end users, clear defined objectives and expected results. A Foundation and Programme Bureau have been mandated to overview progress and decide on appropriate steps (see also description of consortium hereafter)

- *Availability of qualified personnel and AIOs*

The Foundation actively monitors excellence of project members. The strong international embedding of the project plan ensures that personnel can be attracted from abroad

- *Failing co-financing*

The Foundation decides on whether project will be financed under the project plan. On failing co-financing the Foundation will assess the uniqueness of a project partners.

1.6 Consortium: composition & co-operation

The knowledge project plan offers to initiate a co-ordinating Network on Climate on Spatial Planning. The Network is a knowledge centre shared between the government, knowledge institutes, NGOs and the private sector. It will give access to the integral knowledge infrastructure built by the project partners and facilitate the dialogue between them. It will function as a clearinghouse on climate and spatial planning for partners and other stakeholders. The Network will be linked to other (inter)national knowledge centres and central in the Dutch participation in (inter)national research.

For the implementation of the knowledge project plan and the initiation of the Network the Foundation for Climate, Land-use and Infrastructure is established. Figure 1-3 illustrates the project plan organisation.

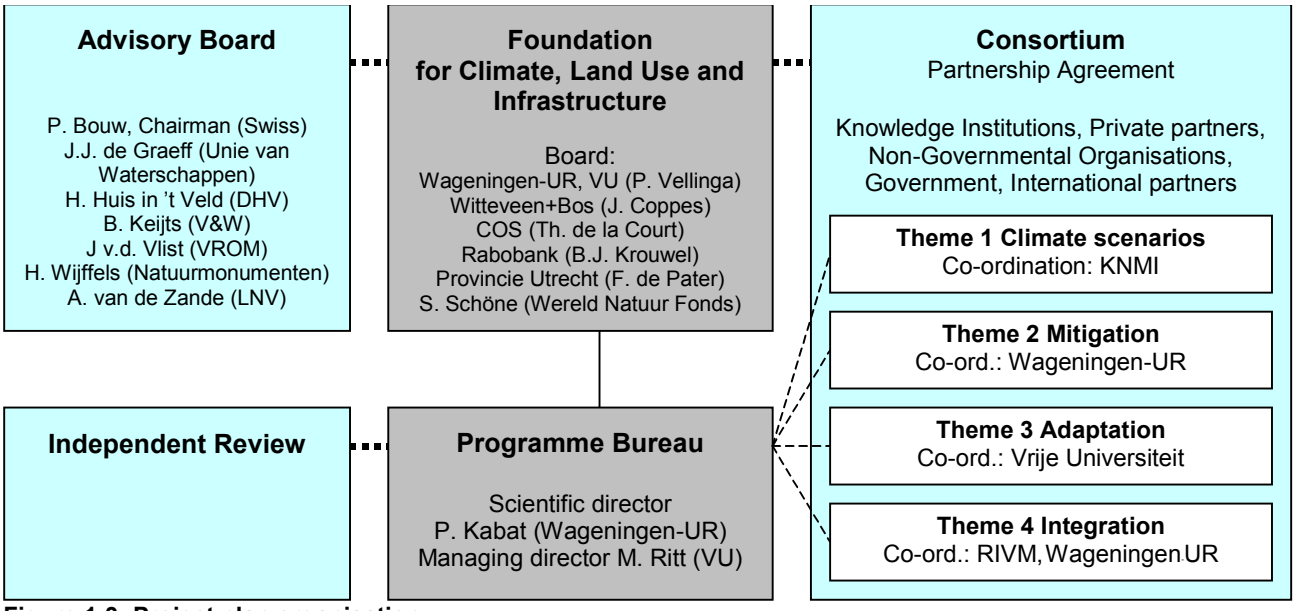


Figure 1-3: Project plan organisation

The Board of the Foundation is responsible for the successful execution of the project plan. The Foundation is supported by an Advisory Board, that recommends on the prioritisation of knowledge questions to be addressed. To back integration and multi-disciplinarity in implementing the project plan, board members of both the Foundation and Advisory Board are associated with the private sector, science, government and interest groups.

The Programme Bureau outlines the scientific strategy, in close co-ordination with the Board. To do so the Bureau confronts the (inter)national knowledge demand and availability of project partners and other (intern)national parties on the interface of climate and spatial planing. In addition the Bureau facilitates the dialogue between project partners and co-ordinates the implementation of the knowledge project plan.

Scientific quality assurance (QA) is an essential element in the project plan. With each theme of the knowledge project a co-ordinator is assigned to oversee the scientific quality and mutual supportiveness of individual projects, and their contribution to the overall knowledge infrastructure of the Network. An independent scientific feasibility, midterm and final review will be performed by the Netherlands Organisation for Scientific Research (NWO). NWO also evaluates new project proposal submitted under the open program.

Knowledge project plan partners	
Ministeries - National Government	
Ministerie van LNV	Ministerie van VROM
Ministerie van V&W	
Government	
Adviesgroep voor Verkeer en Vervoer	Provincie Overijssel
Dienst Landelijk Gebied	Provincie Utrecht
Dienst Waterbeheer en Riolering Amsterdam (DWR)	Provincie Zuid-Holland
Milie Dienst Rijnmond	Staatsbosheer
Minsterie van EZ - NOVEM	Unie van Waterschappen
Ministerie van OcenW -NWO	Waterschap Rivierenland
Pilot Stortelersbeek	Waterschap Rijn en Ijssel
Pilot 't Klooster	Waterschap Schieland
Provincie Gelderland	Wetterskip Fryslân
Provincie Limburg	Zuiveringschap Hollandse Eilanden en Waarden
Provincie Noord-Holland	
Knowledge Institutions	
Centrum voor Geo-Informatie	SENSE Onderzoeksschool
Centrum voor Internat. Samenwerking Noord-Holland	Space Research Organization Netherlands (SRON)
Centrum voor Isotopen Onderzoek Rijksuniversiteit Groningen (RuG)	Technische Universiteit Delft-Geodesie
Copernicus Instituut, Universiteit van Utrecht	Technische Universiteit Delft – Internat. Research Centre for Telecommunications-transmission & Radar
Economisch en Sociaal Instituut VU	Technische Universiteit Eindhoven
Energieonderzoek Centrum Nederland (ECN)	TNO Fysisch en Elektrisch laboratorium
Koninklijk Nederlands Meteorologisch Instituut (KNMI)	TNO Milieu, Energie en Procesinnovatie
Koninklijk Nederlands Instituut voor Onderzoek der Zee (KNIOZ)	TNO-NITG Nederlands Instituut voor Toegepaste Geowetenschappen
Nederlands Instituut voor Visserijonderzoek B.V.	Universiteit Leiden - Nationaal Herbarium Nederland
(Stichting) Post-Hoger Landbouwonderwijs (PHLO) - Wageningen Universiteit en Researchcentrum	Universiteit Maastrich - ICIS
Praktijkonderzoek Plant & Omgeving (PPO)	Universiteit Maastricht, Rechtenfaculteit
Rijksinstituut voor Integraal Zoetwaterbeheer en Afvalwater-behandeling (RIZA)	Universiteit Utrecht Faculteit Natuur- en Sterrenkunde
Rijks Instituut voor Kust en Zee (RIKZ)	Vrije Universiteit Amsterdam (VU)
Rijksinstituut voor Volksgezondheid en Milieu (RIVM)	Wageningen-UR, Climate Change & Biosphere Res. Centre (CCB)
Rijks Universiteit Groningen-CIO	WL | Delft Hydraulics
Rijks Universiteit Gronimgen,Fac.Wiskunde&Natuurwetenschappen	
Non-Governmental Organisations	
Both Ends	Stichting Vogelonderzoek Nederland
FLORON	Teylersmuseum
Foundation for Sustainable Development	The Balikpapan Orangutan Survival Foundation
Gelderse Land- en Tuinbouw Organisatie-GLTO	VARA Radio
Nationaal Natuurhistorisch Museum (NATURALIS)	Vereninging Natuurmonumenten
NEMO	Vlinderstichting
Stichting Toegepast Onderzoek Waterbeheer	World Wildlife Fund (WWF)
Private Partners	
Afvalzorg Deponie B.V.	KIWA N.V.
Arcadis B.V.	Koenders Instruments B.V.
Business for Climate	Mentink - procesmanagement B.V.
CaTec B.V.	ODE Desert Enterprises
CE-Transform	R&R Mechatronics B.V.
Centrum voor Landbouw en Milieu (CLM)	Rabobank Nederland
DHV Milieu en Infrastuctuur B.V.	Royal Haskoning, Haskoning Nederland B.V.
Dutch Space	SarVision
ECOFYS B.V.	SME-Milieuadviseurs
Educational Material and Network	TAUW B.V.
FACE Foundation	Virtual Knowledge Center
GEODAN	VITENS
Interpolis Re	WaterWatch remote sensing
Kema Nederland B.V.	Witteveen+Bos
Kipp & Zonen B.V.	

Knowledge project plan partners	
International Partners	
Alfred Wegener Institute	Tyndall Centre for Climate Change Research
CETP-UVSQ	University of South Carolina, School of Policy Planning&Development
IGBP (ICSU-Global Change)	University of Bonn –Meteorological Institute
Max-Planck-Institute fur Biochemie (CARBOEUROPE)	WCRP (ICSU)
Potsdam Institute for Climate Impact Research.(PIK)	SEECON Social Ecological & Economic Consulting

1.7 Knowledge: distribution & transfer

Knowledge transfer is an important objective of the knowledge project. Project plan Theme 4 *Integration* specifically aims at delivering product for direct use in outreach and knowledge transfer. Overall project results are rooted in knowledge infrastructure of the Dutch society by:

1. Knowledge exchange within the new Network on Climate and Spatial Climate
2. Making outreach, distribution and knowledge exchange explicit review criteria for each project, for each of the four main themes of the project plan and for the knowledge project as a whole
3. Linking the knowledge project plan to (inter)national programmes and centres of excellence both at project level and institutionally
4. Tailoring toolboxes and other project result to the needs of different stakeholders
5. Designing new instrument for knowledge transfer and dialogue
6. Offering educational packages, a clearing house and a central website on project findings
7. Scientific publications and presentations at symposia and workshops

By making a financial reservation for an open program, interested parties can directly be invited to contribute to the knowledge network by putting forward a proposal. New project partners will have direct access to the knowledge infrastructure of the Network. Visa-versa being complementary and knowledge transfer will be important criteria for project approval.

Indicators of knowledge distribution and transfer are:

- Frequency at which the Network on Climate and Spatial Planning is approached for advise, information and service
- Number of projects in the open program
- Number of visitors of the Network's website
- Response to questionnaires of the Network and its project partners
- Number of products, developed under the project plan in public-private partnership

1.8 Finances: budget & coverage

To implement the knowledge project plan the consortium applies for a subsidy under Bsik of 49.1 M Euro in total. The Budget specification follows the four main themes of the knowledge project plan. Including the matching of the project partners, the total project costs amount to 100.25 M Euro.

Themes	Matching partners [k Euro]	Requested Bsik grant [k Euro]	Total Knowledge Project Costs [k Euro]
Climate scenarios	11068	10204	21272
Mitigation	13174	13172	26346
Adaptation	13798	13528	27326
Integration	7288	6291	13579
New projects / Review	5874	5874	11648
Total	***51202***	***49068***	***100271***

2 Background

2.1 Context of knowledge project plan

Extreme weather records are broken every year and disasters claim lives, disrupt national economies and leave affected people bemused and angry. People are looking for assurances and actions to combat climate related catastrophes. Dealing with climate change and climate variability is one of the largest challenges for the coming years, both on a national and global scale. The Intergovernmental Panel on Climate Change (IPCC) presents increasing evidence of impacts of climate change and suggests that most of the warming observed over the last 50 years is attributable to human activities. The main findings of the IPCC are summarised in Chapter 3. In the Netherlands impacts of climate change are to be expected on land and water use, including infrastructure, water systems and agriculture. Illustrating the reciprocity of climate change and space, the IPCC warns that water and land uses may also add strains that heighten vulnerability to climate change.

The Dutch NATIONAL WATER POLICY recognises that eventually national physical planning policies will need to take into account the effects of rising sea level, ground subsidence, increased rainfall and heavier river discharges. A long term strategy is required to enable an effective response to these developments (Fourth National Policy Document on Water Management NW4, Ministry of Transport, Public Works and Water Management).

The NATIONAL ENVIRONMENTAL POLICY PLAN 4 (NMP4) (Ministry of Housing, Spatial Planning and the Environment, 2001) highlights climate change as one of the seven most pressing environmental problems of today. Amongst these seven, climate change takes a special position, because it has close links with each of the other problems. It is concluded that climate change can intensify other environmental problems and directly impacts economic development (Metz et al, 2001: IPCC WG3 TAR).

As a main barrier for a sustainable solution, the NMP4 points at the predominantly *sectoral* approach of climate change. Climate change requires *integral* and cross-sectoral policy development. The NMP4 continues that the knowledge (infrastructure) for approaching climate in an integrated, multidisciplinary and participatory way is largely missing. A similar conclusion was reached by the Dutch Council for Country Planning [De Raad voor het Landelijk Gebied], which stated that climate-change is a broad and far-reaching societal problem that goes beyond traditional sectoral and national boundaries. Climate change and the use of the physical space are strongly intertwined with each other. A broad recognition of the climate-change problem and its impacts on spatial planning is a *conditio-sine-qua-non* to develop an adequate and timely set of policies for mitigation and adaptation. These sets include adequate management of rural areas (De Raad voor het Landelijk Gebied, 1998).

Internationally a number of countries has taken important steps to coordinate research and build awareness on climate change. Successful examples from the United Kingdom (Tyndall Institute) and Germany (Bundesministerium für Bildung und Forschung, 2001) have not been introduced in the Netherlands so far. The conclusion that the Netherlands must invest in dialogue between science, politics and society on the issue of climate change that is of such large societal importance (Commission Middelkoop, 1995/1996) was recently repeated in Parliament in the discussion on the CLIMATE POLICY NOTATION PART II (Vaste Kamer Commissie voor VROM en EZ over de Uitvoeringsnotitie Klimaatbeleid deel II, 2000).

The Netherlands play a prominent role in the international negotiations on climate change and Dutch science institutions are actively involved in the most important international research programmes, such the World Climate Research Program (WCRP), the International Geosphere-Biosphere Program (IGBP) and the International Human Dimensions Project (IHDP). (see also Section 4.6). Support of Dutch negotiators and research programs is needed on both scientific-political topics (IPCC, EU Sixth Framework Program) and political-strategic issues (United Nations Framework Convention on Climate Change (UNFCCC) and ECF).

By ratifying the Kyoto Protocol of the 1992 UNFCCC the Netherlands committed itself to realising a 6% emission reduction, relative to 1990 levels. This emission reduction is aimed at stabilizing human-induced greenhouse gas concentrations in the atmosphere at a level that will prevent dangerous interference with the climate system. In last years evaluation of the Dutch Climate Policy the National Institute of Public Health and the Environment (RIVM) doubted the Kyoto target would be met by the present mix of policy instrument. It concluded that the implementation of new technologies, the start of a change in infrastructure and the introduction of new energy carriers requires a strengthening of policy instruments (MILIEUBALANS 2002, 2002).

Summarising it is concluded that although the co-dependency of spatial planning and climate change has largely been accepted, spatial planners and the climate change community have so far had mostly separate (research) agendas. The existing Dutch knowledge infrastructure presently fails to meet the increasing demand for integration of climate change and climate variability considerations into spatial planning. In addition chances are missed to cash opportunities that the mutual supportiveness of climate change and spatial planning offers to policy makers and businesses.

Aiming to address this niche in the Dutch knowledge infrastructure seven leading Dutch knowledge institutions initiated a broad consultation that lead to an Expression of Interest (EoI) for subsidy under the Decree on subsidies for investments in the knowledge infrastructure (Bsik, formerly ICES-KIS-3). The EoI, titled "Ruimte voor Klimaat • Klimaat voor Ruimte", was submitted in September 2001.

The EoI got highest marks and the Dutch Government, as formulated by the Minister of Economic Affairs in a letter of March 23rd 2002, made 'Climate & Spatial Planning' one of the 21 areas of interest for which ICES-KIS3 funding is available. Motivated by this recognition a consortium was formed to write this project plan, covering the prioritised area 'Climate & Spatial Planning'.

The socio-economic relevance and the relation of the project plan with the major Dutch policy plans is treated in more detail in Chapter 5.

2.2 Consortium

The project plan was created in close collaboration with a wide range of stakeholders, including the Ministries of Housing, Spatial Planning and the Environment (VROM), Agriculture, Nature Management and Fisheries (LNV), Transport, Public Works and Water Management (V&W), Education, Culture and Science (OcenW) and Economic Affairs (EZ), regional and local governmental agencies, the private sector and NGOs. Consortium partners include nationally and internationally recognised institutes, securing the international position of the consortium.

The consortium unites suppliers of knowledge and expertise and knowledge user or clients. It does however not aim to discriminate between institutions or individuals based on this qualification. Rather it aims to breach the traditional roles of supplier and client and recognises that all partners hold valuable expertise on element of the system. Sharing information and dialogue are central to realising partnerships between divers project members. All partners contribute according to their own expertise and special interest. Internationally the knowledge project is supported by the world leading Tyndall Institute in the UK and the German Potsdam-Institut.

The consortium is treated in more detail in Chapter 7.

2.3 Mission and Main Objectives

Climate change should become one of the guiding principles for policy planning in the Netherlands (and Europe). At stake is to advance an emission-poor, "climate-neutral" (re)development of our spatial infrastructure, to enhance land-use opportunities with respect to sources and sinks of greenhouse gases, to increase adaptive capacity in the management of agriculture, natural resources and water, and to enhance the protection of our infrastructure and thus the safety of our people. An important part of the vision of the consortium is its recognition that the benefits of climate research arise from the application of its findings and not simply from its generation. Research on climate must be strongly coupled with research on applications science, and ultimately the measure of success of this project plan is the degree to which applications are successfully implemented and strengthen the Dutch knowledge infrastructure.

This knowledge project plan builds on the challenging interface of climate change and spatial planning. The mission of the consortium is:

to face the challenges of living in a changing climate by fostering a dialogue between spatial planners and the climate community and making climate change one of the guiding principles for spatial planning in the Netherlands.

*Following its mission the main objectives of the '*Climate *changes* Spatial Planning' *knowledge project plan are to:*

- Offer Dutch government, the private sector and other stakeholders a clustered, high-quality and accessible *knowledge infrastructure* on the interface of climate change and spatial planning.
- Engage in a *dialogue* between stakeholders to develop *innovative integral approaches* of spatial planning and land use that anticipate for climate change and contribute to a safe, sustainable and resilient socio-economic infrastructure in the Netherlands.

Secondary objectives are to*:*

- Co-ordinate, deepen and extend inter- and multidisciplinary research on climate change and spatial planning.
- Evaluate the effectiveness and efficiency of (inter)national policy measures and strategies in the light of the relation between climate change and spatial planning.
- Position the Dutch knowledge institutions, government and private sector in the European and global climate change arena.
- Create a learning environment for integral planning and knowledge based decision making.
- Develop and apply new forms of communication and discussion platforms between science, government, the private sector and civil society. Examples include national climate platform, regional climate dialogues, integrated participatory assessment methods

The socio-economic relevance of the knowledge project plan is treated in more detail in Chapter 5.

2.4 Strategy

To realise the goals set in the previous section the "Climate *changes* Spatial Planning" knowledge project plan will:

- To create an integrated *Network on Climate and Spatial Planning* that will greatly enhance communication between government, knowledge institutions, the private sector and others.
- A set of projects addressing interdisciplinary knowledge questions.

The Network on Climate and Spatial Planning will offer a unique environment for bringing together scientists, policy makers, businesses and other stakeholders on climate change related issues and to contribute to the co-ordination of their activities. It offers a one-desk facility for all public or private actors that require information. At the same time it will act as a scientific clearinghouse by giving access to on-line data and publications and function as a Centre of Excellence in an international context. Additionally the related national climate portal will be beneficial for information exchange with civil society.

The projects explicitly address gaps in knowledge that have been identified by the consortium. These projects add to the knowledge infrastructure of the *Network on Climate and Spatial Planning* and offer its partners the opportunity to work together and strengthen public-private partnerships.

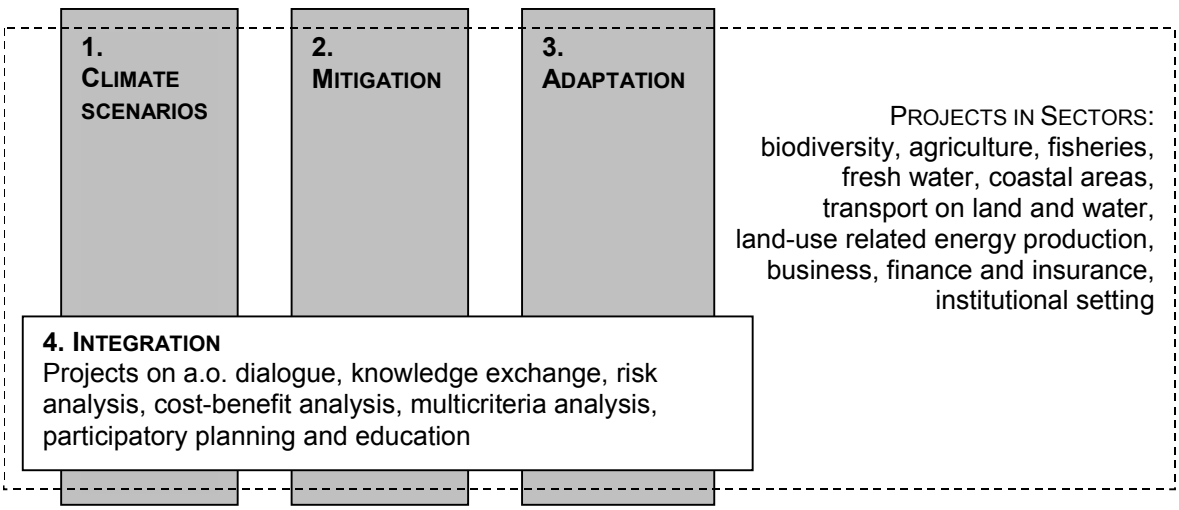


Figure 2-1: Main components of this knowledge project plan

The projects will be centred around four main knowledge support themes:

- climate scenarios: climate scenarios & climate data management for decision support in spatial planning
- mitigation: decreasing greenhouse gas emissions
- adaptation: dealing with the effects of climate change in spatial planning
- integration: methods for knowledge exchange and integration

Key words are: integration, global change research, ready for dialogue, risk management and long term scenario thinking.

Figure 2-1 illustrates the main themes, the knowledge project plan builds on. Projects are selected by the consortium to cover sectors that have been identifies as particularly relevant to climate and spatial planning. Sectors include: biodiversity, agriculture, fisheries, fresh water, coastal areas, transport on land and water, land-use related energy production, business, finance and insurance, institutional setting.

3 Knowledge project: situation analysis

3.1 Scientific and socio-economic problem definition

Spatial planning offers a unique opportunity for both reducing greenhouse gas emissions (mitigation) and making the Netherlands less vulnerable for the effects of increasing climate variability and climate change (adaptation). However spatial planners and the climate change community have so far had mostly separate (research) agendas. The existing Dutch knowledge infrastructure presently fails to meet the increasing demand for integration of climate change considerations into spatial planning. In addition chances are missed to cash opportunities that the mutual supportiveness of climate change and spatial planning offers to policy makers and businesses. Policy measures to limit effects of climate change (mitigation) and measures to adapt as a society to climate change in the field of use of land and water (adaptation) have to be developed and implemented. To gain a better insight in the interaction of climate and spatial planning extensive climate, spatial and socio-economic data will have to be efficiently linked, integrated and consolidated.

In this light the problem definition of this knowledge project plan faces a two fold challenge to:

1. develop a knowledge infrastructure for dialogue, exchange, collaboration and co-ordination of research and development between members of the science community, policy makers and the business community.
2. fill specific gaps in knowledge on the interface of climate change and spatial planning, with special attention to the national and local level.

The Netherlands has committed itself to the targets in the Kyoto Protocol. However a much further-reaching reduction of greenhouse gas (GHG) emissions of up to 80% towards the end of this century is needed to deflect the anthropogenic contribution to climate change. Both on the short- and long-term the economy of the Netherlands is faced with a difficult challenge. Dealing with Climate Change does not stop at the Kyoto commitments.

Climate Change after the Kyoto commitments

An integrated approach of monitoring, mitigation and adaptation measures could contribute considerably to fulfilment of international obligations to reduce emissions. The Netherlands has committed itself to reduce its emissions by 6% in the period 2008-2012 relative to 1990. A difficult task, considering the fact that in 2000 emissions increased by 2% in spite of the implemented climate policies. To a stop the anthropogenic contribution to climate change requires a far-reaching emission reduction of 80% on the long-term. This implies a transition towards more sustainable and climate-neutral economic development where emissions are detached from economic growth. This transition goes far beyond the current sectoral policy objectives and beyond the domain of single sectors. It is about system innovation in which different sectors are involved simultaneously. A transition like this will take several to many decades and involves geographical scales that go beyond the Netherlands.

The challenges of long-term climate policy (2050-2100) versus immediate societal issues demand for transitions. Transitions are drastic changes that are required to address complex problems. Transitions are not implemented overnight but require a slow carefully managed process, involving many actors with different short and long-term perspectives. Transitions in relation to the climate change issue will take time. Time, in order of decades, and involve geographical scales that go beyond the borders of the Netherlands. There is a strong need for long term planning, strengthening and co-ordination of activities.

A transition is necessary to meet the following challenges:

- achieving an 80% emission reduction target of greenhouse gas emissions towards the end of this century, transitions are necessary in energy supply, in industrial activities and land use. Improved physical planning can assist in achieving such challenge.
- a paradigm shift is in the Netherlands, from "Keep the land dry, and build higher dikes to be safe" towards "Living with floods and droughts" to cope with sea level rise, extreme weather events and changing river discharges.

Pitfalls are manifold in achieving transitions including:

- Paradigm shifts implicate allocation of more space for natural dynamics in a highly urbanised country in which the physical space is part of a highly competitive market.
- It is difficult to take adaptive measures well before stakeholders recognise risk or experience damage.
- The government has insufficient overview of the technological and economic possibilities to steer the transition process of our national energy economy (VROM Raad, 1998).
- Initial expenses will have to made in order to yield (long-term) returns: the "Optiedocument" estimates the annual costs of the present climate policy between 0,5 and 2 billion Euros in the year 2010. Later, the costs will increase quickly. This is related to increased emission reduction efforts. Investments in the long-term promising options are needed right now to maintain reduction costs manageable after 2010.

The consortium has identified four major themes as a framework for translating the problem definition into research questions and concrete knowledge projects. The next section introduces the knowledge questions addressed under the four main themes: climate system, mitigation, adaptation and integration. The project plan is designed to create a learning environment for its consortium members and other partners in which knowledge questions can be addressed adequately and coherently. Although partners can table projects in a later stage, a significant number of projects has already been defined as part of this knowledge project plan, answering the key questions. Chapter 6 describes the implementation of the project plan and introduces the knowledge projects.

3.2 Key questions

The problem definition of the previous section translates into concrete research questions that the project plan wishes to address.

3.2.1 Theme 1: Climate scenarios: tailor-made Climate Scenarios and climate data management for decision support in spatial planning

Spatial planning in a changing climate requires detailed knowledge about present-day's climate and possible climate change in north-western Europe. This data should not only be available to scientists but to society as a whole. To respond adequately to the threats and challenges that come with climate change, government, businesses and the general public need to be informed about what lies ahead. Presently however climate change scenarios and data are scattered, incomplete and of a resolution unsuitable for regional decision making.

Under theme 1 'Climate scenarios' of this knowledge project plan consortium partners will realise projects aimed at advancing tailor-made regional and local climate scenarios and access to detailed and reliable climate information. Monitoring and modelling are essential tools to reach these objectives. Projects tie in closely with the international research agenda of the IPCC, the EU 6th Framework Program and a number of major US and European funded research initiatives.

More specifically the following research questions are addressed:

Communication of climate information

- Who are potential users of climate information and what are their data requirements?
- How to design a data centre for climate information that allows users to access different data formats and provide feedback on data provided?

Production of climate scenarios relevant for spatial planning

- How do extreme events in precipitation and wind change in the 21st century?
- Can a regional climate model (RCM) derive time series to drive models of river discharge or storm surge?
- What weather patterns, caused by anthropogenic forcing, can we expect?
- What is the relation between the dominant circulation patterns influencing Western Europe and the regional climate?

Assessing the future by exploring the past

- How to provide precipitation and temperature time series from the 18th century up to present at very high (sub-daily) time resolution?
- What will the occurrence of rare extreme events be according to a record of climate variability under initial CO_2 conditions dating back a few thousand years?

Monitoring vital climate parameters

- What is the spatially and temporally resolved distribution and trend of solar fluxes, aerosol, clouds and greenhouse gases over the Netherlands and Western Europe?
- Will climate change alter the Thermohaline Circulation (THC) with potential enormous and abrupt impact on our climate?

Uncovering the role of vital processes in shaping our climate

- Can we set-up and evaluate a fine scale model of the middle part of the Netherlands with the specific purpose to derive surface fluxes of sensible and latent heat and greenhouse gases?
- Can we map surface fluxes for practical application in water conservation and drought detection, using satellite and model outputs?
- What are trends in aerosol loading over the Netherlands and to what extent do they influence climate, directly, and indirectly through their effect on clouds?
- Will a new parameterisation of root water uptake improve modelling of the effects of crop choice and land use/groundwater management?

3.2.2 Theme 2: Mitigation and monitoring of greenhouse gases and aerosol emissions

Complying with emission reduction commitments following the implementation of the Kyoto protocol and future commitments under the UNFCCC requires a boost in knowledge and data infrastructure to (i) meet UNFCCC national reporting in a most cost effective way, (ii) integrally assess emission reduction, cq mitigation strategies both in the Netherlands and in for co-operation promising countries abroad and (iii) develop verification methods to independently assess the effectiveness of mitigation measures and the reliability of (inter)nationally reported data.

Although reduction targets for the first commitment period under the Kyoto Protocol are relatively modest, they are likely to become more demanding, requiring transitions in energy, industrial and land use related sectors. Challenges are decentralisation of mitigation policies and facilitating the Clean Development Mechanism and emission trading within and between economic sectors and countries. In terms of spatial planning these instruments relate to 'sinks' projects and/or biomass production for energy. Especially land use related emissions are relatively poorly understood and quantified.

This knowledge project plan provides a platform for the dialogue on mitigation and the monitoring of emission(-reductions) between scientist, policy makers and private stakeholders. Research questions feeding the dialogue under Theme 2 'Mitigation' include:

Greenhouse gases and aerosol emission information system

- What is the spatial and temporal variation of greenhouse gases and aerosols exchange between the land surface and atmosphere?
- How are different greenhouse gas (GHG) sources and sinks linked? How do transitions in land, water and nutrient use affect short and long term GHG emissions?
- What is the overall effect of sulphate and nitrate aerosols on regional climates?
- How can we develop and implement a cost efficient information system on GHG, aerosol emissions, and the relevant land-based parameters determining these two that is easily accessible

Land use and mitigation

- What is the potential of land-use related mitigation in the Netherlands looking at emission prevention, carbon sequestration and substitution?
- How does mitigation in the Netherlands fit into the European and global context of land-use and land-use change?

Land use and energy; the transition towards a sustainable energy system

- What comprehensive evaluation tools do regional planning and energy policy require?
- How to increase the share of renewable resources and carbon neutral fossil fuels in spatially differentiated energy scenarios?
- What are opportunities and threats of European biomass production and trade flows for the Netherlands?

Integrating mitigation and adaptation policies (a case study)

- How to quantify and integrate effects on greenhouse gas emission reductions into land and water management in the Dutch fen meadows
- What sites will be chosen for measurement and dialogue?
- What stakeholders will be involved and what is expected from participatory planning?

Climate neutral entrepreneurship

- What methodologies for benchmarking and for the measurement of carbon footprints do best fit the needs of the corporate sector and how can the spatial component be considered in these instruments?
- What are the economic and environmental benefits of climate neutral strategies?
- What tools assist the corporate sector in moving towards climate neutral entrepreneurship?

3.2.3 Theme 3: Adaptation

This theme focuses on exploiting new adaptation strategies in the Netherlands for sustainable alleviation of negative effects of climate change and climate variability. Projects are realised in a multi disciplinary network jointly assessing impacts and developing adaptation strategies. Special focus will be paid to loss of efficiency of investments in biodiversity (e.g. the National Ecological Network, EHS), changes in food and fibre production, impacts on housing transport and infrastructure, impacts of sea level rise on agriculture and flood risks. Climate scenarios developed under Theme 1 and evaluation techniques implemented under Theme 4 are an important input.

More specifically the following research questions are addressed:
- What climate impacts are to be expected on the Dutch National Ecological Network? How will the abundance and distribution of plant and animal species, including invasive species change?
- How can coastal flood risk be integrated into spatial planning?
- How can agriculture adapt to brackish water conditions following sea-level rise?
- What role can financial arrangements, like banking services and new insurance arrangements related to flood risks and land use re-allocation, play?
- What adaptation is needed in the transport sector? Can water related strategies be combined to enhance accessibility of Rotterdam Harbour under climate change?

3.2.4 Theme 4: Integration

This project plan provides a platform for the dialogue on climate change and spatial planning between scientist, policy makers and private stakeholders. An essential element is the integration of project results carried out under this project plan and the expertise and special demands of project partners.

Research questions feeding the dialogue under Theme 4 'Integration' include:

Integrated assessment and dialogue; tools for decision making
- How do technologies and institutions interact in assessing the viability of management options?
- What relevance does the research carried out under this project plan have for policy making and science?
- What materials for training and education will communicate the research findings under the project plan?
- What theoretical framework can be used to select participatory approaches on the regional and local level?
- What (inter)national and local institutional arrangements benefit emission reduction projects?

Cost benefit analysis
- What are the socio-economic consequences of adaptation options in agriculture and forestry related to changes in temperature, precipitation and water regime, including salinisation?
- What are cost and benefits of adaptation options in water management
- What are cost and benefits of land use related mitigation strategies abroad both for the Netherlands and the partner country?
- What economic value can be assigned to the statistical lifetime of specific forms of land use and protection against flooding?
- How can adaptation be funded by bilateral development co-operation organisations and the UNFCCC on equitable use of Kyoto Protocol Adaptation Fund?

Knowledge exchange and dissemination
- How can stakeholders' knowledge be used to strengthen research?
- How to convey a sense of urgency to a wider public?
- How to tailor climate information (scenarios and time series) to users needs?
- How to give both the general public and intermediary actors access to climate data through a website?
- How to integrate climate change considerations in the educational system?

4 Scientific relevance

4.1 Introduction

Climate change is a problem with unique characteristics. It is global, long-term (up to several centuries), and involves complex interactions between climatic, environmental, economic, political, institutional, social and technological processes. This may have significant international and intergenerational implications in the context of broader societal goals such as equity and sustainable development.

Developing adequate responses to climate change is characterised by decision-making under uncertainty and risk, including the possibility of non-linear and/or irreversible changes, which enhance greenhouse gas emissions; and induce technological change and diffusion, contributing to wider goals of sustainable development. Such decision making should cover all scales. Emissions, for example, are generated by local activities and only become globally significant through their cumulative effects. Impacts stem from global change in atmospheric composition and climate, but their magnitude depends strongly on local conditions, sensitivity and adaptation capacity.

In 2001 the Third Assessment Report (TAR) of the Intergovernmental Panel on Climate Change (IPCC) was published (Houghton *et al.*, 2001; McCarthy *et al.*, Metz *et al.*, 2001) followed shortly by a comprehensive Synthesis Report, that addressed policy concern; (Intergovernmental Panel on Climate Change, 2002). These reports build upon past assessments and incorporate new results from the past five years of research on climate change. They clearly show the enormous progress that has been made but simultaneously conveys modesty because of the unknowns and uncertainties. They provide, however, an overview of the most up-to-date understanding of the climate system, of climate change and its impacts and ways to respond.

State of the Art

Climate Change
An increasing body of observations gives a collective picture of a warming world and other changes in the climate system. The global-average surface air temperature has increased since the mid 19th century. Temperatures have risen during the past four decades in the lowest few kilometres of the atmosphere. Snow cover and ice extent have decreased. Global average sea level has risen and ocean heat content has increased. Regionally, climate changes have already affected many physical and biological systems and there is evidence that floods and droughts have affected some human systems.

Emissions of greenhouse gases and aerosols due to human activities continue to alter the atmosphere in ways that affect the climate system. Concentrations of atmospheric greenhouse gases, with associated radiative forcing, have continued to increase due to human activities. Most anthropogenic aerosols are short lived and generally produce negative radiative forcing. Natural agents have contributed small amounts to radiative forcing over the past century.

Figure 4-1 illustrates that the global average near-surface temperature has increased about 0.6º C, that the rate and duration of warming of the 20th century has been much greater than in any of the previous nine centuries, and that the 1990s have been the warmest decade of the previous millennium. Another key finding is that sea level has risen on average by 1-2 mm per year and precipitation has increase by 0.5 to 1 % per decade over much of mid- and high latitudes of the Northern Hemisphere.

Climate change mitigation will both be affected by, and have impacts on, broader socio-economic policies and trends, such as those relating to development, sustainability and equity. Forests, agricultural lands, and other terrestrial ecosystems offer significant carbon mitigation potential. Although not necessarily permanent, conservation and sequestration of carbon may allow time for other options to be further developed and implemented. There is no single path to a low emission future and countries and regions will have to choose their own direction. Most model results indicate that known technological options could achieve a broad range of atmospheric CO_2 stabilisation levels over the next 100 years or more, but implementation would require considerable socio-economic and institutional changes. Social learning and innovation, and changes in institutional structure could contribute to climate change mitigation. The successful implementation of greenhouse gas mitigation options needs to overcome many technical, economic, political, cultural, social, behavioural and/or institutional barriers. This prevents the full exploitation of the technological, economic and social opportunities of mitigation options.

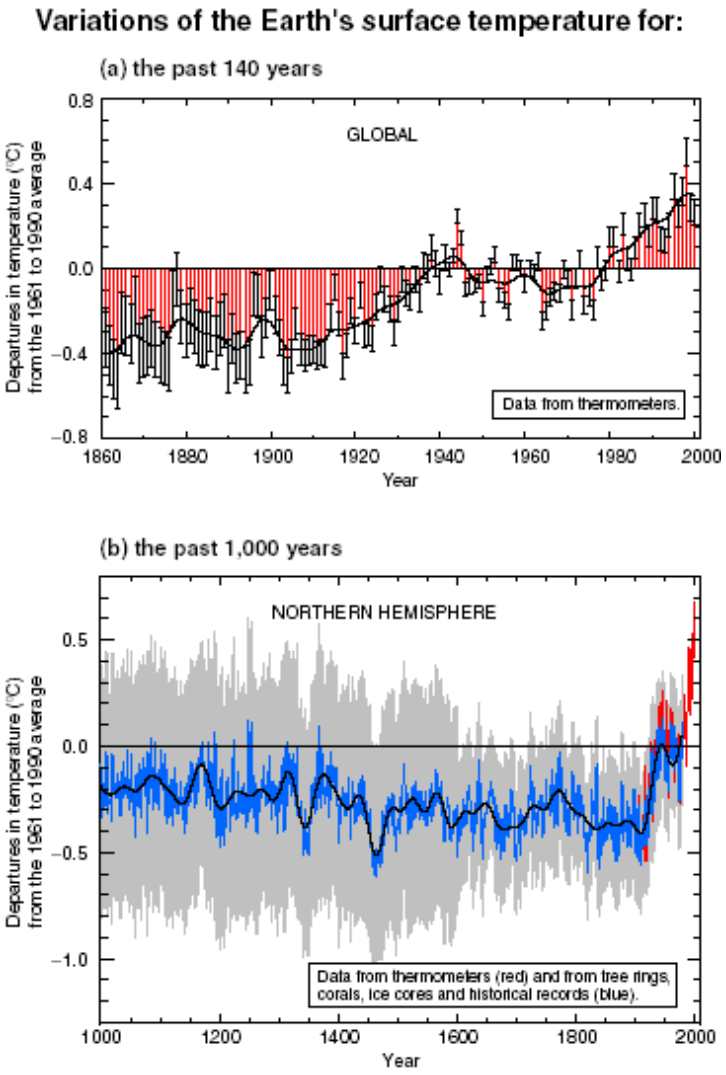


Figure 4-1: Variations of Earth's surface temperature over the last 140 years and the last millennium (IPCC TAR, 2001)

Confidence in the ability of global models to project future climates has increased. There is now stronger evidence of a human influence on global climate than ever before. Scenarios show that atmospheric composition will continue to change throughout the 21st century and that global average temperature and sea level are projected to rise. The latest assessment of the Intergovernmental Panel on Climate Change (IPCC, 2001) is that, globally averaged, the surface temperature of the Earth is projected to increase by between 1.4°C and 5.8°C over the period 1990 to 2100 as a result of human activities. Over the same period, an associated rise in global mean sea level of between 9 to 88 cm is projected.

Natural systems are vulnerable to climate change because of limited adaptation capacity. Many human systems are sensitive and some are vulnerable. Those with the least resources have the least capacity to adapt and are the most vulnerable. Adaptation is a necessary strategy at all scales to complement climate change mitigation efforts.

Climate and weather extremes

There has been increased attention on extreme weather and climate events over the past decade as a result of the largely exponentially-increasing losses that have been associated with them (Figure 4-2). Yearly economic losses from large events have increased ten-fold between the 1950s and 1990s. These losses largely reflect an increase in the vulnerability of society as a whole to extreme events (Kunkel et al., 1999). In many cases this increased vulnerability has not been matched by an appropriate increase in adaptive capacity. Part of the observed upward trend in losses is linked to socio-economic factors, such as population growth, expansion into and population concentration in flood prone areas, increasing wealth, as well as land use and river channel changes. However, these factors alone cannot explain the observed growth in

economic losses: a part of losses can be linked to climatic factors, such as observed changes in precipitation.

It is difficult to quantify the impacts of human activity on climatic extremes. Lack of long-term climate data suitable for analysis of extremes is the biggest obstacle to quantifying whether extreme events have changed over the 20th century, either world-wide or on a regional basis (Easterling et al., 1999). However, recent changes in climate variability seem to have adversely affected flood and drought hazards in several regions and this tendency is likely to continue .

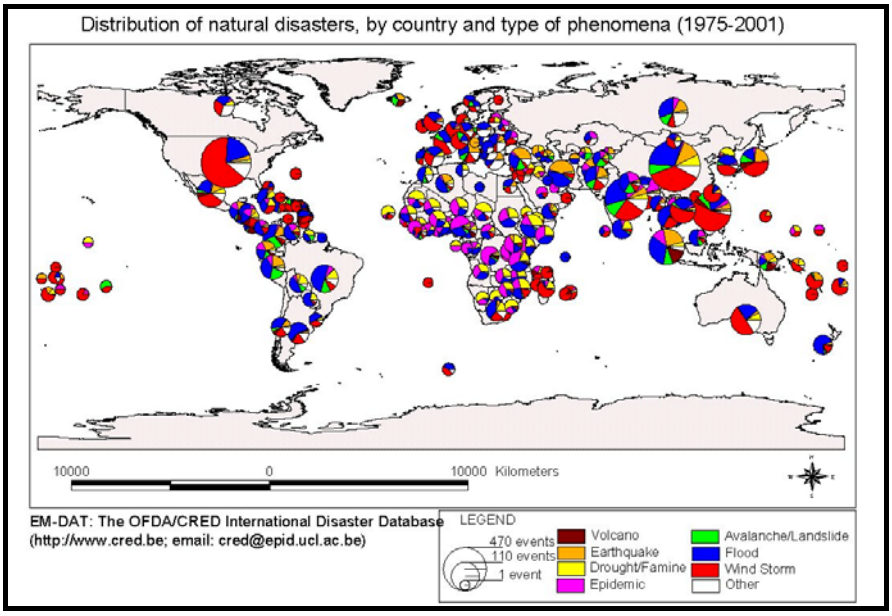


Figure 4-2: Distribution of natural disasters, by country and type of phenomena (Source: CRED, 2002)

Gaps in understanding

Many gaps in information and understanding, however, remain. Many factors continue to limit our ability to detect, attribute, and understand current climate change and to project what future climate changes may be. Further research strengthens future assessments and reduces uncertainties as far as possible so that sufficient information is available for policy making about responses to climate change, including research in developing countries. The following describes where further work is needed. Highlighted are specific areas of research addressed in our Knowledge Project Plan, between brackets the relevant Themes of the Knowledge Project:

- Improve systems and methods of long-term monitoring and understanding the consequences of climate change and other stresses on human and natural systems. Expand the observational foundation for climate studies to provide accurate, long-term data with expanded temporal and spatial coverage. Improve estimates of future emissions and concentrations of greenhouse gases and aerosols, and their forcings. **[Theme 2 and 1]**

- Address more completely patterns of long-term climate variability and their impacts on natural and human systems. Improve the integrated hierarchy of global and regional climate models with emphasis on improving the simulation of regional impacts and extreme weather events. **[Theme 1]**

- Understand and characterise more completely dominant processes and feedbacks in and between the atmosphere, biota, land and ocean surfaces, and deep oceans. Assessing possible thresholds at which strongly discontinuous responses to projected climate change and other stimuli would be triggered. Link more effectively, physical climate-biogeochemical models with models of the human system and thereby provide the basis for expanded exploration of possible cause-effect-cause patterns linking human and non-human components of the Earth system**. [Theme 1 and 2]**

- Develop quantitative assessments of exposure, sensitivity and adaptive capacity and vulnerability of human and natural systems to climate change. Develop methodologies for analysis of the potential of mitigation and adaptation options and their cost, with special attention to comparability of results.

Evaluate climate mitigation and adaptation options in the context of development, sustainability and equity. Cross-cutting these foci are crucial needs associated with strengthening the co-operation within the international research community, building research capacity in many regions, quantifying uncertainties and, as is the goal of this assessment, effectively and describing research advances in terms that are relevant to decision making. **[Theme 3 and 4]**

These conclusions about existing gaps in our knowledge highlight the complexity of the climate problem. All sectors in society and all natural ecosystems are or will eventually be affected. It stresses the necessity to look into both natural and anthropogenic climate variability, including the land/atmosphere interface in an integral approach, especially reinforcing the socio-economic component of both science and policy.

The Dutch knowledge institutions, government and corporate institutions must be adequately positioned in the European (EU, FP6) and global arena (international conventions, UNFCCC commitments, Global Environmental Change Programmes, and global monitoring) to guarantee adequate knowledge transfer and international imbedding. There will be many additional values through clustering of activities / opportunities:
1. Integration of climate policy, spatial planning and land use and water management;
2. Integration of monitoring networks on climate, emissions, impacts and socio-economic indicators;
3. Cross-sectoral and regional dialogues on adaptation and mitigation.

4.2 Scientific/technological innovation of the knowledge project

This project will address several of the knowledge gaps identified by IPCC and by the Global Environmental Change Programmes, most notably WCRP, IHDP and IGBP (Kabat et al, 2003); and these are then prioritised following Dutch policy needs. Its major innovative character is an integrated approach that highlights the complexity of many components of the causal chain and their interactions. Additionally, there will be a major dialogue on of knowledge and understanding of the climate system, which will greatly facilitate use in pragmatic and applied projects.

Methodology
Along several lines of research the main research topics in climate change and its spatial component will be addressed. Climate scenario development, mitigation, adaptation and monitoring, are the knowledge pillars of the project plan.

- Scenario development: advanced methodologies to measure, analyse, model and verify GHG emissions and climate parameters. Development of innovative methods to assimilate and consolidate data. The downscaling of climate models to a regional scale with an improved spatial and temporal resolution by modelling improvements.
- Mitigation: innovative methods to reduce emissions, maximising reductions given socio-economic limitations, and to be incorporated in multifunctional land use, considering also other demands for space.
- Adaptation: assessment of adaptation options, adaptive strategy development, incorporation in multifunctional land use, company strategy development
- Participatory methods and dialogue forms will be an integral part of each of these three themes, specifying the needed information products and translating these to policy support toolboxes.

The proposal comprehends a number of integrated and innovative projects focusing on monitoring, data assimilation, integrated assessments and climate dialogues on a regional and municipal level, water management, insurance and juridical aspects of climate change, education and communication. At the same time a multidisciplinary vision will be defined on the usage of land and water in the Netherlands in which the effects of climate change, emission reduction and adaptation policy will increasingly influence spatial planning.

Scientific and societal value if integration
Addressing these 4 themes in isolation would lead to unnecessary costs as we may fail to recognise synergistic opportunities in both scientific approaches and in application. Mitigation policies may prove to be unattainable because of a lack of public and corporate support, or may prove to be unsustainable under a changed climate. Monitoring efforts could easily forget to address parameters that might be managed through human intervention, and scenarios could also be formulated in terms sub-optimal for potential users. Integration across these 4 themes will better guarantee prevention of such omissions, sub-optimal solutions and cost ineffective measures.

On a number of specific sub-areas within the proposal new innovative solutions are to be expected on a methodological and technological level, as the result from close co-operation between knowledge institutions and the private sector. Examples to be named: high quality measuring devices, data transmission techniques, ICT applications and data-assimilation techniques, ICT and internet applications, E-communication and E-education.

The proposal is intended to offer a broad range of innovative solutions to science, policy makers, the private sector and civil society, including:

- The provision of society and industries with the knowledge and data to timely adopt to climate change effects;
- To adopt spatial planning and use of resources to reduce the emissions of GHG and to fulfil international agreements;
- To make climate change problems and effects part of daily life (participatory knowledge dissemination)
- To establish a prototype of a comprehensive multi-platform monitoring system for GHG emissions and associated climate parameters
- To develop innovative technologies and management systems to cost-effectively reduce emissions or increase sinks (sequestration).

4.3 Scope of the knowledge project within the defined context.

The scope of the knowledge project "Climate *Changes* Spatial Planning" is determined by its thematic foci and its mission: to face the challenges of living in a changing climate by fostering a dialogue between spatial planners and the climate community and making climate change a co-guiding principle for the spatial planning in the Netherlands. The scope is therewith touching upon the central themes of: knowledge of the climate system and climate scenarios, mitigation strategies of greenhouse gases and spatial implications, (spatial) adaptation options for our society to cope with the changing climatic conditions and integrating approaches to engage dialogues, stimulate communication networks and methodologies and interdisciplinary assessment approaches. The project envisages to contribute to our ability to detect, attribute and understand climate change and climate variability.

The knowledge project covers the entire knowledge chain, but it has clear ambition *to invert* the usual formula: instead of starting from fundamental disciplinary research on long-term issues with a high abstraction level and limited transparency to the users, we use a comprehensive mechanism to first articulate the knowledge questions by a broad consultation with the stakeholders, and then decide which focused research efforts, need to be undertaken, either applied or basic.. At the end of this knowledge chain the project aims at bringing attractive, easy accessible information for professional users, as well as for schools, mass media and for the average Dutch citizen.

Spatial scale of the Knowledge Project ranges from the global context of climate change as in frameworks as the IPCC and UNFCC / Kyoto Protocol to European Networks of Excellence down to national policy development and regional and local implementation of climate policy and specific mitigation and adaptation projects with involvement of local stakeholders.

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4.4 Scientific and/or technological knowledge to be gathered / developed, and competencies to be build

The project aims at filling the knowledge gaps as described before in this chapter by gathering and integrating members of the knowledge chain and to give a powerful boost to scientific and technological knowledge product development. We are just at the brink of understanding the whole complexity of the climate change issue and the whole range of implications for spatial planning and land use in the Netherlands. From the many desired developments and knowledge improvements follows a number of areas where the project aims at building and enhancing our mutual knowledge base:

- Better insight how to build and develop and downscale climate scenarios at a regional level.
- How to decrease uncertainties of scenarios and how to deal with them and how to communicate them to stakeholders.
- To develop a balanced mixture of mitigation and adaptation strategies through integrated assessment and cost-benefit analysis of spatial functions.
- To enhance the ability of the scientific community to transfer, translate and communicate their results and findings to policy, the application fields and society at large.

- To bring together multidisciplinary teams with backgrounds and expertise from the entire knowledge chain to tailor knowledge products and diminish communication problems.
- A better incorporation of climate change and climate variability implications in spatial planning and (mult-functional) land-use.
- Further development of criteria for CDM projects to optimise efficiency and efficacy in emission reduction projects and sequestration projects in particular. To contribute to the preparation and vision building for the Post-Kyoto era with special emphasis on LULUCF and nature conservation.
- To enhance our knowledge of the implications of Climate change induced seal-level rise on the safety of our coastal zone, fundamental for future socio-economic stability of our nation.
- To develop and better our understanding of and ability to predict river floods as a result and of changing climatic conditions and land-use by a better coupling and integration of hydrological and climatological models.

4.5 Specific problems or demands raised in the application field for the knowledge project

The ICES-KIS-3 mission is to bring together the different constituting elements of the knowledge chain. However by connecting these different entities from the public-private domain some traditional institutional and cultural bridges have to be crossed. We are facing different sets of preconditions for the different knowledge providers and knowledge users.

- Scientists are devoting their carriers to fundamental research and strongly adhere to scientific quality and the application and development of innovative but scientifically sound and peer reviewed methodologies. Their time frames, deliverables, culture and networks are specific and distinct. They nurture their independence and often have difficulties with what they consider as 'quick-and-dirty' contract work with tight time schedules.
- The managers and policy makers who are in demand of specific knowledge products for their daily practice (water boards, consultants, provincial and local authorities etc.) often have to work under a strong pressure to deliver timely and face specific constraints regarding finances, governance and public responsibility. Besides quality they have specific concerns regarding applicability of knowledge products which could require downscaling or adapting of information (e.g. a regional climate scenario for a water board) and influence factors as accuracy, uncertainty or probability. Scientists and those in the direct application world must tune their specific demands to come to terms with regards to specification of knowledge products.

To overcome this dichotomy the knowledge project plan envisages a constant dialogue between different partners and stakeholders to bring together the various representatives in the knowledge chain with their specific demands and languages. This process of discussion and participatory approach is needed to bridge the cultural barriers as described above and contributes to a better understanding of each other's motives and restrictions. It will promote a better translation and diffusion of state-of-the-art scientific knowledge and will stimulate scientist to tailor their knowledge products to the specific demands of those in the field of application.

The climate issue is a subject that by its very nature is connected to a long-term horizon as the impacts of climate change are predicted to increase with time the coming century and beyond. It is a time-frame with which many scientist are comfortable in making their models and scenarios but it also a time-frame that for those in the application field and for private corporations is too far from their day-to-day business activity or policy horizon. In this knowledge project plan both time frames are considered as they both are relevant and significant for science, society and economy alike.

4.6 Justification for linkage to European research programmes

In many European countries new centres are being founded to improve the insight in the relation between societal processes and the effects of these processes on climate and the use of land and water. Strategic alliances with, and good interaction with these new, leading European Centres (as the Tyndall Institute in England, and comparable institutes in Germany and the Scandinavian area) is actively aimed at by this proposal. One of the underlying ideas is establishing of a European *Network of Excellence*, which is actually being proposed to the sixth Framework Programme of the European Union. Many of the foreign partner institutions have indicated to warmly support a multidisciplinary programme on climate change in the Netherlands.

The proposed Knowledge project plan ties in with pillar A of the EU sixth Framework Programme (FP), the so-called priorities. Priority 6, "S*ustainable development, Global change and Ecosystems"* matches the most the thematic scope of the project plan. Research to be undertaken under this priority will be complemented by the development of advanced methods for risk assessment and methods of appraising environmental quality, including relevant pre-normative research on measurements and testing for these purposes.

Many of the leading Dutch institutions involved in this Knowledge Project have already research projects ongoing under the 5th FP of the EU, and are actively involved in preparations of new projects to be submitted under the 6th FP. These projects are thematically closely connected to all main themes of the proposed Knowledge Project. The synergy and co-operation which will be developed between these European projects and the ICES KIS Knowledge project present one of the most important international (European) dimension of the Dutch research activities in field of Climate and Spatial Planning. Examples of the European projects which will be strongly linked to ICES KIS Knowledge Project are:

- CLOUDNET/CLIWANET on climate monitoring and processes
- PRUDENCE on regional climate scenarios
- DAEDALUS, EOROTRAC on aerosol- en and transboundary air pollution transport
- CARBOEUROPE cluster; quantification and understanding of the European carbon balance
- GMES operational satellite information for environmental and climate studies
- enVISage, sustainability and Integrated Earth system approaches
- PEER, Biodiversity ,Landscape planning, Aquatic ecosystems, pollution and its remediation, Global Change, PA and DSS tools

The National Platform on Climate (see Chapter 7) that is currently being initiated tends to harmonise the Dutch input in international programmes related to climate, among which the sixth Framework Programme. The goal is to ensure that the Dutch contributions are embedded in both the national and international ongoing state-of-the-art climate research. Relevant EU FP-5 and FP-6 research projects and networks are:

Linkage to other international programmes and networks

This proposal aims also at facilitating a good connection of the Dutch knowledge institutions to "new" forms of dialogue on climate, both within Europe as in a global setting. These new international fora embrace the underlying thought of this ICES KIS initiative: knowledge integration and a dialogue between actors form science, policy and the private sector. A European Climate Forum (ECF) was founded, stimulated by the European Commission, in which the predominant European "global change" institutes, large industries and societal organisations discuss sustainable solutions for the climate change issue. The European Climate Change Programme (ECCP) is a comparable body with direct participation of national governments. The ECCP addresses cost-effective emission reduction policy options on a European scale.

The Netherlands research on global change is well embedded in, acknowledged by and co-steering in the three large international scientific programmes in the field of global change research: the International Geosphere Biosphere Programme (IGBP), the World Climate Research Programme (WCRP) and the International Human Dimensions Project (IHDP). The present proposal enables the consolidation and renewal of this position.

In the field of monitoring the Global Monitoring for Environment and Security programme (GMES) was initiated in which various EU member states have a substantial contribution. This initiative links to comparable global initiatives, such as the Global Observing System (GCOS, GOOS, GTOS), operational networks of the WMO and UNEP, or for instance the Global Atmosphere Watch. This apparent explosion of monitoring initiatives is illustrative for the urgency to create these types of international alliances and networks. At the same time the need for co-ordination and integration is recognised. All of the programmes mentioned above collaborate in the Integrated Global Observing Strategy. The proposed knowledge project plan offers a unique opportunity to safeguard the connection of the Netherlands to these international initiatives.

5 Economic and social relevance

5.1 Present and future challenges in the knowledge infrastructure

The issues of climate and climate change and the implications for our spatial planning constitute very important challenges for the Netherlands, now and in the future. Living in the delta of several major rivers and always close to coastline, every Dutch citizen is aware of the danger of rising sea levels and of the possible impacts of frequent floods. The historic concern prevalent in the Netherlands for natural hazards has been provoked by the recent strong indications that our climate is changing (IPCC 2001).The climate issue has caught attention and every new extreme event or record broken revives public interest. Temperatures rise, and precipitation patterns are predicted to change and to entail more extremes. Climate is a driver of change that cuts through sectors and regions and has an indisputable impact on the socio-economic development of the Netherlands.

The climate issue has diverse impacts on society, ranging from safety implications from rising sea-levels and alluvial floodings to impacts on nature, agriculture, the urban environment, transport, industry and tourism. A whole series of recent policy documents tackled various aspects of the climate issue and its consequences for land-use and spatial planning from different sectoral and disciplinary points of view. Also a recognition emerges of the need to decouple economic growth from ever-increasing anthropogene greenhouse gas emissions and other environmental pressures. These documents illustrate that we have just started to develop a more integrated level of consciousness to respond to the serious challenges we are facing as a society and economy under changing climatic conditions. The goal of the proposed knowledge project plan is to contribute to the development of solutions to these challenges and to tackle loopholes in the existing knowledge infrastructure. The possible impacts of climate change for the Netherlands and its economy are multi-fold and far-reaching.

Table 5-1 gives an overview of climate relevant issues identified in various policy documents.

5.2 Benefits to society and economy

The knowledge project plan reinforces the knowledge infrastructure in the Netherlands by joining the best expertise available in the area of climate change and by developing new methods and approaches for assessing climate change impacts, and exploring options for mitigation and adaptation in the Netherlands. This will contribute to socio-economic efficiency in the short and long term, as specified below, by reducing the mitigation and adaptation costs and by reducing the damages that may occur. Thus the knowledge project will contribute to a reduction of the environmental costs associated with economic progress and increase the sustainability of our way of living.

Anticipating the potential impacts of climate change and timely mitigation of its causes inevitably reduces future damage to our economic, social and environmental assets. Mitigation and adaptation measures require investments of billions of euros. Important choices with respect to specific policy measures and management options will have to be made. Choices for modest investments now to safeguard us from uncertain risks in the future must be balanced against postponed investments that might be orders of magnitude larger when made in response to actually materialised hazards. If the issues of climate change, spatial planning, water- and environmental management are not approached in an integrated manner, it could lead to sub-optimal and inefficient governmental policy and management approaches with consequences for the private sector and society at large. Severe damages may occur, goals will not be achieved or only at reduced economic and societal efficiency. New knowledge on mitigation and adaptation, when followed by practical application in policy and private sectors, has the potential to make more efficient use of limited funds, time, and human, natural and geographic resources.

Table 5-1 gives an overview of climate relevant issues identified in various policy documents

Policy principles / Goals	Execution	Relation with Climate and spatial planning
Fifth Policy Statement Spatial Planning, Spatial analysis 2000: The value of a good subsoil (VROM) Vijfde Nota Ruimtelijke Ordening, Ruimtelijke verkenningen 2000: Het belang van een goede ondergrond (VROM)		
• Spatial quality • Vital rural areas • Preserve urban/rural contrast • Intensify, combine and transform • Landscape strategy for spatial development • Tier approach: spatial organisation in close relation to sub -soil and water systems • More cohesion and co-operation in relation with and use of sub-soil	• Urban networks • Balanced landscape visions • Green and red contours • Water test • Tier approach for management • Develop multidimensional arrangement of sub-soil • Process management for long-term developments	• Strengthen ENS with robust corridors, incorporating climate change • Intensify: co-location of heat producing and heat requesting functions (e.g. energy plants and greenhouse farming) • Combine extensive agriculture with new functions • Transform: transition to nature for areas where climate changes poses limitations for man
NMP4 (VROM), Climate policy in practice I and II, Set principles, new arrangements (VROM) Uitvoeringsnota's Klimaatbeleid I and II, Vaste Waarden, Nieuwe Vormen (VROM)		
• Sustainability • Quality of life • Broad and far-ranging visions • Key *Environmental problems*: Biodiversity, climate change, over-exploitation of natural resources, public health threats, external safety, degradation of living environment	• Area oriented approach • Promote sustainable agriculture • Internalisation environmental costs	• Regional, sector-transcending dialogue to increase public support for adaptation and mitigation • Mitigation and adaptation measures as new functions for agriculture • Emission reduction contributes to public health • Climate change may entail surprises • Economic value of belowground functions
Water policy documents and Cabinet statements 4de Nota Waterhuishouding, WB 21, Over stromen, 3de Kustnota		
• Increase of safety • Limit flood damage • Protect fresh water supply (quantity & quality) • Sustainable solutions	• Move with the water ('room for water'), but based on: • Societal cost-benefit analysis between various solutions for damming- and room for water • Spatial arrangement based on water systems • Water test • Catchment management	• Monitoring, climate projections and scenarios: precipitation patterns, temperature and sea level rise as input for integrated policy decisions • Contribution to Integrated Assessment of vulnerability, fresh water supply and water safety systems
Nota Belvedère (OCenW, LNV and VROM)		
• Cultural planning • Cultural identity • Preservation through development	Belvedère areas	Socio–cultural aspects contribute to awareness concerning climate change and the support for a spatial dimension of climate policy
Voedsel en groen (LNV), Licht op groen (LNV), Natuur voor mensen, Mensen voor Natuur (LNV)		
• Corporate social responsibility • Contribution to landscape quality • International competition • Quality of living environment • Preserve rural and urban identities • Bringing nature closer to the people • Nature facelift	• Promotion of public interest • Green-blue veins • Studies in experimental gardens	• Responsible entrepreneurship = emission-neutral use of space • Bio-energy, and management of the regulating functions of the underground • Space for Climate = space for the rural area • Awareness raising of land owners of regulating functions of the subsoil, valuation of management • Combine recreation function with C-management – nature –agriculture and water management.
National Traffic and transport Plan (V&W)		
Nationaal Verkeer en Vervoers Plan (NVVP, (V&W)		
Mobility, but in balance with liveability, sustainability and safety	• Exploit existing infrastructure, • Pricing: a strong relation between use and price of mobility • Building, where bottlenecks persist.	• Emission-neutral traffic- and transport chains • Safety of infrastructure in relation to weather extremes
Contact the future, The economy of the 21st century Contact met de toekomst, De Economie van de 21ste eeuw (EZ)		
• Opening up of information for citizens and companies • Knowledge- and network economy • ICT as driving force	• ICTand E-tools, among which geo-ICT • Generate and disseminate knowledge • Collaboration of government and private sector	• Access to emission and monitoring data: the climate desk of the Virtual Core Centre Climate

Table 5-1: Overview of a number of societal and economic challenges induced by the climate issue and the approaches chosen in the knowledge project plan to address these challenges.

Table 5-2 gives an overview of a number of societal and economic challenges induced by the climate issue and the approaches chosen in the knowledge project plan to address these challenges. The challenges are dived into governmental challenges and challenges for the private sector and the public-private domain.

SOCIETAL AND ECONOMIC CHALLENGE	APPROACH IN KNOWLEDGE PROJECT PLAN
Government:	*Science community:*
In the most recent National Environmental Policy Plan (NMP4) climate change is identified as one of the seven major environmental problems. The climate issue occupies a special position as it can exacerbate the effects of the other signalled problems. To respond to the impacts of climate change in a late phase will lead to much higher costs than if climate change is anticipated with in an early phase. Additionally, many measures taken to alleviate the other environmental problems will also contribute to mitigate climate change, or to prevent grave impacts (Streekstra, LTO Nederland).	Mitigation and adaptation projects will be linked to sectors of society where the shared issue of climate and land use is of major concern: biodiversity, agriculture, fisheries, water management, coastal zone management, the energy sector, transport (over land and water), entrepreneurship, housing, financial arrangements/insurances and institutional framework. Sectoral goals and related (inter)-sectoral climate knowledge questions are dealt with through an integral chain approach, aimed at combining scientific, societal and economic actors.
Implementation of decentralised climate policies on provincial, regional and municipality levels appears to be problematic.	Local authorities will be involved in the dialogue with researchers and central government, thus increasing their commitment to the climate issue and to policy implementation on a local scale.
The government as planner, funding agency and manager of (new) infrastructure, as planner of land use, needs a new philosophy on safety and risk.	An integrated approach of adaptation and projects related to knowledge driven policy will provide innovative points of view.
The Netherlands are a major player in the international negotiations on the climate issue (IPCC, Kyoto Protocol) and Dutch climate researchers have distinguished themselves in international research bodies. There are major challenges to clarify and emphasise the synergy between the important international conventions, such as the climate convention (UNFCCC), the convention for biodiversity (CBD), convention on air pollution (Goteborg protocol), convention to combat desertification (CCD), etc	As part of this knowledge project plan a clearing house will be installed that will provide a gateway to all expertise accumulated in the knowledge project consortium. This will facilitate better support of Dutch negotiators in international conventions. The Centre will facilitate the dialogue between the corporate sector and government to ensure a social responsible and economic attractive usage of a.o. the flexible Kyoto mechanisms.
Internationally it is agreed upon in the Kyoto Protocol that the rich developed nations will support the developing countries in their efforts to cope with the impacts of climate change. During CoP-5 the industrialised nations have been called upon to contribute, through multilateral and bilateral programmes, to finance adaptation measures. The Netherlands wants to respond to this call, both multilaterally as on a bilateral level.	Knowledge questions within the themes mitigation and adaptation focus on turning investment projects "climate-neutral" and on exploring economic and social pre-conditions under which existing programmes in developing countries could be intensified. The knowledge project offers an integral knowledge tool box with regards to region specific impacts of climate change. It addresses among others areas identified by IPCC as important: coastal zone management, forestry (LULUCF), food production, health and biodiversity.
The private sector:	
Large corporations as SHELL and BP acknowledge the risks and implications of climate change. Besides energy efficiency and the development and application of renewables, the private sector invests in measures to reduce emissions in their productive chain. This investment in 'carbon management' is part of a philosophy to turn entrepreneurship "climate-neutral" as part of a broader corporate responsibility to strive for a sustainable and social acceptable form of corporate activity.	Within the projects are envisaged to engage and stimulate an active dialogue between the corporate sector, science and government to research, promote and communicate corporate strategies to reduce emissions and to strive for sustainability by adapting climate-neutral options. The direct participation of the private sector in developing a high-quality monitoring, assimilation and information system can provide for a technological edge, that offers opportunities for new Dutch knowledge export products.
The public-private challenge:	
A broad recognition of the climate issue and of the potential impacts forms a *conditio-sine-qua-non* to achieve an adequate and timely policy to adapt the planning, management and usage of the country side (De Raad voor het Landelijk Gebied, 1998).	The knowledge project plan explicitly identifies scientifically proved, integral solutions for the implementation of a Dutch climate policy (mitigation and adaptation) with special attention to new forms of multifunctional usage of land (and water).
De-coupling of economic growth and greenhouse gas emissions. The Netherlands has committed itself to reduce its emissions by 6% in the period 2008-2012 relative to 1990. A difficult task, considering the fact that in 2000 emissions increased by 2% in spite of the implemented climate policies. To a stop the anthropogenic contribution to climate change requires a far-reaching emission reduction of 80% on the long-term. Both on the short- and long-term the economy of the Netherlands is faced with a difficult challenge.	The integrated approach of monitoring, mitigation and adaptation measures could contribute considerably to fulfilment of the international obligations the Netherlands has committed itself to in the framework of the Kyoto protocol. Monitoring of the climate system can only be addressed effectively through international collaboration and networks. The climate inherently is not restricted to administrative borders and the necessary infrastructure such as satellites and measuring airplanes require a considerable investment.

Table 5-2: societal and economic challenges induced by climate change

The knowledge project focuses on improving the policies in these areas and it will lead to substantial cost savings. An important contribution to sustainable development will be made by introducing new approaches for mitigation and adaptation, based on profound technological and socio-economic analysis. Thus the potential impacts of climate change in the Netherlands will be reduced, and costs of hazards avoided. Also attention will be paid to related environmental problems, like acidification and eutrofication, smog formation and trans- boundary air pollution, as mitigation options for each of these issues generally are also (at least partly) effective against some of the others. Thus the cost-efficiency of measures can often be substantially increased.

By strengthening the scientific infrastructure the competitive strength of the Netherlands and its knowledge based economy is enhanced, and avoided damages will lead to a stronger position of the exporting industries in the Netherlands. More directly, spin-off from the expected innovations, both hardware (e.g. new monitoring systems) and expertise (consultancy) will be marketable and will lead to direct commercial revenues. Internationally, the knowledge project will lead to a strengthening of the Dutch scientific position, e.g. in the institutional framework of IPCC and UNFCCC, but also in competitive international research markets like the European Framework programmes.

Direct economic revenues

Based on estimates of the integral costs of climate measures to be taken by the Netherlands (a/o. NMP 4, Uitvoeringsnota klimaat 1 and 2) an estimate has been made of the potential direct benefits of the proposed knowledge project plan (see Table 5-3). Through a multidisciplinary approach and implementation of high-quality knowledge structures on the long-term an average yearly saving of 100 to 800 million Euros can be realised (estimated efficiency improvement between 5 – 15%). This can even be higher if abatement is done in an integral way addressing different environmental problems at the same time from the climate change perspective.

The Dutch policy documents "Uitvoeringnota's Klimaatbeleid I (1999) and II (2000) have indicated the policy instruments in order to fulfil our emission reduction obligations. The Evaluatienota Klimaatbeleid (2002) assesses the effectiveness of chosen policy measures. We have to pursue a robust strategy and to ensure a high degree of certainty that policy measures will have effect. If permitted emission levels are exceeded we will be penalised (according to the Kyoto Protocol) and we will have to obtain larger reductions (1.3 times as high) in the following period. This will require a considerable increase of costs. Contrary to the targets set the GHG's emissions in 2000 in the Netherlands were 2% above 1990 reference and for CO_2 only the situation is even worse (RIVM 2002: Olivier et al. and Evaluatienota Klimaatbeleid 2002). CO_2 emissions will continue to rise the coming decade and an absolute de-coupling from economic growth will not be achieved. A more robust strategy has to be pursued to attain a higher degree of certainty that targets can be met.

Table 5-3: Socio-economic return on the mid- to long-term.

Policy outlook	Yearly costs until 2010 (M€)	Potential efficiency improvement (%) by proposed knowledge project [6]	Potential efficiency improvement by proposed knowledge project (M€)
Mitigation measures			
- national	1080 [1]	5-15	54-112
- international	193 [2]	5-15	10- 19
Adaptation measures			
NMP4	3379 [5]	0-5	0-169
NVVP	8000	0-5	0-400
NMMN	300	5-10	15- 30
Losses by 'extreme events'			
- storm	287 [3]	5-15	14- 42
- precipitation / floods	100 [4]	5-15	5- 15
Total			**98-787 million EURO/year**

Based on

1. Uitvoeringsnota Klimaatbeleid I; NMP4 even mentions ~3136 mE/yr for transition to a more sustainable energy management
2. Uitvoeringsnota Klimaatbeleid II (4.4): Costs JI + CDM for 2001/2002
3. Dorland et al, Modelling storm damage in the Netherlands and the UK. In Tol (eds), 2000. Weather impacts on natural, social andeconomic systems in the Netherlands. IVM report.
4. Easterling et al 2000. Science 289: 2068-2074
5. NMP4: biodiversity 113 mE/yr, agriculture 1050 mE/yr and acidification 2216 mE/yr; these are sectors for which climate policy can play a role and potential efficiency improvement be obtained through combination with climate policy.
6. The proposed knowledge project must be able in principle to result in efficiency improvements of 5-15% for those areas that coincide entirely with the proposed knowledge project.

5.3 The need for BSIK support

Although the project clearly contributes to (future) economic welfare in the Netherlands, it is obvious that support by BSIK is absolutely essential for its success.

None of the existing (departmental) mechanisms directly earmarked for the issue of climate change have sufficient financial, administrative and judicial means to initiate and bring to fruition an integral impulse of the size of the here proposed program. This is in sharp contrast with the policy wish for integration of complex environmental issues starting with climate change (see a/o NMP4). While elsewhere in Europe both institutional and programmatic support for such integral activities has already started (e.g. Tyndall Institute Centre) the Netherlands still has to make this effort. A powerful impulse as proposed by this initiative will not only enable the Dutch institutions to bridge the present gap (e.g. in the EU 6FP), but at the same time fulfil the important catalytic function for future interdepartmental and inter-sectoral co-operation in this field. This will be tuned with existing (departmental and thematic) structures for financing climate research in the Netherlands (among which the Dutch Follow-up program on Climate research NVKO).

It is unlikely that the climate issue alone will attract the main resources it deserves from the private domain, simply because climate presently is not a corporate issue

- There is no direct incentive for private stakeholders to invest in such an effort. It is a multi-stakeholder problem, with a strong incentive to free ride.
- The knowledge infrastructure in the climate domain should be strengthened, in order to make real progress in our understanding of climate change and its socio-economic impacts and the best adaptation or mitigation strategies. FP6 and/or NVKO resources can only provide marginal resources.
- Foreign centres are generally pre-determined to their national interests and the specific research questions for the Netherlands will not be answered.

The climate issue is an integral environmental problem that must be dealt with through integrated approaches in policy, science and in the framework of public-private partnerships. The knowledge (infrastructure) to tackle the climate issue in an integrated, multidisciplinary and participatory manner is still largely missing. This leaves a clear niche for a proper incentive from within the BSIK framework.

The BSIK contribution is necessary for the following reasons:

- To enhance and reinforce knowledge networks on climate, climate change and spatial planning within the Netherlands with a special focus on co-operation and integration of research activities.
- External impulses are needed to transcend disciplinary boundaries and to reach more integrated and interdisciplinary knowledge development mechanisms. The disciplinary organised knowledge institutions are generally not able to make such leaps without additional financial means.
- To stimulate public-private co-operation to develop, test, apply and transfer knowledge products related to the climate issue and spatial planning. Presently the public and private knowledge domains are largely separate entities. This seriously hampers the development towards a fully integrated and united knowledge base.
- Fundamental and applied research will both be stimulated in response to knowledge demands from every day practice.

5.4 Alternatives are not available

The chosen approach of fundamental and applied research in close co-operation with the relevant stakeholders and the instigation of the Network on Climate and Spatial Planning create the best options to deal effectively and efficiently with climate related issues in the Netherlands. The best parties have been brought together in a consistent framework that will be tuned with the existing (departmental and thematic) funding structures for climate research in the Netherlands (a.o. NVKO).

Following this line of argument three alternative scenarios are considered below:

- *Business as usual*. One could trust that an effective knowledge 'trade' will eventually organise itself in the manner this proposal envisages. It is not very likely that this will happen soon enough (if ever). The importance and urgency of a good spatial policy in relation to climate change are too great not to act.
- *Strengthening bilateral co-operation.* At the project level this could be an option. In view of the wide scope of the climate issue each project will involve a different set of multiple partners. The natural thematic cohesion between projects will make structural co-ordination imperative. This line of thought thus leads automatically to a consortium for climate change research.
- *Interdepartmental collaboration.* A large number of ministries is involved in climate change issues, each with its own modus operandi, and each with its own, only slowly evolving budgets In this situation it is very unlikely that strong enough commitments, both financially and in terms of ambition, will be given that allow to make a *quantum leap* in capacity building.

5.5 Measurable results

Table 6-4 presents project-specific indicators for success to allow evaluation of progress. Here more general indicators will be discussed.

- Improved predictive capability of climate change and variability zoomed on the Netherlands and its direct sphere of influence (i.e. the catchments of Rhine and Meuse rivers)
- An up-to-date, complete and spatially explicit picture of our national greenhouse gas emissions and stores of carbon
- Identification of realistic and -where possible- multi-functional options for mitigation in agriculture, forestry, nature, water management, mobility and transport, corporate strategies
- Identification of realistic and -where possible- multi-functional options for adaptation in agriculture, forestry, nature management, water management, coastal management, transport, and financial management of damages resulting from natural hazards
- A number of Decision Support Tools that facilitate integrated evaluation and cost/benefit analysis of alternative management options
    - i) to mitigate GHG emissions,
    - ii) to assist in spatial location of room-demanding renewable energy sources, iii) to assist in spatial reconfigurations for adaptation,
    - iv) to exploit possible synergies and avoid possible loopholes between related (environmental) policies, e.g. climate, biodiversity, agricultural, or economic policies.
- A consolidated portal to access key information and essential data created in support of all before mentioned goals, and to find/contact experts for tailor-made consultation
- Effective process management tools based on (semi-) permanent dialogues between science, policy, public and corporate sectors that facilitate the transitions needed for mitigation and adaptation.
- Increased public and corporate awareness of the urgency of the climate problem based on pre-cautionary principles, as a fundamental pre-requisite for future economic, technological, environmental and way-of-live *transitions*

On the highest level, realisation of the efficiency improvement as projected in Table 5-3, though arguably hard to quantify, would be the ultimate indicator of this knowledge project's success.

5.6 The BSIK time frame and beyond

The time frame of the first BSIK period is well in phase with preparations for the Kyoto first commitment period. The knowledge and monitoring infrastructure to be developed in the proposed knowledge project will make the Netherlands well prepared to comply with the agreed emission reductions.

The mere development and implementation process of the proposed research knowledge project will help to integrate and develop strategies to put-into-practice the recent policy documents of relevance to climate issues (see section 5.1). First results of the knowledge project may be used during the implementation of these policies, and its conceptual framework, refined and worked-out in detail, will provide significant building blocks for future policies.

The level of investment foreseen and the resulting growth in research capacity cannot be realised in a single year. Therefore a four year knowledge project is planned.

The importance of climate issues will not decrease beyond the end of this knowledge project. Much more significant mitigation needs will have to be negotiated for second and further commitment periods. Climate change will progressively impact our natural and socio-economic environment. The resulting challenges will continue to ask for scientific and technological innovations, and will require a permanent research network and stakeholder dialogue on climate issues. From both supply and demand perspectives there will be a charge to the network i) to act as platform interfacing public, private and science sectors, ii) to constitute a critical mass in terms of human and infrastructural capital, and iii) to come with scientifically sound advices for public and private sectors, asked for or not.

Investments in new monitoring infrastructure and related research capacity are foreseen during this BSIK period that are not only part of scientific and technological development processes, but also function as a prototype for more permanent operational monitoring facilities. In the next phase maintenance and replacement of infrastructure, and continuation of research capacity will be the responsibility of the consortium partners, backed up by permanent funds for operational facilities needed for e.g. Kyoto commitments. The qualitative and quantitative boost given to the consortium by the knowledge project will improve its (international) competitiveness to a level such that will be able sustain itself.

6 Knowledge project: implementation

6.1 Structure in sub-projects and how these will be carried out.

Climate change is a complex problem that may significantly impact our economy, environment and our way of living. Solutions require a new approach where governmental organisations, private enterprises and scientific institutes jointly operate and invest in new technology and innovative products. Where in past, strategies to cope with changes in the environment were heavily drawn from technological driven approaches, the current climate problem demands for a clever use and effective planning of our limited space.

Main goal of this knowledge project is to embed the climate change factor in spatial planning, at all scales and across all sectors of our society. This knowledge project will seek to enhance sustainable use of our space and exploits innovative implementations of multi functional land use. Through a multi sectoral dialog, awareness will be raised and measures will be developed that both decrease emissions of green house gasses and better prepare the Netherlands to adapt to climate change.

In order to ensure, embed and to further enhance the status of the Netherlands as knowledge country, the knowledge project addresses to establish a 'Network on climate and spatial planning' operated by stakeholders from the government, private enterprises and scientific institutes. Partners in the network will conduct a series of interlinked projects, which are clustered around four main themes:

- Theme 1 'Climate Scenarios'; Develop a central database on climate data and climate scenarios
- Theme 2 'Mitigation'; Methods to quantify and decrease land use bound green house gas emissions.
- Theme 3: 'Adaptation'; Designing options for adaptation to climate change
- Theme 4: 'Integration'; Integration through dialogue, risk analysis and knowledge transfer

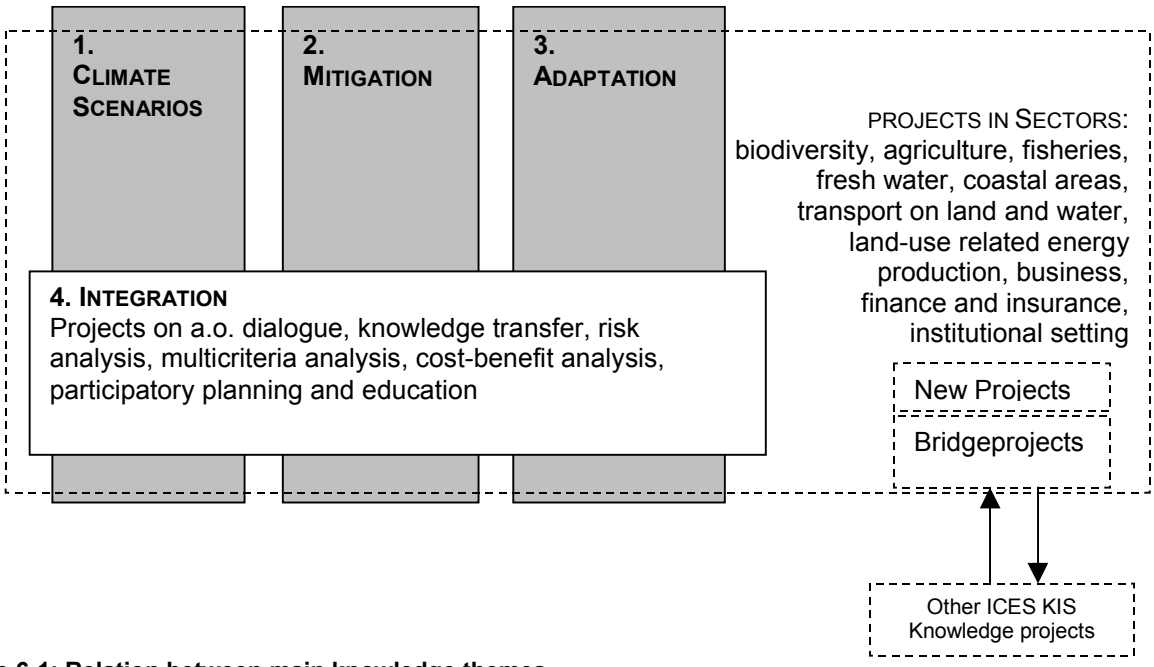


Figure 6-1: Relation between main knowledge themes

Figure 6.1 presents the structure of the knowledge project. Themes 1, 2 and 3 are the knowledge pillars of the project, which are integrated by theme 4 'Integration'. The projects, which fall under each of the four themes, are closely linked (Annex B). They are selected being relevant for the different sectors in our society: agriculture, water management, coastal protection, biodiversity, energy, transport, entrepreneurship, housing, finance and insurance and institutional settings. A budget for an 'Open programme' is reserved for new ideas and projects in order to anticipate to new developments (see 6.5).

The emerging knowledge and products arising from the projects will be accessible for -and hence beneficial to- society through the embedding in the Network on climate and spatial planning. The Network will be managed by the 'Foundation for climate, land use and infrastructure'. The network has an open structure to interactively connect requests from society to the knowledge project and to convey the results to users.

Climate *changes* Spatial Planning co-operates with the knowledge project plans *Ruimte voor Water/Waarde van Water (Living with Water)* and Delft in a number of coherent reference projects (bridge projects, Figure 6-1), in which each programme contributes its specific research issues. It is acknowledged that each of the three BSIK initiatives 'Climate *changes* Spatial Planning', Delft Cluster and 'Living with Water' has its own mission (see Section 7.5)

6.2 Theme 1: 'Climate Scenarios; Tailor-made Climate Scenario's and climate data management for decision support in spatial planning

6.2.1 The challenge for scientists and society

Detailed knowledge about present-day's climate and possible climate change in North-western Europe is of particular importance to spatial planning in the Netherlands. What is the chance that we will have extreme droughts during hot summer months? Do we expect extreme wind, precipitation or river discharges such that the safety of our population is at risk? What is the heat, water, energy and carbon exchange between the surface and the atmosphere in a changing climate, and how will it affect local living and growing conditions?

Society needs to be informed about what we expect our climate to be in the foreseeable future. It needs information at a very high spatial quality dedicated to regional scales. Only then information become relevant to the local user. Climate modellers produce climate scenarios continuously, but this information is often only used by policy makers or specific interest groups that focus on limited issues. Consequently, the wealth of existing climate scenario information is not employed to inform the wider public, including a large community who is in need of up to date climate scenarios. Therefore, a key part of this ICES-KIS investment (project CS-B1 and –B2, Appendix B) will be used to strengthen the communication between producers and users of climate information. A communication platform will be established to develop climate scenarios that are tailor made to users involved in mitigation activities (Theme 2), developing adaptation strategies (Theme 3) and to deliver climate scenarios to a dialogue and assessment on climate change (Theme 4).

6.2.2 Motivation for ICES KIS Investments

At stated above, many users in the Netherlands –such as the water boards- are in need of climate scenarios that are reliable at the regional and local scales. To obtain climate scenarios at the local scale, it is proposed to invest in a Regional Climate Model (RCM). An RCM is embedded in a Global Circulation Model (GCM) or large forecast model, from which it obtains its boundary conditions. At scales smaller than 30 km, local dynamics, local topography, and soil and moisture conditions drive the climate, so that the RCM output is recognisable, understandable, and therefore attractive to the local user. Since there is less area averaging in an RCM than in a GCM, the variability of the local climate is much more realistically described, including the extremes in relevant parameters.

Global versus Regional scenarios
Although results from long-term climate projections are, as yet, too uncertain and varying to meet the operational needs of stakeholders involved in spatial planning, short- and medium-term weather and climate forecasts can potentially already meet their needs. However, short- to medium-term climate forecasts are, at present, not yet being used in spatial planning and water management in many parts of the world, partly for lack of capacity, but also because the potential has not yet been realised by stakeholders. Further improvement in short-term forecasting is seen as one of the most important technological challenge of this programme that will improve the adaptive capacity of the Netherlands (chapter 6.4).

Most climate change scenarios are derived from Global Climate Models (GCM). These scenarios have such a coarse resolution that regional and local processes cannot be adequately modelled. At the local scale, GCM outputs are often highly biased, with unrealistic temperature or precipitation forecasts offering only low-confidence climate guidance. And yet it is at the local scale where society exists with its considerable economic activity (IPCC 2001).

Part of the ICES-KIS investment will be selectively targeted towards the improvement of the representation of certain atmospheric processes, which are key to the overall performance of a RCM model (project CS-A4 and CS-A5). These processes are the representation of the soil hydrological component, the boundary layer (governing the exchange of moisture and heat between surface and atmosphere), and clouds and aerosol. In the latest IPCC report, clouds and aerosol were identified as the biggest contributors to uncertainty in our understanding of the greenhouse effect. Furthermore, a small but selective part of the ICES-KIS investment will be geared towards understanding the processes guiding the large-scale circulation patterns that may, or may not alter during the impending climate change (project CS-A1 and –CS-A5). In this way we ensure that new developments in this area of research may be directly captured in the regional models.

It is sometimes suggested that we already know precisely what the current state of our climate is. We can only partly affirm this. Climate data available to us is fragmentary and consists e.g. of information derived from all altitudes throughout the atmosphere or from signals buried deep in historic ' paleo-climatic' data sets. Here one can make the distinction between two types of data sets. On the one hand there exist the vast data sets of the traditional parameters such as temperature, and intensity and frequency of occurrence of rainfall. They may be stored but are in general inaccessible to the potential user. Part of the ICES-KIS investment will be used to uncover this wealth of information (project CS-A9). On the other hand there exist other data sets of highly selective atmospheric para-meters, using modern sophisticated in situ or remote sensing instruments. These parameters are measured (monitored) because they have been identified as playing a vital role in controlling the climate system. Many, but not all, such parameters are measured from space platforms, which are universally acknowledged as the primary means to obtain future global climate data sets.



Figure 6-2. Improved scenarios may support preparing the Netherlands for extreme weather events

Hence, in order to improve our confidence in the predictive capability of the regional climate scenarios, which is key output to the user, a substantial ICES-KIS investment will be necessary to improve monitoring of key climate parameters.

6.2.3 Climate Scenario approach

In summary, the proposed investment in the Theme 'Climate Scenarios' aims at developing the following sub themes :

A. Communication & data management of climate information (see also Theme 4)
B. Production of climate scenarios relevant for spatial planning
C. Assessing the future by mining the past climate
D. Monitoring vital climate parameters
E. Uncovering the role of vital processes in shaping our climate

Figure 6-3 represents the identified projects. Summaries of the individual projects are provided on the project sheets (Annex B).

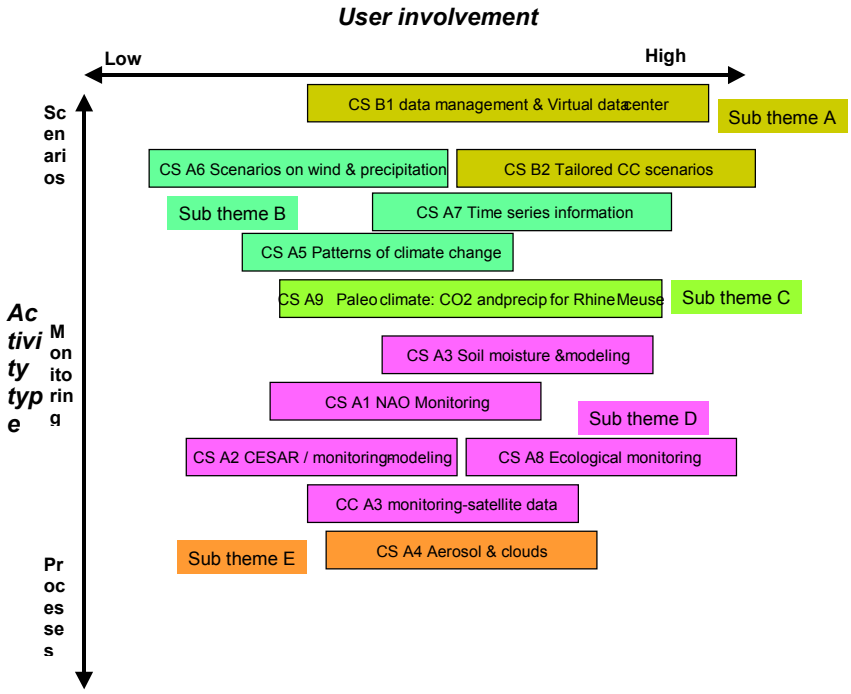


Figure 6-3: Schematic representation of projects in theme 'Climate Scenarios' showing the user involvement on the type of activity.

A. Communication and data management of climate information

There exists a natural separation between those who produce climate information and those who use it. Because production of climate information is a highly specialised activity, the language of the specialist is sometimes incomprehensible to the uninitiated. The climate expert community does not always know what potential users want, and potential users do not know what to ask for and where to ask.

Communication and information exchange between meteorologists, land-atmosphere-biosphere scientists, climate impact researchers and hydrologists is therefore required. We can call this communication with *internal* users. This type of communication includes exchange on collection of suitable meteorological and hydrological data for predictions, on risk analysis and on dealing with uncertainty.

As climate forecasts continue to become more accurate, the communication between meteorologists and *external* users i.e. stakeholders such as water resources managers must keep pace with these advances in order to ensure knowledge is transferred between the groups. It is, therefore, becoming increasingly clear that for the future planning activities and for mitigation (Theme 2) of and adaptation (Theme 3) to climate change, it will of vital importance that any data available be seamlessly integrated into a package readily accessible to the internal as well as the external user.

Climate Data management and Communication

Sub-theme A addresses the need for enhancing the communication between climate scenario users and meteorologists who develop climate scenarios. Therefore, a project has been formulated to sett up a *data management centre* through which all data and scenarios that are output from Theme 1 'Climate Scenarios' will be made available in a transparent manner to the user. The data centre will explore new technologies, e.g. information derived from remote sensing. To make climate data accessible, there are many technical questions to be solved, since data come in all shapes and sizes. A single time series of precipitation going back several hundred years may be of equal importance as a two-dimension map of precipitation produced by a regional climate model. Therefore, exact requirements of the users will be communicated through an ongoing project that aims at capturing user requirements across all projects in this ICES KIS Programme.

Project CS-B1 will serve the purpose of attempting to tailor the climate scenarios to the potential user. Questions are: Who are potential users? What information do they want? How can the producers manage to uncover the data that the users want? And how can the user provide feedback on the data provided? This project aims at educating the user as well as the producer, so that they can educate each other. This is achieved by posting research staff at potential user groups in a number of demonstration case studies and to connect the development of the climate scenarios to projects defined under the other themes.

B. Production of climate scenarios relevant for spatial planning

Regional climate scenarios are a key output to spatial planners. Especially when designing spatial adaptation options such as flood retention areas, accurate knowledge is necessary to develop the most space- and cost efficient solutions. This sub theme aims at delivering regional climate scenarios, which can be embedded in the spatial planning process.

Project CS-A-6 and CS-B2 are designed to obtain quality scenarios. One project is targeted to the actual production of regional climate scenarios with particular focus on the Netherlands. The aforementioned RCMs can produce these scenarios, which include time series needed to drive models of river discharge and storm surges, and to assess extreme weather events. Dutch efforts to produce climate scenarios are embedded in a large European-funded initiative called PRUDENCE, where the main target areas for scenario production include the river Rhine and Meuse catchment areas. Principal questions asked are: How do extreme events in precipitation and wind change in the 21st century? Can an RCM derive time series tailored to drive river discharge, storm surge? What is the quality of the RCM scenarios in present climate? What modifications are necessary in model processing or formulation to improve scenario quality?

One point of concern is the accuracy of the lateral boundary conditions. They introduce variability at the larger scale that inevitably will find its way into the RCM output. What large-scale weather patterns, caused by anthropogenic forcing, can we expect? A modern way to investigate this is to produce ensemble runs with an Intermediate Complexity Model (ICM). This model is a compromise between the need to produce many model runs to build up statistics of variability, and the need to include precise physics in the model. Both needs are at odds with each other, and the compromise is to reduce the essential physical representation in the ICM to those essential processes controlling the large dynamic features. The project Patterns of Climate Change (CS-A5) is designed to answer the dominant question: What is the relation between the phase of the dominant circulation patterns influencing Western Europe and the regional climate? This activity builds on existing expertise at KNMI.

C. Historic climate data series

Our climate archive is vast, and consists of many existing data sets, encompassing all areas of the globe. A challenging aspect is to explore climate data from the past, which may help understanding today's climate. Project CS-A7 has been designed to produce these historic data sets, with focus on precipitation and temperature time series from the 18th century up to present, at very high (sub-daily) time resolution. This high-resolution data is the very best historical data available, and will provide superb quality benchmark data sets for climate models that need to calibrate their variability output on past climate. Special efforts are needed to streamline the data and integrate it into the Climate Data and Scenario's Data centre. A second project on paleo-climate (CS-A9) is designed to extent our record of climate variability under initial CO_2 conditions back a few thousand years. This is important for getting insight in the occurrence of rare extreme events.

D. Monitoring vital climate parameters

When our ancestors began to record weather parameters for posteriority, little was known about the processes driving climate. As our knowledge about climate increased, so did our choice of possible parameters to probe it. We no longer focus only on such elementary things as temperature and wind, having vastly augmented our collection of tools and refined our measurement principles. To monitor the state of our climate neither do we focus only on our back yard but probe selected climate parameters far away.



Projects CS-A1 and CS-A2 have been designed to improve and extend our monitoring infrastructure. All are based on existing infrastructure. One project plans to perform comprehensive monitoring of the atmospheric column at Cabauw, the Netherlands, another plans to integrate vast datasets derived from satellite sources, and yet another serves to extend an ocean monitoring facility tracking the health of the Thermohaline Circulation in the North Atlantic.

Project CS-A1 is a substantial extension of an existing project to moor sub-surface instruments at selected locations in the North Atlantic. Why do we need to know parameters measured so far removed from home? The principal reason is that it has been shown that large and rapid climate changes have occurred in the past when the Thermohaline Circulation (THC) in the North Atlantic Ocean decreases in magnitude and even reverses. It is suggested that increased warming of our climate will, via a chain of complex events, drastically alter the THC with potential enormous and abrupt impact on our climate. Norway, the Netherlands, Germany and the UK have collectively decided to monitor parameters signalling rapid changes in the THC, using selective moorings. This effort will contribute internationally through the WCRP-CLIVAR program.

Project CS-A2: At Cabauw experimental site, a Dutch multi-institute facility is undertaking a comprehensive monitoring activity of the atmospheric column. The effort is internationally acknowledged for its superior quality, and involves co-locations of (remote sensing) instruments to track aerosol, cloud, and land - atmosphere exchange. Several European-funded initiatives to study clouds and radiation rely on their output from this multi-instrumented site, such as CLOUDNET and Cliwanet. Furthermore, it is linked to three future remote sensing satellite missions, namely the funded US Cloudsat and Calypso studies to put radar/lidar in space, and the ESA-funded EarthCare mission to probe clouds in three dimensions. The primary and novel mission of this project is to integrate the different data streams into a comprehensive project for multi-disciplinary studies. For the purpose of this ICES-KIS initiative, the production of these data sets is highly relevant to test the RCM used in the Climate Scenario generation.

Additional effort will be geared during the duration of the knowledge project towards the production of data sets of solar fluxes, cloud, aerosol and greenhouse gases from satellite missions. As above, these data serve to validate RCMs, but just as important provide long-term data sets on climate variation. To obtain consistent time series, data from multiple satellites will be combined. This effort extends existing projects in the European arena, such as the EUMETSAT funded Climate and Ozone Satellite Application Facilities. In both efforts the Netherlands have a leading role. Furthermore, it will extend existing projects related to GOME, SCIAMACHY, OMI and GOME-2 instruments, where the Netherlands play a vital role in the production of retrieval products. The central question to be answered is: What is the spatially and temporally resolved distribution and trend of solar fluxes, aerosol, clouds and greenhouse gases over the Netherlands and Western Europe?

E. Uncovering the role of vital processes in shaping our climate

The primary aim of process studies is the strengthening of our understanding of key elements of the climate system. The representation of these processes in climate models ensures that the predictive capability of these models improves. Major weaknesses exist in our understanding of the exchange of energy between surface and atmosphere, and of the role of aerosol and clouds in affecting the radiative balance of the earth – atmosphere system. Building on existing expertise in the Netherlands, projects are proposed to improve the model representation of these processes.

The IPCC-report has identified clouds and aerosol to be the main target area of research to improve climate prediction. Not surprisingly, the FP6 EU program has issued several calls in 2003 and 2004 to extend research on clouds and aerosol interactions. The Netherlands seek to contribute to these calls by participating in Networks of Excellence or Integrated Research Projects. Project CS-A4 has been designed that organises the major players in research on aerosol and clouds in one activity. Central questions are: What are trends in aerosol loading over the Netherlands? What is the composition of aerosols? To what extent can we identify aerosol loadings as caused by different land use from natural loading? To what extent do they influence climate, directly, and indirectly through their effect on clouds? This work is at the heart of Dutch efforts to integrate aerosol and cloud models, and will contribute towards better predictive capability of the RCM. At the same time, it will form the foundation for a long-term monitoring activity that will probe aerosol concentration and composition and it can be used as a benchmark test in abatement measures.

Project CS-A3 will introduce a new model concept in soil moisture flow. Its aim is to construct a new parameterisation of root water uptake in hydrological and climate models. Root water uptake is strongly related to land use (nature conservation, agriculture) and spatial planning, land use change scenarios and drink water exploitation. This effort is strongly linked to the improvement of an essential RCM feature, namely the prediction of surface temperature, which is controlled by the distribution of solar energy into sensible and latent heat fluxes. Systematic deficiencies in the representation of soil hydrological processes have lead to severe problems in annual cycles of temperature and cloud cover in many RCM's.

Under auspices of GEWEX and through the initiative of the Netherlands, a special international working group to study the boundary layer and its role in our climate system has been formed. A project may be formulated in a later stage which will evaluate the surface fluxes, and study its representativeness over varied terrain. Use will be made of a very-high resolution model embedded in the RCM described above to resolve the fluxes at km scales. Central questions are: Can we set-up and evaluate a fine scale model of the middle part of the Netherlands with the specific purpose to derive surface fluxes of sensible and latent heat and greenhouse gases? Can we improve upon the fluxes derived from the larger scale RCM? Can we map surface fluxes for practical application in water conservation and drought detection, using satellite and model outputs? The output of this project provides data at even higher resolution than that obtained from the RCM project.

6.3 Theme 2: Mitigation and monitoring of greenhouse gases and aerosol emissions

6.3.1 Introduction

Earth's climate is changing due to antropogene emissions of green house gases (GHGs). To keep climate change within acceptable limits, within a range in which nature and human societies can cope with its impacts, requires significant reductions of GHG emissions. In the hard-fought Kyoto protocol and its successors, parties agreed to reduce emissions for the first commitment period (around 2010) by a relatively modest percentage relative to 1990 emissions. The Netherlands agreed to reduce by 6%, of which it plans to realise half abroad through the use of flexible instruments. For future commitment periods much more demanding GHG emission reductions (~20 -50%) are foreseen, requiring much more significant transitions in energy, industrial and land use related sectors. The Netherlands played a significant role in the negotiations for Kyoto, supported by scientific expertise in relevant areas comparable to that of much more resourceful countries. At the same time the Netherlands harbours a lot of marketable technological knowledge for efficient energy generation and efficient use of energy. For both fields, knowledge of natural and antropogene emissions and its causal processes, and technological expertise on how to reduce these, a large international interest exists, from governmental, corporate and scientific communities alike. A very similar, partly overlapping situation exists, with respect to policy negotiations and its supportive knowledge base, for the reduction of transboundary air pollution.

To comply with emission reduction commitments at home, and to improve the export potential of the scientific and technological knowledge base requires a boost in knowledge and data infrastructure. We need to further develop a cost effective methodology to meet the present and future UNFCCC national reporting and accounting requirements on emissions and carbon. Especially land use related emissions are relatively poorly understood and quantified. There is a strong need to further develop sector specific mitigation strategies based on an assessment of environmental and technological potentials, limited by realistic socio-economic, sustainability and (spatial) planning constraints, both nationally and for the most promising countries and sectors. Here, relations between climate mitigation measures and air-pollution reduction measures must be considered to prevent unwanted side effects, and to make maximum use of synergistic effects. Finally, there is a need to develop verification methods to independently assess the effectiveness of mitigation measures and the realism of UNFCCC reported data from sub-national to global levels. Emission reductions start with the 'large, easily traceable catches'. As emission targets become more sectorally widespread, more and more hard-to-trace diffuse sources will be included (e.g. tire pressures in road traffic), the realisation of which can no longer be assessed through bottom-up reporting strategies only.

Meeting future mitigation requirements will be very demanding on society. In addition to developing technological options we must make sure that the general public internalises the concept of sustainable, carbon neutral energy use, or more in general the concept of sustainable use of natural resources.



Mitigation starts with 'large, easily traceable catches'

As emission targets become sectorally widespread, more hard-to-trace diffuse sources will be included

6.3.2 Mitigation and spatial planning

Climate change mitigation policies are being decentralised, distributing responsibilities from the national to more regional and local administrative levels. Emission trading within and between economic sectors, and within and between geographical entities will increasingly become the tool to effectuate emission reductions. To make this possible and effective requires information on greenhouse gas (GHG) and aerosol emissions, and the responsible mechanisms, at similar geographical scales.

The relative importance of land-bound sources and sinks (now 15-20% in the Netherlands) may increase, if and when industrial emissions reduce as a result of mitigation policies. Land-bound sources and sinks are heavily influenced by intrinsic land properties, and by land management in terms of water table regulation, fertiliser application, and other farming and forestry practices. Managing land-bound sources and sinks requires knowledge of relevant, often linked processes and geographically detailed quantitative data.

Mitigation strategies for greenhouse gas emissions require a transition towards sustainable, i.e. low or zero GHG emitting energy systems characterised by an increasing share of either renewable energy sources or carbon neutral fossil fuel use. Space requirements for solar, wind or biomass are several orders of magnitude higher than those for fossil fuels. Increasing the share of carbon neutral fossil fuels necessitates major infrastructural system and spatial planning innovations that guarantee optimal facilitation of renewable energy production and use, balancing its needs with those of other trends in land use (agricultural extensification, EHS, etc), while avoiding compartmentalisation of strategic decision making in regional planning and climate change policies.

Given the relatively high energy conversion efficiencies already existing in the Netherlands, it has chosen to realise 50% of its reduction targets abroad. This is possible through the flexible instruments Joint Implementation (JI projects in Eastern Europe), the Clean Development Mechanism (CDM projects in developing countries) or Emission Trading systems (presently proposed within Europe). Implications of this policy in terms of spatial planning are currently most directly related to 'sinks' projects and/or biomass production for energy, as they involve large areas of some sort of forested land, land often heavily under pressure for conversion to agricultural uses. As a consequence the *a-priori* potential for sinks in CDM is severely constrained by a number of generic criteria (verifiability, sustainability, additionally, etc) that sink-projects in CDM ideally should meet.

Closer at home, the climate change issue is progressively introduced in corporate strategies as companies are realising it is becoming of strategic interest to proactively anticipate possible risks and opportunities in their management considerations. Climate-neutral entrepreneurship is closely linked to initiatives related to CSR (Corporate Social Responsibility). Methodologies to become a climate-neutral entrepreneur are now being developed and include emission reduction options, company carbon foot printing, benchmarking and

investment in projects to offset or compensate for remaining emissions, many of which have a distinct spatial component. The growing awareness on climate change in the corporate world needs input from and must be linked to state-of-the-art scientific insight on global change and innovative technologies, as climate change will affect businesses in ways not often evident to the companies themselves.

Finally, the above mentioned aspects of mitigation cannot be seen in isolation from adaptation aspects of climate change. Adaptation needs with significant spatial impacts (e.g. creating water buffer zones to cope with expected increases in frequency of extreme rainfall events) may compete with demands for mitigating land bound emissions. But also synergistic possibilities for measures serving both mitigation and adaptation needs can be thought of. Integrating these spatial demands with more conventional demands from industry, transport and housing necessitates novel spatial planning innovations. These processes are complex due to often conflicting stakes, policies and incompleteness of information. Combined with a tendency to more open and bottom-up planning processes, this asks for participatory process of dealing with complex issues, which involves combining, interpreting and communicating knowledge from scientific disciplines and stakeholders, such that integrated insights are made available to decision-makers. Addressing this can best be done in a specific case study region were awareness of the need for such integration is emerging. In the Netherlands "het Veenweidegebied" is such a region.

Bridge project: The GHG balance of fen meadows and their management potential for emission reduction

The Dutch fen meadow area (4500km2) has been estimated to emit 5.8 Mton CO_2 equivalents annually (Aerts, 1999 in: van Amstel (eds)). For comparison the Netherlands has agreed to an emission reduction of 25 MT CO_2 for the first commitment period of the Kyoto protocol. However, these emission estimates and their dependence on water and farm management are highly uncertain. Therefore a research project has been developed with the objective to understand the controlling mechanisms and magnitude of GHG emissions (CO_2, CH_4, N_2O) in fen meadow ecosystems, and to assess the possibility of water level manipulation as a management tool for GHG emissions from fen meadows. Three experimental sites will be instrumented in the Horstermeer polder in the province of Noord Holland: (A) an undisturbed wetland with high water table and outside agricultural exploitation for more than ten years, (B) a site under agricultural exploitation, and (C) a site under agricultural exploitation where after one year the groundwater table will be raised (landscape experiment).

6.3.3 Mitigation and monitoring Approach

Based on these considerations a research knowledge project has been developed organised around the following sub-themes. For each of these sub-themes one or more specific projects (Annex B) have been formulated.



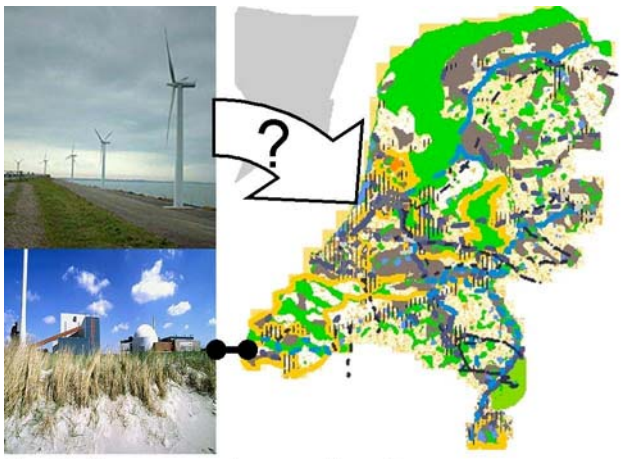
0. **User provider interfacing (project M-A0)**. This constitutes a single project with two main objectives: i) to provide a platform for a permanent dialogue between the science community and its policy and private stakeholders to specify the information needs with respect to mitigation and the monitoring of emission (-reductions). It also will develop a single portal that facilitates searching for and access to data and publications from the large number of projects under this sub-theme. This project links directly to equivalents in the other sub-themes and at the knowledge project level.

A. **Monitoring of emissions** . Under this sub-theme a prototype operational information system will be developed to quantify i) the magnitude and associated uncertainties of the exchange of greenhouse gases and aerosols between the land surface and the atmosphere, and ii) the main factors determining these fluxes, at all relevant spatial and temporal scales. The system should be geographically explicit at local to regional scales, and temporally continuous at all time scales. It builds on enhanced process knowledge, advanced observational strategies and novel coupled modelling methodologies of both land-based and atmospheric processes. It provides a basis for historic reconstructions and future scenarios of GHG and aerosol emissions, for geographically explicit attribution of variability to natural or anthropogenic causes, and for the development of mitigation strategies. The system will make possible the verification of national emissions, by providing a reference to determine the accuracy and credibility of the UNFCCC reports .Three projects will contribute to this objective (projects MM-A 1-3):

- **M-A1 Integrated Observation and Modelling of Greenhouse Gas Budgets at the Ecosystem Level in the Netherlands**. A number of permanent and temporary monitoring sites will integrally determine fluxes of GHG's to the atmosphere for major land cover types in the Netherlands in relation to their management.
- **M-A2 Regionalisation of GHG and aerosol emissions.** Mobile observation platforms and tall towers will address spatial aggregation and atmospheric integration of highly variable fluxes and concentrations. Inverse source apportionment methods estimate the sources and the regional contributions, using regional atmospheric transport models.
- **M-A3 Inventory based carbon budget for the land use sector (LULUCF) in the Netherlands.** Sampling designs will be improved for carbon budget assessment for semi-natural, forest and agricultural systems, all currently poorly represented in national inventories. Inventories of anthropogene emissions will be spatially and temporally dis-aggregated to appropriate levels to make them more useful in M-A2.

B. **Land use and mitigation.** This sub-theme addresses specific mitigation options in the Netherlands and abroad through a series of inter-related products. The potential and relative attractiveness of land-use related mitigation in the Netherlands is assessed, while the development of relevant activities in the Netherlands are established in an appropriate European and global context of land-use and land-use change. The larger scale analysis serves to map connections between land-use priorities within and outside the Netherlands in mitigation-relevant terms. At the same time the relative merit of domestic measures is estimated (projects M-B 1-3):

- **M-B1** Effectiveness of options and evaluation of strategies to mitigate greenhouse gases from agriculture and land use in the Netherlands in an integrated multi-gas approach. To integrate strategies aiming at i) carbon sequestration in, and ii) mitigation of nitrous oxide emissions from agricultural soils, and iii) methane emission from animals and manure storage and relations with other environmental policies. A simple and transparent series of DSS models is updated and used.
- **M-B2** A tool for international allocation of emission reductions over regions, sectors, sources and greenhouse gases. An global emission reduction tool will be developed to weigh and rank major mitigation options across all regions, sectors, gases and sources to establish their relative attractiveness and relevance. Given global scenarios the relative ranking of land-use related options can be estimated.



Sustainable energy supplies generally require more space.
Where to locate e.g. large windturbine parks in our crowded country ?

- **M-B3** European and global land-use and land-use change related emission mitigation. Geographical explicit land-allocation modelling within integrated assessment frameworks will help to secure consistent indications for climate-friendly land-use patterns and practices. A zoom functionality will be developed at the European scale to bridge the gap between national and global levels.

C. Land use and energy. This sub-theme will support the transition towards a sustainable energy system with an increasing share of renewable resources and carbon neutral fossil fuels with i) comprehensive evaluation tools for regional planning and energy policy, ii) spatially differentiated energy scenarios for renewable energy and carbon neutral fossil fuels, and iii) a set of policy recommendations regarding the interface of regional planning and sustainable energy. Three projects respectively will address these 3 objectives (projects M-C 1-3). An additional project addressing biomass production within multifunctional land use systems as part of sustainable bio-energy chains may be called for in the open knowledge project.

- **M-C1** Spatial planning and renewable energy strategies. This project combines a technology oriented cost-benefit model with spatial parameters from a GIS system to analyse the potential for increasing the domestic contribution of renewable energy sources under different conditions. This toolbox will evaluate the mutual dependence of spatial strategies and sustainable energy policy at the local, regional and national levels.

- **M-C2** Regional planning and the transition towards carbon neutral fuels. Biofuels and carbon neutral fossil fuels are likely to play a major role in the transition towards a sustainable energy future. The project will analyse the resulting changes in energy facilities and infrastructure which have substantial regional consequences (technological innovation trajectories, entrepreneurial behaviour and public perception).
- **M-C3** Biomass for fuels and feedstocks: implications of European developments for the Netherlands. European policy trends show an increasing emphasis on the early introduction of biofuels in EU member countries. This project addresses these issues of European biomes potentials and trade flows from the perspective of both regional industrial and climate change policies.

D. Integrating mitigation and adaptation policies in de Fen Meadow area. This sub-theme addresses the possible effects of interventions on land management systems and greenhouse gas emission reductions. And the influence of climate change on the ecological and socio-economic functions of the area. Those are: i) managing Greenhouse gas emissions from Dutch fen meadows through waterlevel interventions; ii) new functions for the Dutch fen meadows and optimisation of the spatial arrangement for multifunctional use; iii) spatial decision support for participative management of Dutch fen (projects MM-D 1-3): see Dutch fen meadow boxes in Adaptation, Integration and present theme.

E. **Climate neutral entrepreneurship** This sub-theme should lead to a toolbox (benchmarking, carbon foot-printing, databases with options) and a tailored knowledge infrastructure to assist the corporate sector in assessing and achieving climate neutral entrepreneurship (project MM-E1):
   - **M-E1 CLIMATIZE** Sustainability indicators for companies – Indicators and implementation. This project will establish indicators for greenhouse gas emissions and land use at the company level, since these two indicators are key to (true) climate-neutral entrepreneurship. Next aspects related to the implementation of Sustainable Development strategies in companies will be analysed, in order to identify, describe and develop climate-neutral entrepreneurship as an acknowledged contribution to corporate social responsibility (CSR).

These projects are linked as depicted in the following Figure 6-4. The following describes some of these links.

Sub-theme 0 provides the interface between the scientists involved in all projects under sub-themes A to F and the information users from governmental, public and commercial sectors. It will ensure that the information and data provided by the science community fulfils the needs of, and comes in a form searchable, accessible and understandable to the non-science communities. It provides a common IT facility to exchange information between all projects in A-F, and to disseminate its products to society.

The projects under subthema A provide vital process based knowledge and quantitative data on (biogenic) GHG emissions and carbon stocks on all relevant space and time scales, that forms the basis for an assessment of the biogeochemical potential for mitigation options to be addressed in B-E. In B this potential is reduced by management and economic limitations and competition for space with other functions of land use. In parallel to B, the projects in sub-theme C have an even narrower focus, dealing with carbon-neutral alternatives (a.o. bio-energy) for fossil fuels and the spatial implications associated with a major transition towards these. The projects under sub-theme D will integrate all issues mentioned under A-C together with adaptation measures for one specific case study area. Finally sub-theme E helps the private sector to develop a more climate neutral business profile using part of the options offered by the projects under B-D.

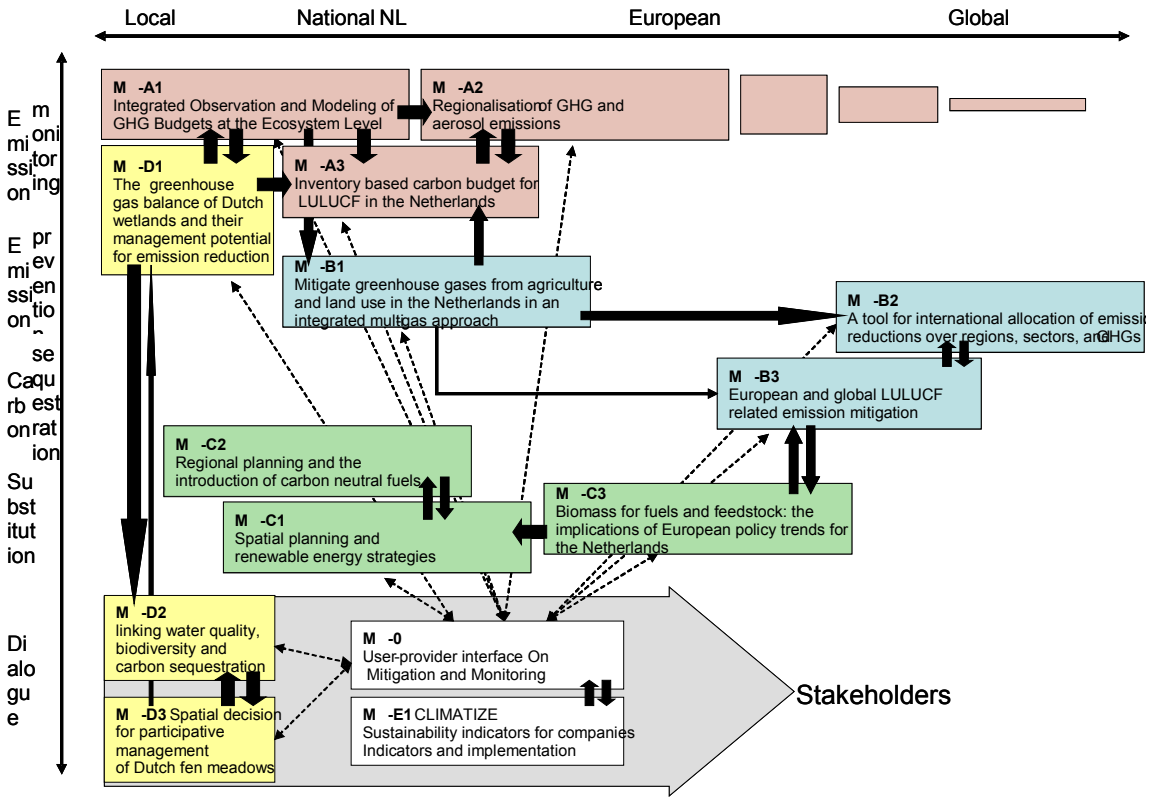


Figure 6-4: Clustering and inter linkages across projects in Theme 'Mitigation'.

In addition to the above, another sub-theme has been identified as important, but for which specific projects will be called for in the 'Open Programme' of the knowledge project (see 6.5). While B and C above have a more national focus, not forgetting international links, theme F deals exclusively with land use options abroad (mostly in the tropics) that help preserve natural carbon stores:

6.4 Theme 3: Adaptation and spatial planning

6.4.1 Introduction

Adaptation can significantly reduce adverse impacts of climate change and is seen as an important part of societal response to global climate change. Adaptation has the potential to both realise new economic opportunities and may substantially reduce climate change damages, especially in the most vulnerable regions around the world (IPCC 2001).

The process of adaptation is not new. Throughout history, people have been adapting to changing conditions, including natural changes in climate. The especially holds for a country as the Netherlands being at the lower end of large European river systems and having a vulnerable coastal region, which for a large part lies below sea level. The Netherlands is known world wide for its adaptive knowledge and technical skills to cope with dangers from extreme events as floods and storm surges. A well known example is the implementation of the 'Delta plan' which illustrates how technical capacity and know-how were effectively employed by combining strength from policy makers, knowledge institutes and engineering companies. It was the integration of these capacities that made the implementation of such a large-scale project successful. It geared up the national economy and still significantly trademarks our water management export capacity.



Figure 6-5: A paradigm shift: Combining technical protective measures (*left*) with spatial adaptation strategies that allow for controlled flooding (*right*).

It is, however, widely acknowledged that the climate system is highly dynamic and that the frequency of extreme weather events in the Netherlands may significantly increase (UNDP 2003). The safety standards that were used to design our current protective infrastructure may not longer serve their purpose. New measures are needed and the introduction of adaptation to global climate change has caused an international paradigm shift. Applying only technical measures will not meet the requirements for a safe society. Clever adaptation measures that more effectively use our space and that reflect a higher awareness of 'living with increased climate variability' are needed.

This program, therefore, focuses on exploiting new adaptation strategies in the Netherlands to alleviate negative effects due to climate change and climate variability and at the same time support sustainable use of our space. The program aims at implementing an integral approach where science, governmental organisations and private companies jointly invest and operate to develop adaptive strategies attached with high quality technology. These outputs will safeguard the Dutch position as 'knowledge society' in the international market. Perquisite for a successful program is an efficacious impulse in a new knowledge network where different stakeholders closely collaborate.

Bridge Project: Adaptation strategies for the Dutch Fen Meadows

The fen meadow programme aims at developing spatial adaptation arrangements for fen meadow areas under changing climate conditions. Increased groundwater tables may increase the carbon retention capacity of the Fen Meadows. Consequently, however, water managers and farmers should consider that phosphate binding capacity will decrease, i.e. more phosphates will leach into ground and surface waters quality will decrease (eutrophication). An integrated inventory of the positive and negative impacts of all the measures to be taken on the ecological functions of the peatland area is necessary to support spatial planning. Solutions can be found in applying multifunctional usage of land by combining recreational use and with carbon sequestration. Furthermore, improved flood polder management will greatly improve storm water quality during and after intense rainfall events, but may also have a distinct role in biodiversity enhancement.

6.4.2 Adaptation and Spatial Planning

Climate change is an environment problem that is much more complex compared to other environmental issues. Cause-effect relationships are not always clear for stakeholders and there is a complex relation with climate change effects and spatial land use planning. Also, investments to alleviate impacts of climate change are of a different order in magnitude than other problems, which causes delay for implementing effective measures.

The Dutch Government in the role as spatial planner, manager of major infrastructure and dominant investor is in need of new approaches with respect to safety and risks. It is expected that the governmental perspective will tend to shift from digitally managed safety systems based on strict – and rather rigid- safety standards to minimising damage through a concerted set of actions where regional spreading of risk will play a dominant role. An example is the ongoing discussion of both enhancing the capacity of protective measures as dikes but at the same time allowing the occurrence of controlled floods in certain areas. Another issue is the development in the agricultural sector addressing new crops or cropping methods that are resistant to increased climate variability such as increased wet and dry years.

Opportunities for all sectors can be found by embedding new adaptation strategies and tools in the spatial planning process. These tools and strategies include, for example, demand driven scenarios analyses for governmental organisations and financial risk arrangements supported by banks and insurers. Innovations may be found by combining these tools and strategies with technical measures implemented by engineering buries.

Bridge Project: Adaptation & Coastal Protection (see 7.5)

Climate change and sea level rise in the long run will lead to situations where safety levels against flooding in parts of the (sandy) coast, no longer meet official standards. In areas of the coast with considerable economic developments, risks will increase. Discrepancies between human interference and ecological functioning in the coastal zone may grow significantly. Counter measures are required such that safety is guaranteed and risks are controlled in combination with an overall improvement of spatial quality.



6.4.3 Adaptation Approach

The adaptation program follows an iterative process where a multi disciplinary network jointly assesses impacts of climate change and exploits and evaluates different adaptation strategies. Figure 6-6 shows this approach and presents where inputs from other thematic activities are projected (Burton 1997).

The adaptation program has identified a set of multi sectoral land use functions that are vulnerable to climate change. Most of these functions are already under pressure through increased demands from population and industry. A first step is to simulate and quantify impacts of climate change on these land use functions. Special focus will be paid to: loss of efficiency of investments in biodiversity (e.g. the National Ecological Network, EHS), changes in food and fibre production, impacts on housing transport and infrastructure, impacts of sea level rise on agriculture and flood risks, impacts on the Dutch continental shelf and increased flood risks near Dutch rivers.

Bridge Project: Adaptation strategies for the Major Dutch River System

Considering the societal impacts related to flooding of rivers, surface water and groundwater pollution, and the effects of climate change on ecosystems, there is an urgent need to improve our understanding of catchment-scale responses in a changing global environment related to scenario analysis and integrated land use planning. Following the flood events of 1993 and 1995 along the main Dutch rivers, new calculations have been made to establish chances of exceeding safety limits used for determining dike heights. Predicted climate change has a direct impact on expected peak flows and brings along an adjustment of safety limits. Complex climate models are to be linked to river discharge models to enhance discharge predictions and related risk estimates and frequency of possible exceedance of limits. As a further enforcement of dikes is not preferred policy makers are now looking into how to retain more water within the riverbed. Possible retention areas have to be selected together with international partners, the Dutch government, municipalities and insurers.

Knowing the impacts of climate change on land use, effective adaptation strategies can be developed and evaluated with stakeholders, the latter which is elaborated under theme 4:' Integration' (Van Ierland et al 2001). Furthermore, an important basis for this approach are improved simulations of future climate scenarios and an operational system that is capable of predicting long-term seasonal changes such as 'water levels' flood risk planning and predicting the 'number of extreme wet and dry years' for regional agricultural planning. These climate scenarios are developed under Theme 1: 'Climate Scenarios'.

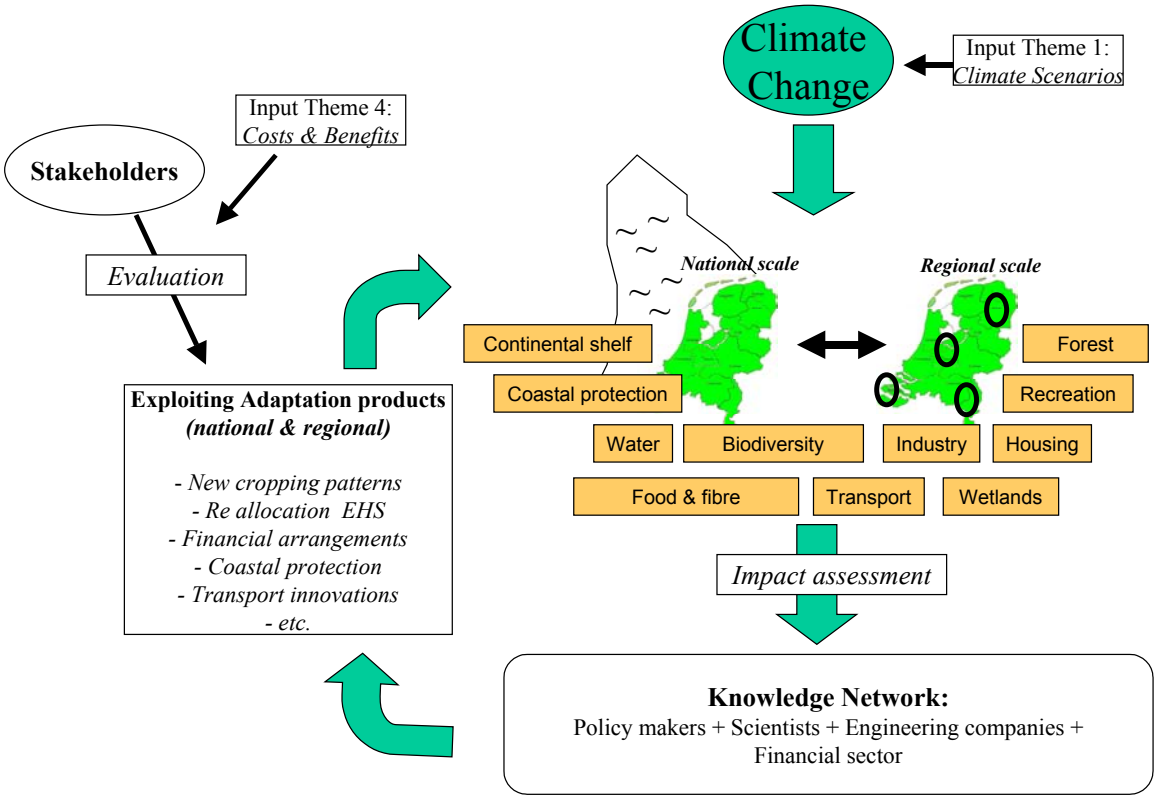


Figure 6-6: General approach of the Adaptation program

The 'Adaptation and Spatial planning theme' aims at developing new adaptation strategies that relate to spatial planning in he Netherlands. The adaptation strategies in this program will be exploited at different scales: the national scale and the regional scale. Adaptation strategies will be drawn from technical options, new policy arrangements and financial services. These strategies should resonate both the socio economic and environmental setting and will be evaluated together with planners and decision-makers ensuring the embedding of these strategies in the spatial planning process. Co-ordination of adaptation policies with neighbouring countries will be addressed for international river basins as the Rhine and Meuse.

The described general approach is supported by a number of sub themes each containing one or more individual projects. Each projects addresses scale aspects, the different impacted land use functions, the involvement of different stakeholders and sectors and aim at developing innovative adaptation products.

The sub themes are:

A. National Adaptation strategies related to land use planning:

- A A1: Designing National Adaptation strategies. This project aims at defining national strategies to alleviate flood impacts, re allocate agricultural areas due to salinisation and seeks to develop strategies based on multi functional land use by combining EHS and flood retention areas

B. Biodiversity and Multi functional land use

- A A2: Adapting the Dutch National Ecological Network: changes in the abundance and distribution of plant and animal species, disturbance in ecosystem function, loss of nature quality, invasive species affecting other species.

- A A3: Exploring the possibilities of multifunctional land use as an instrument in adapting to climate change

C. Agriculture and Forestry

- A A12: Adaptive measures in Dutch horticulture areas: Sustainable glasshouse horticulture in urbanising delta
- A A17: Agriculture adaptation in brackish water conditions: Climate change induced sea-level rise and an increased demand for freshwater can cause ecosystems and food production in the lower parts of the Netherlands to be increasingly exposed to saltwater stress.

D. Financial Arrangements and Spatial planning

- A A7: Financial arrangements: Setting up banking services and new insurance arrangements related to flood risks and land use re-allocation
- A A15: Adaptive land use strategies in small catchments: local adaptation for land use to alleviate impacts form droughts and floods
- A A9: An economic assessment of the value of a statistical life related to the risks of specific forms of land use and protection against flooding

E. Dutch Continental Shelf

- A A10: Developing water quality indicators for the assessment of and adaptation to climate effects in the Dutch coastal waters.
- A A11: climate related shifts in the NCP benthic ecosystem, and consequences for future spatial planning

F. Adaptation & Transport

- A A4: Adaptation strategies for inland navigation
- A A5: Spatial choice and environmental consequences
- A A6: Travel behaviour and environmental consequences

G. Bridge projects (see also 7.5):

Coastal protection:

- A-A8: FRICZ, Fundamentals of Regional Integrated Approaches and Methodologies towards Ecological healthy, Economically sound and Socially equitable Sustainability of Coastal Areas

Central river area

- A A13 Response of water regime and ecosystems to cc
- A A14 Land use change and adaptation for the central Dutch river systems: Developing and Evaluating land use for using flood controlled areas
- A A18 Ecohydrological models for evaluating water management strategies

Dutch Fen Meadows

- Themes 2, 3 and 4: Mitigation of greenhouse gasses through re-allocation of land use and groundwater level changes
- Theme 2, 3 and 4: Spatial Decision support for adaptation strategies in the Dutch Fen Meadows

Table 6-1: Relating Adaptation projects to investments, Scale and other ICES KIS themes

	Sheet No.	Matching Investments			Scale		Relation other sub-programme		
PROJECT	[see annex]	Government	Science	Private	National	Regional	Theme 1	Theme 2	Theme 4
National Adaptation strategies		**X**	**X**	**X**	**N**		**O**		**O**
Adapting the Dutch EHS		**X**	**X**			**R**	**O**	**O**	
Adaptive measures for horticulture areas		**X**	**X**	**X**		**R**	**O**		**O**
Adaptation and coastal protection		**X**	**X**	**X**	**N**		**O**		
Agriculture adaptation & salinization			**X**	**X**		**R**	**O**		**O**
Adaptive strategies for small catchments		**X**	**X**	**X**		**R**	**O**		**O**
Financial arrangements & adaptation		**X**	**X**	**X**		**R**	**O**		**O**
Adaptation for the central Dutch river system		**X**	**X**		**N**		**O**	**O**	**O**
Spatial strategies for Dutch Fen Meadows		**X**	**X**	**X**		**R**	**O**	**O**	**O**
Adaptive capacity & Dutch continental shelf		**X**	**X**	**X**	**N**		**O**	**O**	
Adaptation for the ducth transport sector		**X**	**X**	**X**	**N**		**O**	**O**	**O**

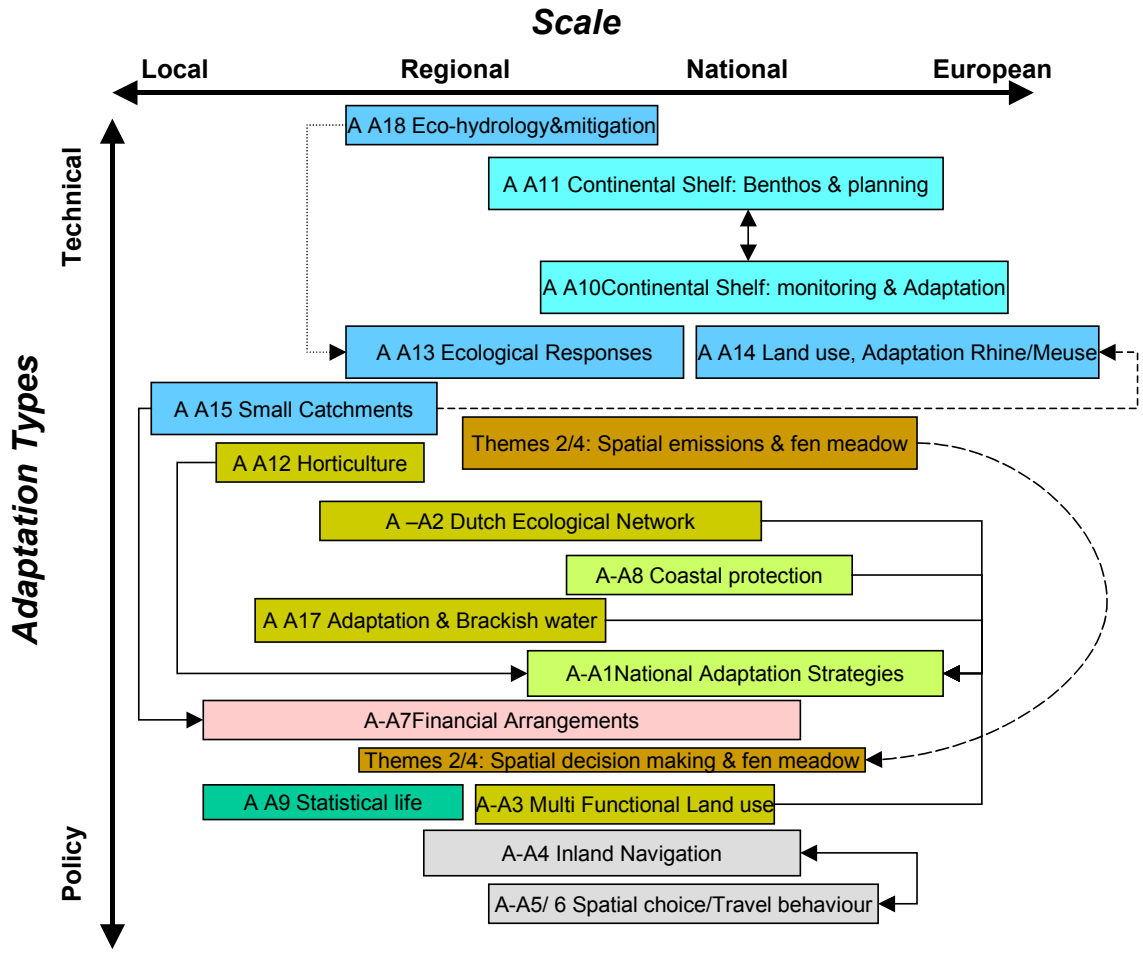


Figure 6-7: Relation across Adaptation projects in terms of scale and adaptation types
Similar colours indicate an inter-linkage across those projects involved.

Table 6-2: Relating Adaptation projects to land use functions

	Projects & involved Land use functions										
	Coast	C.Shelf	Water	Biodiv.	Food	Forest	Wetland	Indust.	Housing	Recr.	Transport
National Adaptation strategies			X	X	X	X	X			X	
Adapting the Dutch EHS			X	X		X					
Adaptive measures for horticulture areas	X							X	X		
Adaptation and coastal protection	X	X	X								
Agriculture adaptation & salinization			X		X						
Adaptive strategies for small catchments			X			X			X	X	
Financial arrangements & adaptation			X						X		
Adaptation for the central Dutch river system			X	X					X	X	
Spatial strategies for Dutch Fen Meadows			X	X			X				
Adaptive capacity & Dutch continental shelf	X	X									
Adaptation for the ducth transport sector			X					X			X

6.5 Theme 4: Integration

6.5.1 Introduction

The projects under 'Integration' are meant to support and integrate activities within themes 1, 2 and 3 and will safeguard consistency across the whole knowledge project. Integration will be achieved through a dialogue that is supported by integrated assessment, cost benefit analyses, knowledge transfer approaches and linkages to international programmes. These elements are reflected in four sub-themes.

A dialogue, as compared to academic research, is particularly able to deal with enormous complexities of information and the values and uncertainties involved in climate change issues. A dialogue is expected to enhance *learning* with and among those involved. Learning is primarily understood as to reach a shared understanding of complexity, especially the facts and values relevant for different participants. To further clarify, a dialogue on climate change, in our approach, does not seek for consensus. It is primarily a means for deepening understanding and sharpening vision in a process of interaction in a heterogeneous group of individuals, i.e. people with different, views, interests and knowledge bases. No doubt that participants will reach consensus on many different themes, if the dialogue is well structured and takes sufficient time for participants to get acquainted. However, of equal value or even more important for the long term is the identification of divergence of views and conflicting lines of argument that either require political choice or maybe resolved over time.

6.5.2 Integration Approach

Within theme 4, four sub themes can be distinguished:

A. Dialogue and Integrated Assessment
This sub theme focuses on the integration of the different constitutive parts of the knowledge project. The integration will be done in a participatory way, i.e. through structuring and facilitating informed dialogues between policy-makers, scientists, stakeholders from business, NGOs and individual citizens / consumers. The dialogues are meant to create a value added as compared to the academic research in that they will

1) provide a continuous and interactive evaluation of the knowledge project's relevance for affected groups and individuals, including its practical implications for policy choice, specific interventions and group and individual behaviour,
2) provide feed-back to research programmes and projects as regards their specific value and potential in terms of substance as well as their communication to a wider audience,
3) thereby specifically investigate into the delicate relations between facts and values, the consistency of research findings and contradictory policy preferences,
4) help to create or maintain a sense of urgency among stakeholders and citizens and thereby raise their commitment to address the risks and opportunities of climate change,
5) identify, analyse, confront, compare and where possible integrate (new) options for adaptation and mitigation, their costs and benefits as well as their implications for land use and landscape,
6) deliberate consideration and exploration of the pros and cons of different pathways for transition to sustainable energy and land use systems, thereby taking into account local, national, European and global dimensions,
7) evaluate competing claims and strategies for governance with a special emphasis on issues of spatial planning and infrastructure.

The dialogue objectives refer to long rather than the short term; short term options and interventions are considered in so far they anticipate or pave the way for high potential long term options. Next to linking short and long term perspectives, the dialogues articulate and compare the impacts and feasibility of options with respect to different levels with specific spatial implications, including levels of government but also the level of single firms (trans-national versus local) or even household, where-ever appropriate.

Important in setting up dialogues is to apply notions of transition management from Rotmans and others (2001). A transition is defined as long term change at different levels (micro, meso and macro). A transition refers to systemic change, i.e. not only technological change but at the same time change of institutions and individual behaviour. Transition management has the following properties:

- Using long term thinking as a framework of consideration for short-term policy
- Thinking in terms of more than one domain (*multi-domain*) and different actors (*multi-actor*)
- The use of sequential and interactive (participatory) decision-making
- Guiding and redirecting through learning processes (*learning-by-doing and doing-by-learning)*
- Trying to bring about system innovation and system improvement
- Keeping open a large number op options (*wide playing field*)

The relevance of notions on transition management is given by their focus on the possibility of deliberate and co-ordinated social change, not by one omnipotent authority but as a co-ordinated effort by socially responsive agents.

Integrated Assessment
In order to explore the many questions and value issues that are at stake in the transitions addressed in Climate for Space, Space for Climate, the knowledge project builds on approaches developed as Integrated assessment. During the last decade Integrated Assessment (IA) has become a rapidly evolving field.



Dialogue and Assessment on the Dutch Fen Meadows
Specific problems for the Dutch Fen Meadow areas and future perspectives for these areas are usually addressed separately from different policy perspectives and science disciplines. For the long term policy agenda, the issues relate to space are increasingly important. The following questions are addressed:

1. To what extent will the fen meadow areas undergo major (physical and social) changes as a consequence of both developments in the different policy areas and projected climate change?
2. To what extent are long-term policy goals for spatial planning, water management, nature protection, agriculture, and climate consistent or in conflict with one another?
3. What are the impacts as regards adjacent policy objectives? What choices are made by stakeholders from national and local policy-making agencies, nature and agriculture agencies and NGOs, as well as local inhabitants?

Integrated Assessment uses modelling and other scientific techniques in combination with, or in addition to stakeholder participation (Hisschemoller, Tol and Vellinga, 2001). This will also happen in this knowledge project. It will in particular build on recent experiences with participatory integrated assessment, such as the COOL project (Climate OptiOns for the Long term). In this project, stakeholders at the national, European and global level worked out strategies for emission reductions up to 80% by industrialised countries in 2050. Many stakeholders from major energy companies, other industries and NGOs have showed willingness to participate in a follow-up, which should address lessons and questions that have remained from COOL. The major issue relates to an interdisciplinary and long-term assessment of the interactions between technologies that appear promising and institutions needed to make the transition happen. Such an assessment must take into account the variables related to space and infrastructure. These are expected to meet not so much with technological difficulties as well as with major obstacles in the sphere of governance and public acceptance (Hisschemoller and others, 2002). Next to considerations related to methodology, the participatory approach to the issues of transition in this knowledge project is innovative, because so far, the effectiveness of policy institutions and instruments is, in the Netherlands and abroad, looked at from separate disciplinary angles.

The theme is organised into dialogues and integrating research in support of dialogue (project CC-C1). To start with the former, the dialogue project CC-C1 relates to a Dialogue Methodologies and Stakeholder Dialogues on Climate System, Mitigation and Adaptation.

Links to other Themes
Next to and in co-ordination with dialogue, this knowledge project will include two research projects of an integrating nature. In Sub-theme 3, *Methods for Cost benefit analysis of adaptation and mitigation options for climate change and spatial planning* the focus will be on methods for costs benefits analysis and project ranking, and their application for assessing the cost and benefits of policy options for mitigation and adaptation that are related to land use and spatial planning for the Netherlands. Project A-A1 (theme Adaptation) will analyse the consequences of various adaptation and mitigation options for, on the one hand, climate effectiveness, and, on the other hand, changes in land use and landscape.

B. Cost benefit analysis
The project CC-C2 under this sub theme will develop a consistent method that can be used in projects under other themes. The projects will assess costs on the basis of detailed cost studies for specific policy measures and technologies. Benefits will be assessed on the basis of the direct economic and physical impacts and the assessment of secondary effects, valued in monetary terms where possible and otherwise by means of economic and ecological indicators. The analysis will be in line with the OEII method as proposed by the CPB and further it will be based on the economic valuation methods that are appropriate, like CVM, hedonic pricing, production function approach, travel cost method for recreational values and a valuation of possible impacts on health and morbidity, based on the statistical value of life or days of illness.

The project will focus on the methodological issues of which methods to use for establishing and comparing the cost and benefits for decision-making under uncertainty in the presence of irreversibility's and will include interrelations amongst impacts of projects and ancillary benefits. The project will not only assess traditional cost benefit methods but it will pay due attention to multi-criteria analysis and other methods for project ranking. A specific topic will be of how to allocate costs and benefits to various domains, if ancillary benefits exist.

Links to other themes:
- *Theme 3; Adaptation: A socio-economic analysis of the adaptation options.* The study will pay detailed attention to scenarios for Land use and their socio-economic implication in the setting of a clear cost benefit analysis of changes in the agricultural and forestry sector related to climate change. This requires a detailed model study of the options and their costs and benefits by means of scenario studies for these specific sectors in the Netherlands. The project is directly linked to the project under 6.3 Adaptation "Designing land use adaptation strategies in the Netherlands under changing climate conditions. The project will focus on applying costs benefit analysis for competing Land use activities at a more detailed level than can be done in the more aggregated study under 6.3, after detailed selection of the cases by the project team members. Case studies will focus on the assessment of costs and benefits for biomass and agriculture, multiple Land use for recreation, agriculture and carbon sequestration or for the competition between agriculture and residential areas.
- *Theme 3; Adaptation: Cost and benefits of adaptation options in water management.* Various options exist to change the water management system in order to adjust to climate change. This will include options for coastal defence, water retention and water storage areas, reinforcement of dikes along rivers and installing additional pumping capacity at various locations. Although many plans in this area exist, a profound analysis of the cost and benefits of the various options has not yet been made and an urgent need exist for proper cost benefit analysis on water management options related to land use options for e.g. nature, infrastructure, agriculture and housing. The study will focus on assessing the economic cost and benefits of a policy alternatives for water management and the risk of flooding, including related damages of flooding for a number of specific case studies in the Netherlands, including restructuring of coastal infrastructure near Katwijk. This projects is directly related to the Coastal Protection project that was mentioned under 6.3 Adaptations.
- *Theme 2; Mitigation: Cost benefit analysis of land use related mitigation option.* The study will focus on the costs and benefits of land use related projects abroad and will provide insight in the cost of these projects and their implications for the hosting countries in a number of case studies. The work will focus on carbon sequestration in developing countries, including Ecuador and Indonesia. The new contribution of the study is the focus on the economic, technical and political risks of projects abroad and the related cost and benefits. In addition specific attention will be paid to leakage of carbon sequestration, in order to properly assess the net quantities of carbon sequestration in the projects. The results will be integrated as such that an appropriate trade off can be made between policy measures in the Netherlands and policy options in other countries under clean development mechanism and joint implementation in order to support the decision making in the Netherlands on Land use and carbon sequestration.
- *Theme 3; Adaptation: An economic assessment of the value of a statistical life.* Climate change leads to changes in various risks to which people are exposed such as the spread of certain diseases and the occurrence of natural disasters. Such risks vary in space: in some locations they are higher than in other places, and hence there is a clear link with land use. For example, if areas with high flood risks would remain unoccupied, the effects of natural disasters would be much lower compared with densely populated areas under risk. The standard way in which these risks are dealt with in land use planning is to impose safety standards such as the probability of a flood of 1 per 2000 years as a norm for mitigating measures. Although such standards may have some value for public policy, their foundation is weak. In addition they are not easy to incorporate in cost-benefit analysis of alternative land use policies or risk

reducing measures. Therefore there is reason to carry out a systematic analysis of the valuation of climate change related risks. A proper valuation of these risks is an important ingredient of cost-benefit analysis of land use policies -and policies in other fields- that imply different risk exposure levels. It is proposed to focus on the costs associated with casualties, because these appear the ones that are most difficult to quantify. An important way to address these costs is to investigate consumer's willingness to pay for reductions in these risks. From these amounts of money one can infer estimates of the so-called 'value of statistical life' (cf. Viscusi, 1993).

C. Knowledge transfer and diffusion (*see also chapter 8*)
Communication, citizen participation and the co-production of operational knowledge are considered key elements in understanding climate change problems and to create public support and active stakeholder involvement in developing mitigation or adaptation options. So far science has failed to communicate a sense of urgency to the wider public. Many citizens and stakeholder groups that represent them in one way or another, do not consider climate change as a threat nor as a guiding principle in spatial planning, and are not sufficiently challenged to play an active role in coping with its potential consequences. This lack of citizen and stakeholder involvement in climate change issues leaves a potential to significantly increase societies operational knowledge on the complex interlinkages between spatial issues and climate largely untapped.

Another issue is the wide range of institutes involved in climate change research and policy development. The institutions involved have separate communication policies with regard to their own field. At present an entity is lacking that has the national responsibility to elaborate the tuning and integration of the various activities so as to implement a consistent climate communication strategy. Consequently the range of communication activities is fragmented, incomplete and inconsistent in terms of messages. This situation needs improvement.

This problem can be tackled only through a concerted action. No single partner has either the means or the responsibility to do so single-handedly. A national multidisciplinary program, like ICES KIS3, is needed to provide the impulse. This sub theme aims at improving communication related to climate change issues to society by:

- Developing a national Platform for Communication on Climate Change in which people work together on a structural basis. This platform will harmonise and synchronise communication activities of the suppliers, initiate multidisciplinary communication activities and serve as the national focal point for requests for information on climate change. Besides it will act as the national focal point for international communication initiatives.
- Develop a website (climate portal) that serves to distribute information both to the general public and intermediary actors. Besides the site will facilitate local, regional, and national discussions on climate change between representatives of different actor groups from different environmental and socio-economic disciplines.
- To develop courses on climate change and spatial planning for students, scientists and professionals from the government and private companies
- To stimulate communication by developing new products such as brochures, magazine or newsletter, presentation material, database of speakers, symposia, discussion platform, data visualisation website.

The platform will be supported by both the Foundation for Climate, Land use and infrastructure (chapter 7) and NCCC (see 8.2). The climate communication platform will offer policy makers, the private sector, Non governmental Organisations, scientists and other stakeholders a clustered, high quality and accessible knowledge infrastructure on the interface of climate change and spatial planning. The platform will engage a dialogue between stakeholders to develop innovative socio-economic approaches of spatial planning and land use that anticipate for climate change and contribute to a safe, sustainable and resilient infrastructure in the Netherlands

Important is to reach out to governmental bodies and programmes and to embed results within education, media, NGOs, etc. For example, the results will connect to several existing governmental strategic programmes such as Dutch vision on Water management for the 21st century (WB21, 2000), the fifth policy plan for spatial planning (VIJNO, 2001), The Vision of the future economic infrastructure (VES, 2001), The vision on Society and Nature the Netherlands (Natuur voor mensen, mensen voor Natuur, 2001), The national environmental policy plan (NMP4, 2001) and the climate policy plan I+II (Klimaatnota I+II, 2001/2). In order to achieve the communication goals 5 projects have been formulated, summarised by Table 6.3

Table 6-3: Formulated Projects Knowledge transfer and diffusion

Project	Objectives	NEW Products	Target audience
CC-A1 National Communication Centre on Climate Change , NCCC (RIVM/KNMI)	- To develop a consistent and tuned national communication strategy on climate change - To co-operate with international communication activities	- website (Klimaatportaal) - Communication platform - Newsletter - Contact database - Symposia - Presentation material	- General public - Stakeholders, focussing on intermediary actors (belangen organisaties) - Scientists
CC-A2 Knowledge bridging to acting (SENSE)			- Professional decision makers in spatial planning - Bachelor, master and postgraduate students
CC-A3 Climate mirror; linking knowledge about climate change to concrete municipal and provincial mitigation and adaptation measures	- Implementation of local/provincial indicator system for effectiveness of climate policy	- Framework of a local/provincial indicator system to monitor implementation of adaptation and mitigation measures	- General public - Local policy makers
CC-A4 Data Integration for a virtual data centre	- A portal of a Virtual Data Centre to enhance development of problem-solving decision support systems on adaptation and mitigation measures.	- A shared climate database - A portal	- Scientist/students from different disciplines
CC-B1 Los ninos and las ninas and global change (aarde NU and consortium)	- to disseminate appropriate knowledge that enhance the support, the attitudes, behaviour, skills and abilities of individuals and groups - Awareness raising on global change issues	- Educational work packages containing: lesbrieven, documentaries - Pilot projects on schools on education on climate change building upon Natuurkalender & Check Climate Change! - Museum exhibitions - Use of provided internet facilities of NCCC (DD-A1 & DD-B2)	- Students (primary & secondary school) - Teachers - General public
CC-B2 Risk communication in knowledge production and utilisation for climate change prevention and adaptation.	- to contribute to a widely shared sense of urgency and sense of the problem ownership and public support needed for a timely needed restructuring of the Netherlands - to make better use of operational knowledge on climate change (weather variability) and its impacts -	- New tools for risk & Uncertainty communication - Participatory monitoring networks - **Interactive** website	- Stakeholders - General public - Scientists

D. International linkage (*see also chapter 7*)
In line with the set up the knowledge project and its 'Foundation on Climate Land use and Infrastructure' we can observe an international trend of clustering of knowledge partners in Europe and on a global scale. This project aims to unify and represent the national knowledge institutions in these international frameworks and to engage in strategic partnerships with leading European "centres of excellence" as in Germany, England and Scandinavia. These partnerships will also be used to position ourselves in the Sixth European Framework Programme of the EC. The inherent cross-border character of the climate change issue asks for such international scientific alliances and linkages.

Furthermore, important is to link the outputs of the knowledge project to the IPCC and its Climate Change International Institutions Programme (CCIIP). The CCIIP of the IPCC is envisaged to provide scientific material for the Policy work of IPCC. The IPCC itself does not undertake new primary research work. It undertakes assessments of published scientific articles. A review of three policy assessments of IPCC indicates that there is considerable literature available in some fields (e.g. economic analysis) and much less in other fields (social, legal and political analysis), which leads to an imbalance in the assessments. Some of the fields inadequately researched are:

a) the issue of multi-level governance in the climate change regime; the relationship between public international law and private international law in the climate change regime;
b) the issue of liability for the potential impacts of climate change;
c) the issue of international biomass trade for the purposes of energy generation as a potential solution to the problem of climate change.

The CCIP programme focuses in first instance on the above-mentioned problem areas and this knowledge project will contribute towards enhance knowledge on these themes.

In summary*:*
Figure 6.7 presents the basic structure of the Theme Integration through Dialogue. The user platforms constitute affected groups in a certain area who will be receiving the reports from the research in that area, i.e. climate system, adaptation and mitigation. From these groups, dialogue participants will be recruited. The theme is organised into dialogues and integrating research in support of dialogue. Project CC-C1 relates to (1) Dialogue Methodologies and (2) Stakeholder Dialogues on Climate System, Mitigation and Adaptation. Also in project CC-A3, the Climate Mirror, a dialogue with consumers is included. The dialogues carried out in the context of the Fen Meadow Project (Theme Mitigation, M-D3) and the Coastal Zone Project (Theme Adaptation, A-A8 FRICZ). The project team will develop a knowledge project's organisation and management structure which will try to maximise both an autonomous execution of (sub)projects as well as a meaningful collaboration, that is sharing experience on planning, methodology, policy science interaction and substance. Leading Scientists active in the research on climate system, adaptation and mitigation will also be involved in the knowledge project structure, as they are vital for the science policy interaction.

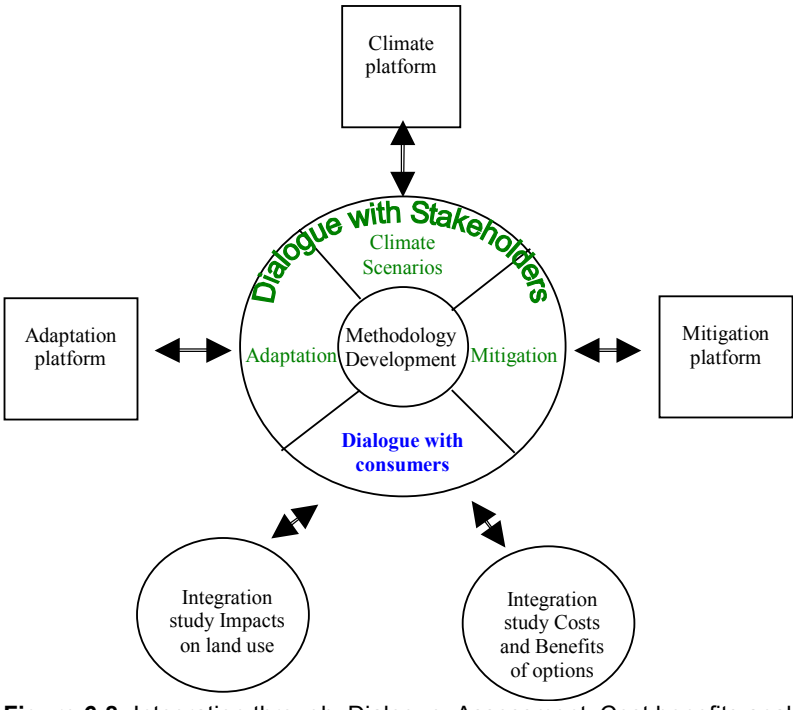


Figure 6-8: Integration through: Dialogue, Assessment, Cost benefits analyses and participation.

6.6 Open Programme

It is expected that developments in technological and methodological advances can proceed quickly, since the total duration of the project is relatively long. In order to flexibly connect to new developments, the knowledge project has reserved about 15% of the total budget for new projects and initiatives. The clustering around the four themes, however, remains fixed throughout the project duration. This means that each new initiative or project idea must connect to either 'Climate scenarios', 'Mitigation', 'Adaptation' or a subject that relates to integrating these themes. And, any new initiative should preferably connect to existing projects.

A few potentially new projects have been identified and refer to: The impacts of pests and diseases, Biodiversity and ecological networks, Implications of EU policies on Dutch spatial planning, the relation of surface heat fluxes on regional climate models, the use of satellite data for climate models and exploring options for mitigation abroad.

Open Programme	
Theme	**Project Topics**
1. Climate Scenarios	• Heat fluxes / Climate processes • Satellite based monitoring & model validation
2. Mitigation	• Mitigation abroad • Biomass production • C-sequestration in arable soils
3. Adaptation	• EHS / Biodiversity • Pests and Diseases
4. Integration	• Impacts of EU policies on Dutch spatial planning • Costs and benefits of multi functional land use in the coastal zone

6.7 Phases and milestones of the different projects of the sub-themes

Table 6-4 presents the expected deliverables per theme and sub-theme. It illustrates the phasing of different project activities connected to a deliverable and what success criteria will be used to measure whether a deliverable fulfils the pre set requirements. The different grey-shades relate to planned activity intensity connected to the set deliverable.

PHASING, DELIVERABLES & SUCCES CRITERIA (Per themes & Sub themes)																
Theme / Sub theme & Deliverable	**2004**				**2005**				**2006**				**2007**				**Success Criteria**
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
THEME 1: CLIMATE SCENARIOS																	
A. Communication and data management																	
Communication activities to develop CC scenarios																	Involvement with stakeholders & users
Data management platform																	Operational data centre
B. Climate Change scenarios																	
Tailor made cc scenarios (global-regional – local)																	User interaction + Use in other case studies and projects (See Themes 2, 3 and 4)
C. Historic climate data																	
Historic precipitation and flood events series																	Use of historic data for future hydrological simulations
Historic CO2 series																	Use of data in IPCC projections

D. Climate parameters		
Time series assessment on climate extremes		Freely available data series used by wide audience
Ecological parameters for monitoring purposes		Accessible Ecological data series
Improved atmospheric observation site		Site/results used by end users for validation studies
Aerosol assessment study		Published papers
Hydrological and meteorological Parameter assessment		Measurements in accessible database
Measurements of soil moisture		Use of results in climate model
E. Climate processes		
Historic trends in aerosol loadings		Use results in climate model
Cloud cover simulation		Use results in climate model / contribution to IPCC
Precipitation and cloud scenarios and simulations		Use of data in RCM models
Ocean data assimilation assessment		Operational database at KNIOZ
Improved Ocean process knowledge		Published paper
THEME 2: MITIGATION		
Dialogue & communication		
Dialogue workshops		Delivery according to specification
Database and portal		Use by stakeholders
A. Monitoring of emissions.		
Operational mon. sites		Continuous multi annual time series
Temp. var. assessment		Scientific publications
Activity specific emission factors		Use in A3 & B1 & mitigation options
Operationl monitoring GHG &aerosol		Continuous multi annual time series
Operationl fac. & spat. var. assessm.		Spatially distributed flux maps
Data assimilation tool operational		Annually update emission estimates
Annual emission estimates, trends		Use in mitigation policy evaluation
Improved C-stocks soil & forest		Use in UNFCCC reports
Hi-res (spat. & temp.) inventories		Use in MM-A2
B. Land use and mitigation		
DSS tool data assimilation		Use in integrated assessment
European and global sink potentials		Use in allocation tool
Land based mitigation options		Use in integrated assessment of options
Improved Crop and C sub models dev.		Integration in IMAGE
Food-chain em. scenarios		Scientific publications
Forest C emission scenarios		Scientific publications
Reduction options & costs		Use in policies development
C. Land use and energy		
Tool box development		Use in scenario analysis
Scenario analysis NL		Use in policies development
Techn. & regulatory roadmap		Use in policies development
Model & database development		Use in scenario analysis
Scenario & impact analyses		Use in transition development
Biomass transition roadmaps		Policy recommendations
D. GHG balance fen meadows and mitigation options		
Water management options		Use in integrative spatial model
biodiversity enhancement scenario's		Use in integrative spatial model & Spatial regional policies
Carbon sequestration options		Use in integrative spatial model & Spatial regional policies
Operational process design		Use in participative workshops
Transition path fen-meadows		Policy recommendations
E. Climate neutral entrepreneurship		
Audit protocol		Participation of large companies
Management guidelines		Use in corporate strategy development
F. Mitigation abroad		
Project proposals		Positive proposal evaluation
Project execution		pm

THEME 3: ADAPTATION	
A. National Adaptation strategies	
National Adaptation strategies	Strategies used by RIVM
Design and land use plan. instrum.	Operational LUMOS system
Cost benefit analysis	More Cost effective adap. strategies
B. Biodiversity	
Species at risk	Publication
Quantified Recreation change	Adaptation in spatial Policy
Adaptation scenarios	Strategies used by government
Multi function. strategies	Implementation at regional farm/biodiversity level
Scenario and impact assessment	Involvement and participation by stakeholders
C. Agriculture and Forestry	
Dialogue on CC and horticulture	participation by stakeholders
Scenario & assessment study	Use in horticulture sector
Inventory of salt resistant crops	Implementation in agric. sector
Methods for using brackish water for biomass production	Participation by private companies
D. Financial Arrangements and Spatial planning	
Risk assessment	Involvement insurance company
New banking and finance system for disaster management	Involvement banking organisation + government
Adaptation strategies for flooding	Implementation by water board
Adaptation strategies for droughts	Implementation by water board
Methods for valuing statistical life	Published paper & participating by government
E. Dutch Continental Shelf	
Water quality maps	Use of maps to enhance adaptation by RIKZ
Inventory benthos	Working Website with results
Updated Spatial planning of NCP	Participation government
F. Adaptation & Transport	
Adaptation strategies for navigation	Participation and implementation port of Rotterdam
Spatial choice model	Participation government
G. Bridge projects	
Coastal risk maps	Involvement RIKZ
Spatial planning maps Coastal area	Involvement VROM / RPB
Ecological impacts CC river system	Implementation in policy document RIZA
Quantifying Land use changes Rhine/Meuse	Updated adaptation strategies by RIZA
Fen Meadow projects: see Theme 2	
THEME 4: INTEGRATION	
A. Dialogue and Assessment	
National dialogue	Participation stakeholders / implementation in national policy
National Mitigation assessment	Use of results in policy document
National adaptation assessment	Use of results in policy document
Local dialogue	Participation stakeholders / implementation in local policy
Framework for mitigation dialogue local-regional	Published article on framework
Transition analyses on energy	Implementation of framework in national policy panning
B. Cost benefit analysis	
Framework for CBA	Implementation framework in case studies (see projects theme 3)
Inventory of carbon sinks	Published report
Valuing statistical life	Implementation in policy document
C. Knowledge transfer/diffusion	
National com. platform	Participation by all stakeholders
Climate portal	Operational web site
Courses and summer schools	Participation by students & professors
Museon exhibition	Permanent exhibition in Museon
Risk communication	Involvement stakeholders + published article
D. International linkage	
Multi governance assessment	Published papers / implementation in 4 case studies
Methodology for intern. Biomass trade	Implantation I 2 case studies
Assessment of impacts of int. funding on	Implementation by UNFCCC

Table 6-4: Phasing, deliverables and success criteria

6.8 Main risks, what measures have been taken to mitigate/reduce them

The following issues have been identified for risk management in carrying out the knowledge project.

Ensure Knowledge Transfer
Outputs of the whole knowledge projects will be embedded in the Network on Climate and Spatial Planning, which will be monitored through the Foundation for Climate, Land Use and Infrastructure. Special knowledge projects have been identified to transfer knowledge to educational institutes and provide courses to governmental organisations and private companies.

Management Structure (see chapter 7)
In order to provide a sound management of the knowledge project, the daily Programme Bureau will supported by a Board and an Advisory committee. The Board and the Advisory committee consists of a mix of CEO's from organisations related to the government, private companies and scientific institutes. The programme bureau and the board are advised by a review committee commissioned by NWO to ensure scientific quality (chapter 7.2).

Open Programme:
In order to anticipate to new developments and technologies, the knowledge project has reserved about 15% of the total budget for new projects and initiatives. The new initiatives, however, must comply with the existing knowledge project structure, and hence must fit into the four pre defined themes: (1) Climate scenarios (2) Mitigation (3) Adaptation and (4) Integration (See paragraph 6.6).

Project quality:
Each project will be co-ordinated by senior scientists and consultants (Annex C). A first requirement for selecting the projects was to follow a relatively detailed project proposal, including detailed budgets, participation of end users, clear defined objectives and expected results. Each proposal shows a timetable with milestones and deliverables (See also Table 6-4). It is known that –especially larger- projects will face start up problems and problems in meeting deadlines. Therefore, much attention will be paid to closely monitor the progress of these projects by the foundation and review committee.

Scientific quality:
The Netherlands Scientific organisation (NWO) has been assigned with the task to review all project proposals before they will be finally granted. NWO will also deliver capacity to perform a scientific midterm- and final review of all results.

6.9 Activities & steps to continue after completion of the project

Where elsewhere in Europe both institutional and programmatic support of integral activities have already started (e.g. Tyndall Centre in the UK, German Potsdam Institute for Climate Impact Research), the Netherlands still have to make this effort. The Bsik (ICES-KIS3) grant offers a unique chance to initiate the co-ordinating 'Network on Climate and Spatial Planning' and establish the basic knowledge infrastructure required for its work. This will give the Network an (inter)national position and will catalyse for future interdepartmental and inter-sectoral co-operation. The consortium is confident that after its head start the network will be fully equipped to generate income from other sources and sustain its existence. This approach is preferred over a more gradual building of the Network. International evidence suggests that a series of smaller and loosely connected initiatives cannot generate the snowball effect that a single, well co-ordinated and targeted investment will have in tying together different partners and becoming the obvious focal point for (inter)national co-operation.

The following issues have been incorporated in the knowledge project activities to ensure international and national embedding of the network after the ICES KIS grant period:

- The ICES KIS have been made contact to other international centres (Tyndal and Potsdam) to establish a European network
- There is vast link towards the NVKO research programme to co-operate on themes communication and knowledge transfer
- The knowledge project will tie up its results to relevant Dutch strategic policy documents as NMP.

7 Consortium: composition and co-operation

7.1 Composition of the consortium

Aiming to strengthen the Dutch knowledge infrastructure, seven leading Dutch knowledge institutions initiated a broad consultation that lead to an Expression of Interest (EoI) for subsidy under the Decree on subsidies for investments in the knowledge infrastructure (Bsik, formerly ICES-KIS-3). The EoI, titled "Ruimte voor Klimaat • Klimaat voor Ruimte", was submitted in September 2001. The consortium unites providers of knowledge and expertise and knowledge users or clients. It does however not aim to discriminate between institutions or individuals based on this qualification. Rather it aims to breach the traditional roles of supplier and client and recognises that all partners hold valuable expertise on element of the system. Sharing information and dialogue are central to realising partnerships between divers project members. All partners contribute according to their own expertise and special interest. Internationally the knowledge project is supported by the world leading Tyndall Institute in the UK and the German Potsdam-Institut for Climate Impact Research.

Motivated by this recognition a consortium was formed to write this Knowledge project plan, covering the prioritised area 'Climate & Spatial Planning'. The project plan was created in close collaboration with a wide range of stakeholders, including the Ministries of Housing, Spatial Planning and the Environment (VROM), Agriculture, Nature Management and Fisheries (LNV), Transport, Public Works and Water Management (V&W), Education, Culture and Science (OcenW) and Economic Affairs (EZ), regional and local governmental agencies, the private sector and NGOs. Consortium partners include nationally and internationally recognised institutes, securing the international position of the consortium.

The consortium recognises that the benefits of climate research arise from the application of its findings and not simply from its production. Research on climate must be strongly coupled with research on applications science, and ultimately the measure of success of this project plan is the degree to which research findings are successfully implemented and strengthen the Dutch knowledge infrastructure.

The consortium, therefore, comprises a mix of multi sectoral institutes, scientific institutes and private enterprises. Table 7-1 presents an overview of the consortium:

Knowledge project plan partners	
Ministeries - National Government	
Ministerie van LNV	Ministerie van VROM
Ministerie van V&W	
Government	
Adviesgroep voor Verkeer en Vervoer	Provincie Overijssel
Dienst Landelijk Gebied	Provincie Utrecht
Dienst Waterbeheer en Riolering Amsterdam (DWR)	Provincie Zuid-Holland
Milie Dienst Rijnmond	Staatsbosheer
Minsterie van EZ - NOVEM	Unie van Waterschappen
Ministerie van OcenW -NWO	Waterschap Rivierenland
Pilot Stortelersbeek	Waterschap Rijn en Ijssel
Pilot 't Klooster	Waterschap Schieland
Provincie Gelderland	Wetterskip Fryslân
Provincie Limburg	Zuiveringschap Hollandse Eilanden en Waarden
Provincie Noord-Holland	
Knowledge Institutions	
Centrum voor Geo-Informatie	SENSE Onderzoeksschool
Centrum voor Internat. Samenwerking Noord-Holland	Space Research Organization Netherlands (SRON)
Centrum voor Isotopen Onderzoek Rijksuniversiteit Groningen (RuG)	Technische Universiteit Delft-Geodesie
Copernicus Instituut, Universiteit van Utrecht	Technische Universiteit Delft – Internat. Research Centre for Telecommunications-transmission & Radar
Economisch en Sociaal Instituut VU	Technische Universiteit Eindhoven
Energieonderzoek Centrum Nederland (ECN)	TNO Fysisch en Elektrisch laboratorium
Koninklijk Nederlands Meteorologisch Instituut (KNMI)	TNO Milieu, Energie en Procesinnovatie
Koninklijk Nederlands Instituut voor Onderzoek der Zee (KNIOZ)	TNO-NITG Nederlands Instituut voor Toegepaste Geowetenschappen
Nederlands Instituut voor Visserijonderzoek B.V.	Universiteit Leiden - Nationaal Herbarium Nederland

Knowledge project plan partners	
(Stichting) Post-Hoger Landbouwonderwijs (PHLO) - Wageningen Universiteit en Researchcentrum	Universiteit Maastrich - ICIS
Praktijkonderzoek Plant & Omgeving (PPO)	Universiteit Maastricht, Rechtenfaculteit
Rijksinstituut voor Integraal Zoetwaterbeheer en Afvalwater-behandeling (RIZA)	Universiteit Utrecht Faculteit Natuur- en Sterrenkunde
Rijks Instituut voor Kust en Zee (RIKZ)	Vrije Universiteit Amsterdam (VU)
Rijksinstituut voor Volksgezondheid en Milieu (RIVM)	Wageningen-UR, Climate Change and Biosphere Research Centre (CCB)
Rijks Universiteit Groningen-CIO	WL | Delft Hydraulics
Rijks Universiteit Gronimgen, Fac. der Wiskunde & Natuurwetenschappen	
Non-Governmental Organisations	
Both Ends	Stichting Vogelonderzoek Nederland
FLORON	Teylersmuseum
Foundation for Sustainable Development	The Balikpapan Orangutan Survival Foundation
Gelderse Land- en Tuinbouw Organisatie-GLTO	VARA Radio
Nationaal Natuurhistorisch Museum (NATURALIS)	Vereniging Natuurmonumenten
NEMO	Vlinderstichting
Stichting Toegepast Onderzoek Waterbeheer	World Wildlife Fund (WWF)
Private Partners	
Afvalzorg Deponie B.V.	KIWA N.V.
Arcadis B.V.	Koenders Instruments B.V.
Business for Climate	Mentink - procesmanagement B.V.
CaTec B.V.	ODE Desert Enterprises
CE-Transform	R&R Mechatronics B.V.
Centrum voor Landbouw en Milieu (CLM)	Rabobank Nederland
DHV Milieu en Infrastuctuur B.V.	Royal Haskoning, Haskoning Nederland B.V.
Dutch Space	SarVision
ECOFYS B.V.	SME-Milieuadviseurs
Educational Material and Network	TAUW B.V.
FACE Foundation	Virtual Knowledge Center
GEODAN	VITENS
Interpolis Re	WaterWatch remote sensing
Kema Nederland B.V.	Witteveen+Bos
Kipp & Zonen B.V.	
International Partners	
Alfred Wegener Institute	Tyndall Centre for Climate Change Research
CETP-UVSQ	University of South Carolina, School of Policy Planning&Development
IGBP (ICSU-Global Change)	University of Bonn –Meteorological Institute
Max-Planck-Institute fur Biochemie (CARBOEUROPE)	WCRP (ICSU)
Potsdam Institute for Climate Impact Research.(PIK)	SEECON Social Ecological & Economic Consulting

Table 7-1: Knowledge project plan partners

The parties, who have submitted a joint project proposal, have send a letter of support, provided CV's of their employees and a capacity statement of their institute (see Appendix A and Appendix B).

7.2 Availability of qualified personnel, description of 'track record' of individual research leaders and of the participating stakeholders, expertise and how they are complementary.

A large number of knowledge institutes participate within this knowledge project and make available well experienced team members and leading scientists. In most projects several parties are involved, ensuring that the people with the right skills complement each other's expertise. Most of the projects involves personnel from research institutes, private companies and governmental organisations.

However, a number of vacancies do exist, consisting mainly of doctoral candidates. In order to fill these vacancies a large effort has already started at both national and European (EU) scale. This preliminary search for the candidates will be formalised started as soon as it becomes clear whether the knowledge project plan is approved. Candidates will be hired after the first quality review (see below).

Each major research theme in the knowledge project is co-ordinated by an international leading scientist. They are assisted by qualified senior researchers and professionals. Hence, each project will be co-ordinated by senior scientists and consultants. The CV's are presented in Annex C.

Safeguarding research quality
The tasks of scientific review and evaluation will be commissioned to the Netherlands Organisation for Scientific Research (NWO), which will follow its standard procedures. NWO will also deliver capacity to perform a scientific midterm- and final review of all results.

NWO will be involved at four stages in the knowledge project:
1. After government approval of the knowledge project plan, the projects specified in the project sheets will be further detailed in order to allow scientific evaluation by NWO and the subsequent hiring of PhD students and postdocs. The aim is to judge whether proposals meet the minimum scientific standard (A or B marks in a range of A-D). This will be based upon peer review by at least two independent (generally foreign) referees per proposal, rebuttal by the applicant and final judgement by a committee of scientists. This committee will be established by NWO in consultation with the Board of the "Foundation for Climate, Land Use and Infrastructure" (see 7.3) Decisions on the allocation of funds will be made by the Board of the Foundation on the basis of the scientific review and on a review of the fit to the knowledge project plan's societal goals. Under no circumstance projects with a C or D scientific rating will receive funding;
2. Part of the knowledge project's budget is deliberately left open in order to allow for flexibility in meeting the overall knowledge project's goals and to allow for new partners to join. For this part of the budget, NWO will organise (i) the call for proposals and (ii) the evaluation as described before. The evaluation will result in a ranking of the proposals according to scientific quality. Final decision on the allocation of funds will again be made by the Board of the Foundation;
3. A mid-term review of the scientific progress and quality of the knowledge project as a whole will be organised by NWO through an evaluation panel constituted of about 5 foreign scientists under independent chairmanship. The membership of this evaluation panel will be decided by NWO;
4. In the last year of the knowledge project NWO will be responsible for the final review of the scientific quality of the knowledge project.

7.3 Knowledge project organisation and form of collaboration in the consortium

Consortium and the "Foundation for Climate, Land Use and Infrastructure"
A broad *Consortium*, outlined in paragraph 7.1, has initiated this knowledge project plan. At this stage of planning of the knowledge project, not all members of this Consortium participate as members in the *"Foundation for Climate, Land Use and Infrastructure",* which is being set up to act as a legal body to interface between the Ministry of Economic Affairs and the Consortium about executing this knowledge project. However, all parties actively participating in the Consortium have signed a *Partnership Agreement* and/or other related documents (i.e. *Letters of Intent* and/or *Letters of Commitment*) which rely their responsibilities within the Consortium.

See Bijlage (Appendix) of the Bsik Application Form and the Appendix A of this Knowledge project plan for the Partenership Agreement, Letters of Intent and Letters of Commitment of all partners.

In *Partnership Agreement* and related documents, the parties commit themselves to participate in the knowledge project activities on joint risk and liability basis. Accordingly they have expressed their financial commitments for the given periods. The Agreement has made provisions for parties wishing to join, and for the potential further premature exiting of parties. The Agreement also covers a mandate for the setting up of the "Foundation for Climate, Land Use and Infrastructure" , initially by the Wageningen University and Research Centre (Wageningen UR) and the Vrije Universiteit (VU) Amsterdam. This Foundation will act as the legal entity, which will submits this knowledge project plan and interface, on behalf of the Consortium, with the Ministry of Economic Affairs about executing this knowledge project. The members of the *Board of the Foundation* have been selected to represent all typical involved in this knowledge project: the parties using the developed knowledge, the parties developing the knowledge and the parties disseminating the knowledge.

The Board of the "Foundation for Climate, Land Use and Infrastructure"
The Board oversees the lawfulness, appropriateness and economic efficiency of the management. It decides upon general research objectives, as well as over important matters of research policy and financial matters of the "Climate *Changes* Spatial Planning" project plan, and lays down the basic principals for performance control. The Board is composed of at least four and at maximum 7 honorary members. The Board of the Foundation will have at least 2 meetings per year, in which they take the necessary decisions on the implementation of the complete knowledge project and the specific projects.

To reflect the dynamics of research activities programming within the knowledge project, financial means have been reserved for projects to be defined in a later stage. The Foundation is responsible for generating the tender procedures for this open programme. Furthermore the Foundation is responsible for interacting with NWO about the definition of the profile for the review committees, which will then be used by NWO to select the members of the review committees, and to conduct the reviews. The Board will delegate the day-to-day management of the Knowledge project to the Programme Bureau.

The Programme Bureau
The Programme Bureau will receive its operating guidelines from the Board of the Foundation for Climate, Land-use and Infrastructure. The Programme Bureau will be run by a Science Director and Managing Director, both acting as delegated representative of the Board of the Foundation. The Programme Bureau will perform the day-to-day scientific and administrative management of the ICES-KIS 'Climate *changes* Spatial Planning' project plan in accordance with the Knowledge project plan, the Partnership Agreement, supporting Documents, and the resolutions of the Board of the Foundation. The Programme Bureau develops the initiatives necessary for fulfilment of the tasks in the areas of planning, co-ordination and controlling, and ensures an effective and economically efficient use of the available means.
The financial means needed for this bureau are estimated at about 3,5 % of the total budget of the Knowledge project, and will be brought up by all parties involved in the Knowledge project.

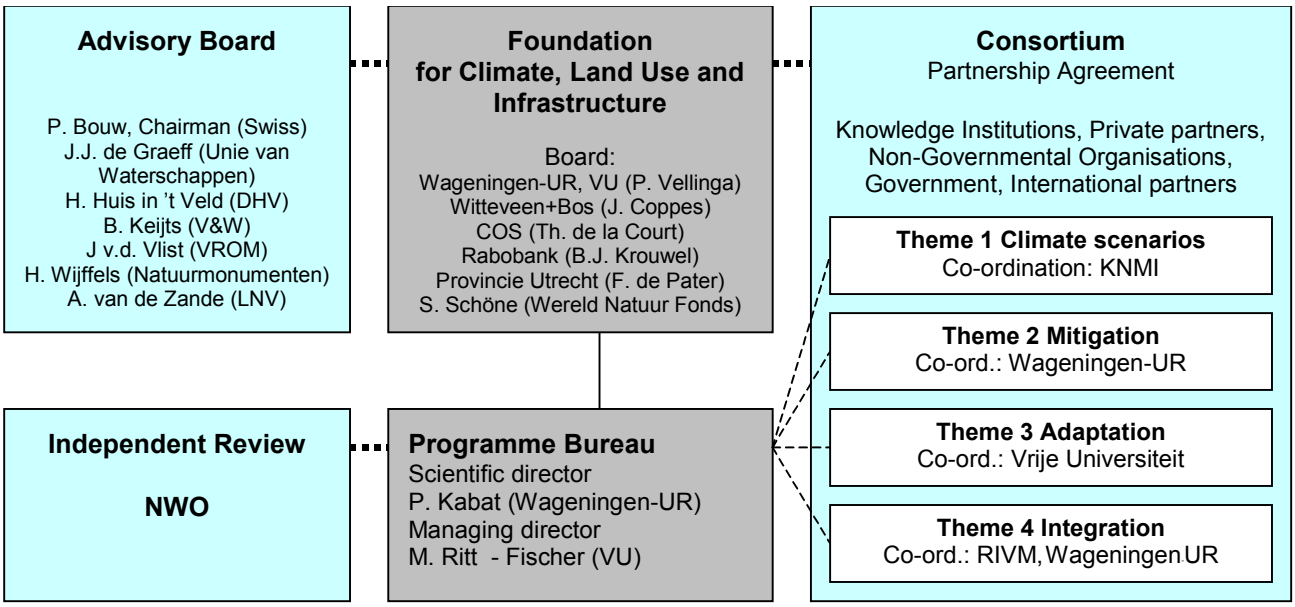
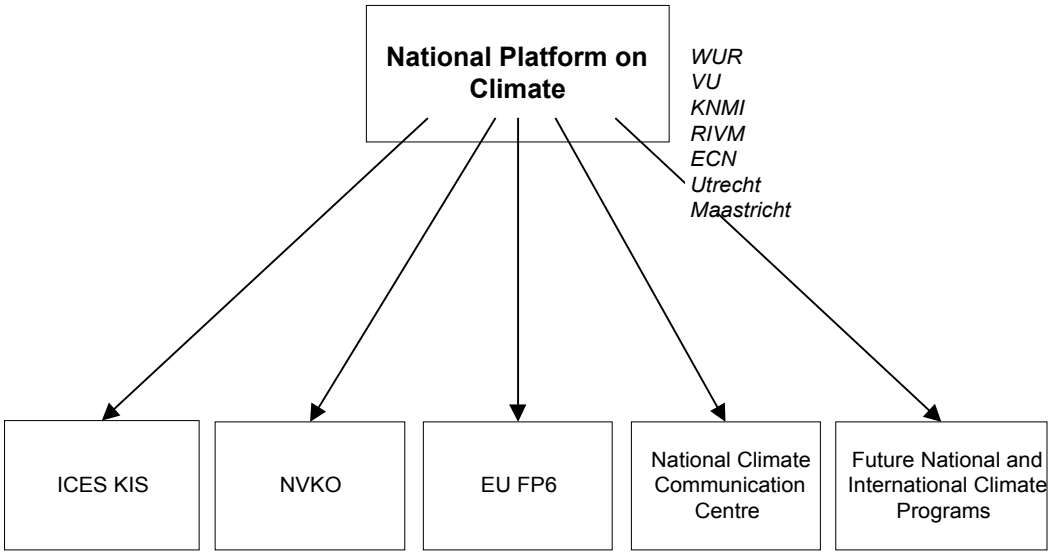


Figure 7-1: Project plan organisation

The Advisory Board
The Advisory Board is an advisory organ for the Board of the Foundation, and will advise the Board on all matters relating to the knowledge project. The Advisory Board consists of representatives of the state government, industrial organisations, large and medium-size industrial enterprises, the research and academic establishment. It is the intention that the Advisory Board meets once or twice annually. In case of a serious conflict between members of the Foundation, the chairman of the Advisory Board will act as a mediator.

National Platform on Climate
Within the Netherlands seven players who work together frequently in various fields of climate research (Wageningen University and Research Center, KNMI, RIVM, VU Amsterdam, ECN, Utrecht University and

ICIS Maastricht) decided to take first steps to form the National Platform on Climate. It is the ambition of the initiating parties to create a strong Dutch platform, which co-ordinates and harmonises the Dutch contributions in and with national and international programs related to climate. The purpose of the bringing together of research and development, communication and dialogue is to ensure that the Dutch contributions are embedded in both the national and international ongoing state-of-the art climate research. The Platform will have a strong interaction with the Departments of VROM, LNV, EZ and V&W.



As a first step, the Platform would attempt to harmonise the inputs of the Dutch research community to ICES KIS Knowledge project, NVKO, National Climate Communication Centre (NCCC)- see the letter of support by the Ministry of Environment (VROM) in Appendix 1– and the European 6th Framework Programme.

The interaction between parties mainly using the knowledge of climate, the parties mainly developing the knowledge and the parties who disseminate this knowledge, is of large importance in the field of climate change. The National Platform on Climate envisages to permanently encourage this Cupertino.

As it is the case of the proposed Knowledge project "Climate Changes Spatial Planning", also The Platform on Climate would promote strategies to cross the traditional knowledge disciplines and traditional knowledge structures and to work co-operatively at multiple sites in a virtual knowledge environment thus integrating across disciplines and sites. It will be goal of the Platform to facilitate integrating the knowledge so that the unprecedented spatial and temporal scales over which climate variability and climate change operate and impact society are adequately brought into common. The Platform will make a strong contribution towards the provision of integrated knowledge on climate change and land-use and infrastructure. Through active involvement of the Netherlands Environmental Assessment Agency (MNP-RIVM) these efforts will also enhance the assessment of climate change knowledge in general in support of policy making in the Netherlands. Specific communication provisions to support this function will be included, stemming from the Knowledge project ICES KIS and the NVKO communication programme.

7.4 Relation with other ICES-KIS knowledge projects

The investment knowledge project plan "Climate *changes* Spatial Planning" is submitted under priority cluster- theme 2 "Multiple Land Use" aimed at innovations of flexible, multi-functional and high-quality usage of our land and water. Within this theme a close co-operation exists between 8 focus groups (so called " 8 voor Ruimte platform") which together form a thematic framework group and cover the whole range of subjects. This co-operation framework is used to tune knowledge project activities and to facilitate co-operation and knowledge transfer regarding the theme.

A close linkage exists between the focus groups "Climate *changes* Spatial Planning", "Space for Water | Value of Water" and "Centre of Expertise Underground" as they all three focus on the interactions between the human system and the natural system (soil, water, biosphere, atmosphere). A clear link is also formed with "Geo-information" as it focuses on the important integration of spatial information. Common grounds are

also to be found in relation with theme 3 "sustainable systems innovations". Projects aimed at sustainability of energy, food security and natural resources clearly have a close linkage to the issue of climate change and spatial planning.

Jointly co-ordinated Bridge projects

The BSIK programma focuses on improving the innovation capacity in the Netherlands. This requires an interactive process and a continuous co-operation, not only between the research communities of distinct disciplines and institutes, but also, and especially, between research communities and the users of the knowledge developed by the research communities.

"Climate *changes* Spatial Planning" therefore has positively responded to a proposed co-operation with *Ruimte voor Water/Waarde van Water (Living with Water)* and Delft Cluster to jointly define and execute a number of coherent reference projects (bridge projects), in which each programme contributes its specific research issues. It is acknowledged that each of the three BSIK initiatives 'Climate *changes* Spatial Planning', Delft Cluster and 'Living with Water' has its own mission and innovation area which can briefly be characterised as follows:

- *Delft Cluster* aims at developing the fundamental strategic (beta) knowledge required for enabling the GWW-sector to conceive, design, build and maintain socially and environmentally accepted innovative solutions for infrastructure-related problems in the near and far future;
- *'Climate* changes *Spatial Planning'* aims at contributing to innovative physical research on climate changes and contributing to solving the associated societal spatial planning problems;
- *Living with Water* aims at developing a balanced mixture of gamma and beta competencies required to identify and elaborate innovative solutions for the spatial planning in relation to water management and the value water resources.

Although each programme has its own specific domain, certain overlapping areas are evident. It is decided not to try and exclude these overlapping areas, but to establish close co-ordination and co-operation between the programmes.

Three typical geographical areas have been identified where co-ordination and co-operation are considered opportune:

- Coastal area;
- Riverine area;
- Regional wetland systems;

For each of these areas a joint *Steering Committee* will be established including stakeholders, NGOs, government representatives, administrators and researches from the three programmes. The joint *Steering Committee* identifies and develops a joint programme identifying the area specific problems, developing visions and scenarios and specifying the objectives of the reference project and the major research issues. In section 6.4 brief descriptions (in boxes) are presented for the bridge projects as included in the project plan Climate *changes* Spatial Planning.

Within the overall joint programme, several specific projects have been identified, and these will have a maximum overlap of 20% between at least two of the programmes. These specific projects will be further elaborated and submitted for final approval to the respective *Steering Committee*.

8 Knowledge: distribution and transfer

8.1 Contribution to transfer of new and existing knowledge, translation of new and existing knowledge in applications/products

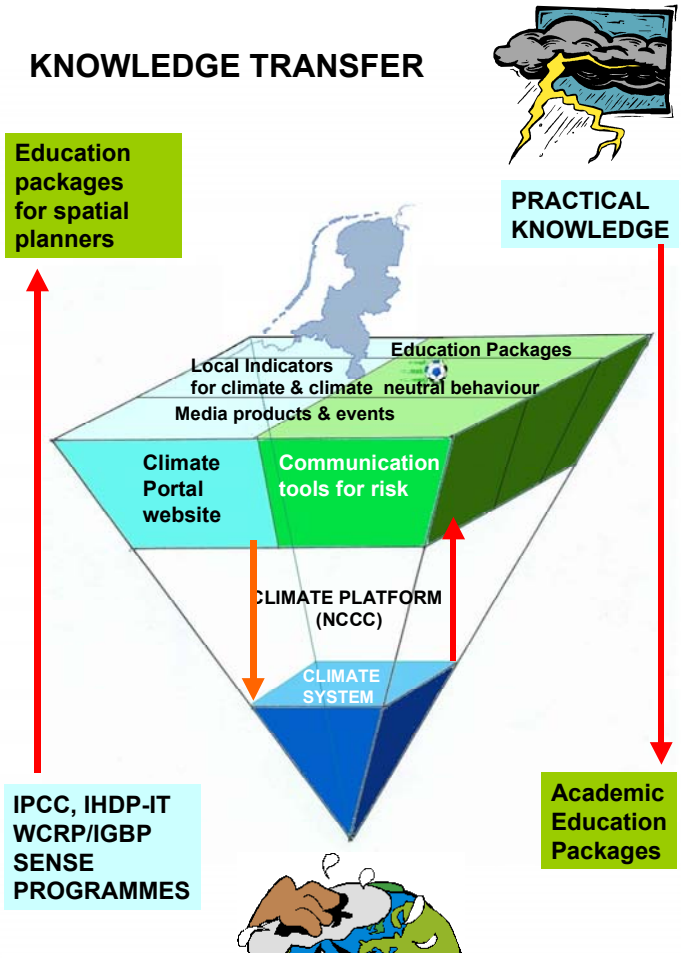


Figure 8.1, Key products out of Communication & Education programme (in red arrows the knowledge transfers for which innovation is necessary)

Context

Communication, citizen participation and the co-production of operational knowledge are considered key elements in understanding climate change problems and to create public support and active stakeholder involvement in developing mitigation or adaptation options. Although climate research in the Netherlands has developed significantly in the last 15 years, science has failed to communicate a sense of urgency to the wider public. Many citizens and stakeholder groups that represent them in one way or another, do not consider climate change as a threat nor as a guiding principle in spatial planning, and are not sufficiently challenged to play an active role in coping with its potential consequences. This lack of citizen and stakeholder involvement in climate change issues leaves a potential to significantly increase society's operational knowledge on the complex interlinkages between spatial issues and climate largely untapped.

Another issue is the wide range of institutes involved in climate change research and policy development. The institutions involved have separate communication policies with regard to their own field. At present an entity is lacking that has the national responsibility to elaborate the tuning and integration of the various activities so as to implement a consistent climate communication strategy.

This knowledge project aims at developing a platform that serves as a communication entity as well as a portal through which information on climate change will be conveyed to society. The projects to establish such platform are mentioned in Chapter 6, Theme 4 Integration. The platform will be supported by both the Foundation for Climate, Land use and infrastructure (chapter 7) and the Netherlands Climate Change & Communication initiative (see 8.2). The communication platform will offer policy makers, the private sector, NGOs, scientists and other stakeholders a clustered, high quality and accessible knowledge infrastructure on the interface of climate change and spatial planning. The platform will engage a dialogue between stakeholders to develop innovative socio-economic approaches of spatial planning and land use that anticipate for climate change and contribute to a safe, sustainable and resilient infrastructure in the Netherlands

An ICES/KIS3 impulse into a Dutch climate change knowledge platform is justified because:

- The Dutch expertise on climate change (causes, effects, adaptation and mitigation measures) is huge, however, distributed over many institutions and not easy accessible for everybody. Moreover, institutions involved have separate communication strategies and integration of knowledge is required.
- We are currently at the stage that strategic national policy documents related to climate change and spatial planning need to be made operational on a local level (provincial and municipal). The formulated long-term objectives at strategically national level for emission reduction and adaptation strategies are ambitious, while stakeholder and citizen participation in climate policy on a local scale is still in an early stage of development.

Objectives of the Knowledge platform:
- to disseminate and communicate appropriate knowledge that enhances the support, the attitudes, behaviour, skills and abilities of individuals (citizens) and groups (stakeholders/decision makers in spatial planning) in order to implement adaptation and mitigation measures
- to tailor climatic information (scenario's and time series) for impact, adaptation and mitigation studies by supporting expert dialogues and supporting multidisciplinary research (see projected activities in Theme 1, 'Climate Scenarios').
- to develop risk & communication methodologies that contribute to a widely shared sense of urgency and sense of the climate change issue and public support needed for a timely needed restructuring of the Netherlands
- to make better use in decision making and science of local operational knowledge on climate change (weather variability) and its impacts
- to further develop (and to implement in pilot studies) a methodology for citizen-based environmental (policy) monitoring
- to further develop (and to implement in pilot studies) a municipal/provincial framework for indicators to measure the performance of municipal/provincial climate policy (adaptation and mitigation)
- to position Dutch knowledge institutions, government and private sector in the sixth framework programme of the EU, the international global change research programmes (IPCC, WCRP, IGBP and IHDP) the international policy arena (UNFCCC) and international monitoring initiatives, like GMES, GTOS and GOOS.
- Dissemination of scientific knowledge to communication experts (e.g. intermediate organisations like museums, science writers).

8.2 Organisation of knowledge transfer and specification of activities and products

The observed fragmentation of knowledge and the knowledge gap between science, policymakers and civilians requires a concerted action. The problem can be tackled by improving communication related to climate change issues targeted at specific groups in society (Table 8-1) by developing the following products:

Platform
Developing the above described national Platform for Communication on Climate Change in which people work together on a structural basis. This platform will harmonise and synchronise communication activities of the suppliers, initiate multidisciplinary communication activities and serve as the national focal point for requests for information on climate change. Besides it will act as the national focal point for international communication initiatives.

Climate Portal
Develop a website ('climate portal') that serves to distribute information both to the general public and intermediary actors. Besides the site will facilitate local, regional, and national discussions on climate change between representatives of different actor groups from different environmental and socio-economic disciplines. This site will be developed in co-operation with educational sites (Kennislink - www.kennislink.nl; Kennisnet – www.kennisnet.nl), general public (Naturalis – ewww.natuurdatabase.nl, KNMI www.knmi.nl/voorl/weer/, natuurkalender www.natuurkalender.nl), and sites for provincial and city councils (Novem (www.gemeenten.novem.nl/).

Education
Projects that stimulate and enhance climate change education and research aim at:
- Development of short courses (2-4 ECTS points) focused on (bachelor and master) students in the Netherlands.
- Two summer schools of 4-5 weeks duration focused on (master and PhD) students inside and outside the Netherlands.
- Three series of 4-6 evening workshops focused on professionals from governmental institutions, NGOs, and private enterprises.

Furthermore, students of secondary schools will be accessed through the development of educational material (e.g. 'lesbrieven', experiments, excursions, video, Internet applications) in participation with schools, teacher organisations and specialised institutions as SLO. Material must fit within the terms formulated by the government for biology, chemistry, physics and geography. To stimulate the interest of students in global change issues, it can be considered to give students of 'het studiehuis' the possibility to participate in research projects.

Connection to Strategic policy documents
An important goal will be to implement relevant climate change information and its relation to spatial planing to strategic governmental plans. Examples of such documents are: Dutch vision on Water management for the 21st century (WB21, 2000), the fifth policy plan for spatial planning (VIJNO, 2001), The Vision of the future economic infrastructure (VES, 2001), The vision on Society and Nature the Netherlands (Natuur voor mensen, mensen voor Natuur, 2001) and The National Environmental Policy Plan (NMP4, 2001) and the climate policy plan I+II (Klimaatnota I+II).

General public
General public will be informed through participation with intermediate institutions, industry and NGO´s (e.g. television networks, N5, museums, WNF, energy companies like Nuon, game manufacturer like Nintendo) development of exhibitions, recreational activities (excursions, documentaries, computer games etc.) with global/climate change elements.

Table 8-1: Target audience fro knowledge transfer and communication projects

Target audience	Know. transfer projects (see 6.5.3) Codes refer to project numbers as specified in appendix B	Key-objective
Decision-makers in spatial planning (stakeholders)	**CC-A1** PCCC	National Communication platform
	CC-A2 Knowledge bridging to acting	Educational package for practice
	CC-A3 Climate Mirror	Measure performance of local implementation of climate policies
	CC-B2 Risk Communication tools	Provide decision makers with the tool
Citizens	**CC-A1** PCCC **CC-A3** Climate mirror	Information supply (web,events, etc) Practical local Indicator system for climate neutral behaviour
	CC-B1 Los niños and niñas	Documentaries & museum exhibitions
Academic students	**CC-A2** Knowledge bridging to acting	Enhance multidisciplinary & participatory capacities of global change students
Climate System, Mitigation and Adaptation Experts	**CC-A1** PCCC **CC-B2** Risk Communication Tools **CC-A4** Data Integration for a Virtual Portal	Tailoring climatic information (scenario's and time series) for impact, adaptation and mitigation studies by expert dialogues
Scholars & teachers of primary and secondary school	**CC-B1** Los niños and niñas **CC-B2** Risk Communication Tools **CC-A3** Climate Mirror **CC-A1** PCCC	Disseminate appropriate knowledge that enhance the support, the attitudes, behaviour, skills and abilities of individuals and groups in order to implement adaptation and mitigation measures
Communication experts	**CC-B2** Risk Communication tools	Enhance knowledge on global/climate change research and policy
International scientific Experts and policy makers	**CC-A1** PCCC **CC-B2** Risk Communication tools	Positioning Dutch knowledge institutions, government and private sector in the sixth framework programme of the EU, the international global change research programmes (IPCC, WCRP, IGBP and IHDP) the international policy arena (UNFCCC) and international monitoring initiatives.

8.3 Preference above possible alternatives.

In case it is not possible to invest in a clustered, high-quality and accessible knowledge platform on the interface of climate change and spatial planning for Dutch officials, the private sector and other stakeholders and to engage a dialogue between stakeholders, we should consider that:

- The risk of environmental confusion by decision-makers and citizens caused by diverging messages/education materials from knowledge institutions will increase.
- The sense of urgency to implement adaptation and mitigation measures will decrease and as a result targets for emission reduction will be not be met on time. Measures to restructure the Dutch landscape in order to cope with climate change will be delayed or even postponed.
- It will be very difficult to bring private partners into the national climate communication into a dialogue with scientific institutes that supply climatic information, without the financial incentive from ICES/KIS3.

8.4 Indicators of transfer and diffusion of knowledge

For a complete overview of performance indicators related to the different project on knowledge transfer and diffusion is referred to 6.7 (Table 6-4). In this table success indicators and deliverables are gathered. As key products can be named a.o. websites, a framework on climate-neutral behaviour of municipalities, educational packages, academic curricula, courses on climate change for spatial planners, exhibitions, broadcasts of documentaries on the climate issue, implementation of a virtual data centre. Before project implementation it will be required to detail deliverables and performance indicators during the implementation period to monitor and steer project progress.

9 Finances: budget and coverage

9.1 General breakdown of costs

The knowledge project has been split up into four themes. The project budget is therefore also presented in the main thematic research clusters climate scenarios, mitigation, adaptation and integration. Furthermore the budgeted costs for the programme bureau are added.

The individual project sheets (Annex B) present a detailed overview and breakdown of costs per project.
The knowledge project has been split up into four themes, each of which is again divided into sub themes and/or projects. Below we present the aggregated budgets per theme.

	Matching partners	Requested ICES- KIS-3 Subsidy	Total Project Costs
Climate scenarios	11.068.400	10.204.100	21.272.500
Mitigation	13.174.000	13.171.900	26.346.000
Adaptation	13.798.000	13.527.600	27.325.600
Integration	7.287.900	6.290.700	13.578.600
Budget related to the themes of the knowledge project plan, for which specific projects will be determined in due course [2] + [3]	5.873.900	5.873.900	11.647.800
Total	51.202.200	49.068.200	**100.270.500**

Financing of matching by consortium partners

The consortium partners will finance their part of the project cost through basic funding (in case of research institutes), employment of personnel, machinery and equipment and materials, by funding through private parties (such as preparing and making available of data), and through subsidies to a maximum of 15%. Commitment given to the consortium by a broad selection of public and private partners gives the knowledge project plan a solid financial backing as so many stakeholders are willing to contribute their share to implementation.

A detailed financial presentation of all projects can be taken from the budget which is annexed to the Bsik application form. Project budgets are also to be found in Annex B with a detailed breakdown of cost items.

Budget management and organisation

The programme bureau will consist of a Science Office and a Management Office

The costs of the programme bureau will amount to an estimated 3,5% of the overall budget and will be furnished by the consortium partners relative to their participation in the knowledge project plan and eventually, if necessary, from the programme budget related to projects for which projects will be determined in due course.

Management Office	2004-2007	
Management Director (1FTE)	4*120	480
Management officer (2FTE) (accounting staff)	4*90*2	720
Secretarial assistant (1FTE)	4*45	180
Accommodation, communication, travel budget	4*100	400
Board expenses	4*100	400
MO-Total		**2180**

[2] The costs of the programme bureau will amount to an estimated 3,5% of the overall budget and will be furnishedby the consortium partners relative to their participation in the knowledge project plan and eventually, if necessary, from the programme budget related to projects for which projects will be determined in due course.

[3] The costs of the quality review as performed under the steering of NWO will approximately amount to Euro 500,000.

Scientific Office	2004-2007	
Scientific Director (1FTE)	4*120	480
Scientific project officer (1FTE)	4*90*1	360
Secretarial assistant (1FTE)	4*45	180
Accommodation, communication, travel budget	4*100	400
SO-Total		**1420**
	Total	**3600**

Scientific quality assurance
The costs of the quality review as performed under the steering of NWO, (see 7.2) will approximately amount to Euro 290,000 for the duration of the project plan period. Other costs for scientific quality assurance such as workshops and seminars are planned.

Scientific Review Costs	2004-2007
Scientific evaluation of projects by NWO (peer review and including involvement of representatives of NGO's and the private sector)	70 projects * Euro 2000: 140.000
Mid-term Review (MTR)	100.000
Final Review	50.000
Total	**290.000**

9.2 Cost development and proposed phasing/planning

At the start of the programme, a detailed financial plan will be prepared, when the individual projects have been authorised to proceed after the first review. It is expected that the cost phasing will evenly be balanced over the total programme. Final payments will be made after successful Final Review.

9.3 Cumulation or grant applications

As explained in 4.6 the proposed knowledge project plan 'Climate *changes* Spatial Planning' ties in with pillar A of the EU sixth Framework Programme, the so-called priorities. Priority 6, "S*ustainable development, Global change and Ecosystems",* Part III of priority 6, "*Global Change and Ecosystems*":

Research undertaken under this priority will be complemented by the development of advanced methods for risk assessment and methods of appraising environmental quality, including relevant pre-normative research on measurements and testing for these purposes.

The members of the National Platform on Climate who have initiated this project plan are harmonising the Dutch input in international programmes relating to climate, among which the sixth Framework Programme. The goal is to ensure that the Dutch contributions are embedded in both the national and international ongoing state-of-the-art climate research. Relevant EU FP-5 and FP-6 research projects and networks are:

- CLOUDNET/CLIWANET on climate monitoring and processes
- PRUDENCE on regional climate scenarios
- DAEDALUS, EOROTRAC on aerosol- en and transboundary air pollution transport
- CARBOEUROPE cluster; quantification and understanding of the European carbon balance
- GMES operational satellite information for environmental and climate studies
- enVISage, sustainability
- PEER, Biodiversity ,Landscape planning, Aquatic ecosystems, pollution and its remediation, Global Change, PA and DSS tools.

Subsidies from these programmes will be claimed where possible and in accordance with BSIK rules to cumulate to maximal 65%.

10 References, Acronyms and abbreviations

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10.2 Appendix B: Abbreviations and Acronyms

A

AOGCM	Atmosphere Ocean General Circulation Model

B

BAHC	Biospheric Aspects of the Hydrological Cycle (IGBP)
BSIK	Decree on subsidies for investments in the knowledge infrastructure (formerly known as ICES/KIS3)
BAHC	Biospheric Aspects of the Hydrological Cycle (IGBP)

C

CBO	Community Based Organisation
CCB	Climate Change and Biosphere Research Centre Wageningen-UR
CCVUA	Climate Centre Amsterdam
CDM	Clean Development Mechanism
CERUDEB	Centenary Rural Development Bank
CGIAR	Consultative Group on International Agricultural Research
CIESIN	Consortium for International Earth Science Information Network

CEI	Columbia Earth Institute
COOL	Climate Options for the Long term project
COS	Centrum voor OntwikkelingsSamenwerking
CSIRO	Commonwealth Scientific and Industrial Research Organisation (Australia)

D

DWC	International Dialogue on Water and Climate

E

EAC	East African Co-operation
ECF	
EHS	National Ecological Framework
ENSO	El Niño-Southern Oscillation
EoI	Expression of Interest
EPA	Environmental Protection Agency (USA)
EU	European Union
EZ	Ministry of Economic affairs

F

FAO	United Nations Food and Agricultural Organisation

G

GBM	Ganges-Brahmaputra-Megha Basin
GCM	Global Circulation Model
GCOS	Global Climate Observing System
GEWEX	Global Energy and Water Cycle Experiment
GHG	Greenhouse Gases
GIS	Geographic Information Systems
GMES	Global Monitoring for Environmental Security
GRID	Global Resource Information Database
GTN-H	Global Terrestrial Observing Network-Hydrology
GLAMI	Stuurgroep Glastuinbouw en Milieu

H

HAPEX	Hydrological Atmosphere Pilot Experiment
HELP	Hydrology for the Environment, Life and Policy (UNESCO)

I

IAHR	International Association of Hydraulic Engineering Research
IAHS	International Association of the Hydrological Sciences
ICZM	Integrated Coastal Zone Management
ICES/KIS3	Decree on subsidies for investments in the knowledge infrastructure (Currently known as BSIK)
IGBP	International Geosphere Biosphere Program (ICSU)
IHDP	International Human Dimensions Program on Global Environmental Change
IHE	International Institute for Infrastructure, Hydraulic and Environmental Engineering
IIASA	International Institute for Applied System Analysis
IMAGE	Integrated Model to Assess the Greenhouse Effect
IPCC	Intergovernmental Panel on Climate Change (WMO/UNEP)
IRI	International Research Institute for Climate Prediction
IUCN	International Union for the Conservation of Nature and Natural Resources
IVM	Institute for Environmental Studies, Free University Amsterdam
IWRM	Integrated Water Resources Management

J

K

KNMI	Royal Netherlands Meteorological Institute

L

LDC	Lesser Developed Country
LOICZ	Land Ocean Interactions in the Coastal Zone (IGBP)
LUCC	Land Use and Cover Change (IGBP)
LNV	Ministry of Agriculture, Nature Management and Fisheries

M

N

NASA	National Aeronautics and Space Administration
NCP	Dutch Continental Shelf [Nederlands Continentaal Plat]
NHS	National Hydrological Services
NGO	Non-Governmental-Organisation
NOAA	National Oceanic and Atmospheric Administration
NMP4	Nationaal Milieubeleidsplan 4 (beleidsnota VROM)
NVKO	Nederlands Vervolgprogramma Onderzoek Klimaat
NWO	Netherlands Organisation for scientific research

O

OCenW	Ministry of Education, Culture and Science
OECD	Organisation for Economic Co-operation and Development

P

PIK	Potsdam Institute for Climate Impact Research

Q

QA	Quality Assurance

R

RCM	Regional Climate Model
RIVM	National Institute for Public Health and the Environment

S

SADC	Southern African Development Community
SAR	IPCC Second Assessment Report
SDR	Department of Rural Development (Nordeste, Brazil)
SIWI	Stockholm International Water Institute
SVAT	Soil-Vegetation-Atmosphere Transfer

T

TAR	IPCC Third Assessment Report
THC	Thermohaline Circulation

U

UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific & Cultural Organisation
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
UvW	Unie van Waterschappen

V

V&W	Ministry of Transport, Public works and Water Management
VNG	Verenigde Nederlandse Gemeenten
VROM	Ministry of Housing, Spatial planning, and the Environment

W

WCRP	World Climate Research Program
WIMEK	Onderzoekschool Wageningen UR: Wageningen Instituut voor Milieu-

	en Klimaatvraagstukken
WHO	World Health Organisation
WHYCOS	World Hydrological Cycle Observing System (WMO)
WMO	World Meteorological Organisation
WTO	World Trade Organisation
WUE	Water Use Efficiency
WWF	World Wide Fund for Nature