Interactive development of spatial adaptation strategies

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1 Description work package

1.1 Problem definition, aim and central research questions

This Work package integrates quantitative spatial information on impacts of climate change and adaptation within the more qualitative process of spatial planning. We propose to develop an approach that uses this information effectively to interactively develop adaptation strategies with multiple stakeholders with often conflicting objectives. Maps are used to communicate and exchange knowledge among policy-makers and stakeholders. Stakeholder participation is supported through a series of interconnected workshops, where effective use of spatial information is facilitated through the use of maps, decision support tools and touch-enabled screens (Microsoft Surface, Map Table or Touch Table).

This WP makes results from all work packages available for use in interactive design and evaluation of adaptation strategies. Starting point is quantitative spatial information from the “Climate atlas”. Other inputs are the results from spatial and economic modeling (WP1 and 2), damage estimates (WP2) and risk perception (WP 5). Results from spatial valuation (WP 6) and Visualization (WP4) are fed back into the design process to improve the adaptation strategies. We intend to support this feedback using a mixture of optimization, evaluation and visualization tools (see also Figure 1).

The main objective of the project is to develop implement and test a map based interactive environment for the design of adaptation strategies. Research questions will focus on effective use of information in a participatory workshop setting. Specific attention will be given to the development of heuristics to generate reference alternative, development of design and negotiation tools, negotiation strategies, improvement of the map as an interface and workshop design.

1.2 Interdisciplinarity and coherence between the projects

The work package plays a central role in the integration and use of results generated by the other projects of the theme 8 consortium (see also Figure 1). Close cooperation is envisaged with Work package 4. Visualization methods developed in this work package will be used to support design of adaptation alternatives. The use of visualization methods within the interactive workshops will be used to test the effectiveness of visualization methods developed in WP4.

1.3 Stakeholders

Stakeholders are linked to the hotspot “Fen meadows and shallow lakes”. This hotspot has allocated tokens to support the work in this work package. Participants within within this hotspot are the Waterschap Noorderzijlvest, Wetterskip Fryslan, Hoogheemraadschap de Stichtse Rijnlanden, the Province of Utrecht and Friesland and Stowa.

Stakeholder workshops are planned in each of the three case studies planned in this hotspot: 1. Zegveld, 2.Zevenblokken and 3. Tjeukemeer. Stakeholders input is very important in preparation of these workshops and stakeholder interaction is central to the workshops themselves.

1. The case study Zegveld is policy oriented. Stakeholders involved in this case study are the Province of Utrecht and Waterboard Stichtse Rijnlanden (HDSR). Stakeholders will be participate in one workshop that combines various policy plans for this polder with predictions on ground water levels and soil subsidence. This workshop is planned for 2010.
2. Within the case study Zevenblokken stakeholders are the Waterboard Noorderzijlvest, The Province of Drenthe, Natuurmonumenten and local farmers and their organization (LTO). Two or three workshops will be conducted with these stakeholders as part of a process to develop water management plan (Integraal Peilbesluitplan Smilde). Stakeholders are consulted in preparation of these workshops and will be asked to participate. Workshops are planned in 2010 and 2011.
3. The case study Tjeukemeer includes both the lake and the fen meadow polders to the south of the lake. Stakeholders are the Wetterskip Fryslân, the Province of Fryslân, the municipality of Lemsterland, farmers and their organization (LTO Noord), Nature NGO"s (Staatsbosbeheer and It Fryske Gea), organizations of local residents. Three workshops are planned involving these stakeholders in the years 2011 and 2012.

2 Project 3.1 Interactive development of spatial adaptation strategies

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2.1 Problem definition, aim and central research questions

After reaching the limits of technical instruments adaptation and spatial planning have become increasingly interrelated. As a result land use change plays a central role in the development of adaptation strategies. However, it is also clear that is that national and provincial agencies face many difficulties in adjusting their policies in such a way that future land use changes get serious consideration.

On the one hand, this may be related to the fact that the consistency of different (long term) policy goals have not yet received due attention. On the other hand, strong public resistance at local level against any perspective of near future landscape changes has created an atmosphere of deadlock. Policy makers seemingly face the dilemma between doing the right thing and doing it the right way, i.e. through consulting the public. A participatory approach which will involve a multitude of stakeholders may be successful in that the stakeholders will be able to identify and reflect upon several comprehensive strategies and assess, with the help of scientists, their specific impacts for policy areas such as climate change, water retention, nature conservation, agriculture and other considerations with respect to spatial planning.

Spatial adaptation strategies can be developed only in a complex process of interaction with a large number of stakeholders. A number of decision support systems have been developed to support water management. The use of these systems in participative decision processes has not always been successful (Uran and Janssen 2002). There are two main reasons: 1. the decision support systems are not well tailored to the needs of the participative process and 2. systems are often information driven, ignoring the process and human side of the use of these systems (Janssen and Uran 2003).

Within this project we will describe the relevant decision processes and try to identify the information needs by the various stakeholders at different stages of these processes. We will develop interactive workshops to facilitate problem analysis, problem identification, design of management alternatives evaluation of alternatives and feedback to design. The project will focus on the development of spatial design approaches using a mixture of formal design routines, visualization techniques and structured feedback from participants in workshops. Techniques will be integrated in a spatial decision support framework implemented in hardware suitable for interactive use in a workshop.

Within this project maps are used as the main means of communication. Since most people use reference maps, such as road maps, they are familiar with their use and are happy to use them as a source of information. In practice effective use of maps is a difficult task for many people. A task that becomes more difficult if the information density of the map increases and the direct link with reality gets weaker (Janssen and Uran 2003, Carton and Thissen 2009).

Tools will be developed to support map related tasks within the negotiation process. This will include tools to support generation of alternatives (Janssen et al 2008). Tools to support evaluation and feedback to design (Janssen 1992, Eastman et al 1998; Malczewski 2006). Tools to support negotiation (Feick and Hall 2002, Belton and Stewart 2002 Stewart et al 2009) and, finally, tools linked to spatial objectives such as connectivity, shape and fragmentation (Janssen et al 2008).

Spatial planning requires a combination of formal analysis and holistic design. In landscape design such as nature development in the river plains, the landscape architect plays an important role. Hand drawn maps go hand in hand with model output from hydrological models. Because the information load is high spatial decision support should complement design by the landscape architects. At present available ICT-based instruments are insufficiently adapted to these processes. Examples of available ICT -based

instruments are group decision rooms, design tools, spatial evaluation and presentation tools, and finally interactive use of the Internet (Geertman and Stillwell 2008, Jankowski 2009, Scholten et al 2009)). This leads to the following research question and sub questions:

How effective are map based decision support tools for interactive design of special adaptation strategies.

- Which tasks can be identified within the overall process of development of adaptation strategies;
- Which methods can be developed to support these tasks;
- How can these methods be integrated into an interactive workshop setting.
- How effective is this support in the development of adaptation strategies.

2.2 Approach and methodology

This project integrates quantitative information on impacts of climate change and adaptation within the more qualitative process of spatial planning. We propose to develop an approach that uses this information effectively to interactively develop adaptation strategies with multiple stakeholders with often conflicting objectives. Maps are used to communicate and exchange knowledge among policy-makers and stakeholders.

Within this project we intend to use an interactive mapping device (the „Touch table") to support participatory planning workshops. The table is used in a series of workshops with the various stakeholders to generate, assess and discuss adaptation strategies for the case studies. The approach involves three types of workshops. The nature of each workshop is defined according to one of the three frames in the framework for map use in policy making (Carton and Thissen 2009).

- Analysis map a research model
- Design map as a design language
- Negotiation map as a decision agenda

Interaction between stakeholders is prompted through the use of maps, decision support tools and touch-enabled screens to support stakeholder collaboration and spatial information handling (Microsoft Surface, Map Table or Touch Table). The following steps can be identified.

1. Analysis of the planning process and design of workshops. Within the planning process three types of workshops are identified: 1. Analysis workshops: map a research model; 2: Design workshops: map as a design language; 3: Negotiation workshops: map as a decision agenda. As a first step we will describe the processes to be supported by these workshops and identify the information handling tasks within these processes.
2. Development of tools Linked to these tasks support tools will be developed. This will include a tool to support generation of a set of start alternatives to define the decision space. This tool will be based on a heuristic algorithm in combination with goal programming to be applied on vector maps. Tools will also be developed to help the participant to identify certain aspects of the information and to stimulate feedback from these stakeholders. These tools could be based on map transformations but also on visualization techniques. Special emphasis will be given to the

development of tools linked to spatial objectives such as connectivity, shape and fragmentation. These tools are important for nature (corridors, habitat) but also for recreation and landscape. Decision support tools will be developed to support the feedback from evaluation to design. Finally, tools will be developed to support negotiation between stakeholders.

4. Experiments with different types of hard and software. The use of touch–enabled screens is a rapidly developing field. At present the Microsoft Surface cannot be used in an ArcGIS environment. We will explore the possibilities of Microsoft Surface for this project and will also evaluate other hardware options if they become available. A comparison will be made between multi and single user applications.
3. Set up experiments to test the tools. Define clear tasks and test how well these tasks are performed.
4. Integrate tools into a workshop design. Define the different types of workshops and integrate the tools into a scripts for these workshops
5. Set up experiments to test the various scripts. Define clear assignments and test how effectively participants use the tools to complete the assignment.
6. Test the scripts on the case studies. Set up full workshops. Analyze how participants perceive these workshops and identify potential and limits to the use of these workshops in practice.

Framing the decision problem is an important aspect of workshop design. A social psychologist will be consulted to ensure that the problems are adequately framed.

2.3 Scientific deliverables and results

The project will produce workshop scripts, tool descriptions, software and results of experiments. Part of these results will be published in workshop reports and technical manuals. Results linked to method development and experiments will be published in the scientific literature.

D1. Journal article on the effectiveness of tools
D2. Journal article on effectiveness of workshop design
D3. Journal article on one or more case studies.
D4. Software and technical manual
D5. PhD

2.4 Integration of general research questions with hotspot-specific questions

The hotspot “Fen meadows and shallow lakes” has stated that this hotspot considers this WP as crucial to support development of regional adaptation strategies in the context of spatial planning processes. Main role of this project in these processes will be to make available relevant spatial information, to identify various perceptions regarding possible solutions and to make explicit relevant trade-offs and to support negotiation between stakeholders.

2.5 Societal deliverables and results

Three case studies have been selected within the hotspot Fen meadows and shallow lakes and within the hotspot Rivers. Within these case studies the approach developed in this WP will be used to support

actual spatial planning processes. It is expected that our approach will improve effective use of spatial information, will improve stakeholder participation and hopefully will improve the quality of and support for the plan produced If successful a wide range of similar policy problems can benefit from this approach.

D6. Workshop scripts

D7. Support tools to be used in fen meadow workshops Zevenblokken

D8. Support tools to be used in fen meadow workshops Tjeukemeer

D9. Support tools to be used in fen meadow workshops Zegveld

D10. Manual on workshop design

2.6 Most important references

1. Belton, V. and Stewart, T.J., 2002, *Multiple Criteria Decision Analysis*: An Integrated Approach (New York: Springer).
2. Carton, L.J. and Thissen, W.A.H., 2009, Emerging conflict in collaborative mapping: Towards a deeper understanding? *Journal of Environmental Management*, 90, pp. 1991-2001.
3. Eastman, J.R., Jian, H., and Tolenado, J., 1998, Multi-criteria and multi-objective decision making for land allocation using GIS. In *Multicriteria Analysis for Land-Use Management*, E. Beinat and P. Nijkamp (Eds), pp. 227-250 (Dordrecht: Kluwer Academic Publishers).
4. Feick, R.D. and Hall, G.B., 2002, Balancing consensus and conflict with a GIS-based multi-participant, multi-criteria decision support tool. *GeoJourna*l, 53, pp. 391-406.
5. Geertman, S. and Stillwell, J. (Eds), 2008, *Planning Support Systems: New Methods and Best Practice* (New York: Springer).
6. Jankowski, P., 2009, Towards participatory geographic information systems for community-based environmental decision making. *Journal of Environmental Management*, 90, pp. 1966-1971.
7. Janssen, R. 1992, *Multiobjective decision support for environmental management* Kluwer Academic Publishers, Dordrecht.
8. Janssen, R. and Uran, O. (2003), "Presentation of information for spatial decision support: A survey on the use of maps by participants in quantitative water management in the IJsselmeer region, the Netherlands", *Physics and chemistry of the earth*, vol. 28, pp. 611-620.
9. Janssen, R., van Herwijnen, M., Stewart, T.J., and Aerts, J.C.J.H., 2008, Multiobjective decision support for land-use planning. *Environment and Planning B: Planning and Design*, 35, pp. 740-756.
10. Joubert, A., Janssen, R., Stewart,T.J. 2008. Allocating fishing rights in South Africa: a participatory approach. *Fisheries Management and Ecology* 2008 nr 15 pp 27-37
11. Malczewski, J., 2006, GIS-based multicriteria decision analysis: a survey of the literature. International *Journal of Geographical Information Science*, 20, pp. 703-726.
12. Scholten, H.J., Velde, R. van de, Manen N. van (eds) 2009, Geospatial technology and the role of location in science, Springer, New York.
13. Sieber, R., 2006, Public Participation Geographic Information Systems: A Literature Review and Framework. *Annals of the Association of American Geographers,* 96, pp. 491-507.

14. Stewart, T. J., Joubert, A., Janssen, R. 2009, "MCDM Framework for fishing rights allocation in South Africa", *Group Decision and Negotiation.* available on line.
15. Uran, O. and Janssen, R. (2003), "Why are spatial decision support systems not used?: Some experiences from the Netherlands", *Computers, environment and urban systems*, vol. 27, no. 5, pp. 511-526.