Development of climate change adaptation strategies within the transdisciplinary network INKA BB

Andrea Knierim[a], Sonja Siart[a], Verena Toussaint[a], Klaus Müller[a] and Hubert Wiggering[b]

[a]*Leibniz Centre for Agricultural Landscape Research (ZALF), Institute of Socio-Economics, aknierim@zalf.de (corresponding author)*
[b]*Leibniz Centre for Agricultural Landscape Research (ZALF) and University of Potsdam, Germany, wiggering@zalf.de*

Abstract: *The network INKA BB aims to ensure the sustainable use of land and water resources under close cooperation of science and practice partners, who through their participation in INKA BB, increase their capacities to adapt to climate change. The methodological approach in this large scale research and development project is based on transdisciplinary and action research concepts. Thus, the network itself is seen as a large self-organising body of corporative actors and regional agencies. The network management designs and promotes the internal process of learning and change management. All methods focus on the integration of practice partners for the development of adaptation strategies. The following theses are guiding the network management board:*

(1) Strategic adaptation to climate change requires a transdisciplinary approach
(2) The transdisciplinary approach has to be organised as a network
(3) Networks can not be steered or directed but only fostered and supported
(4) Knowledge is the medium of network coordination–trust is a prerequisite

Keywords: *action research, climate change adaptation, knowledge, land use, network, transdisciplinarity, water management*

Introduction

There is a broad agreement among scientists that climate change is happening and that it is due to emissions of greenhouse gases produced largely by industrialised countries (Parry et al., 2007). In addition to mitigation, adaptation to climate change is now recognized as an inevitable component of an overall climate change response strategy (Ikeme, 2003).

Parry et al. (2007) define the adaptation to climate change as adjustment in ecological, social or economic systems in response to actual or expected climatic stimuli and their impacts, which moderates harm or exploits beneficial opportunities. Thus, adaptation measures constitute actions designed to adjust or cope with the consequences of climate change in order to decrease the vulnerability of people and ecosystems. Adaptation is an important way to increase readiness and address the impacts of climate change (de Loe et al., 2001). The process of designing an effective anticipatory adaptation strategy is, however, hindered by the uncertainties surrounding the pace, pattern, extent and severity of climate change (Barnett, 2001).

The German Federal Ministry of Education and Research (BMBF) is furthering the development of innovative approaches to climate change adaptation through a funding program: "KLIMZUG". It particularly stresses the regional aspects of climate adaptation. The implementation of climate adaptation strategies are achieved through regional networks among science, business, administration and public agencies. KLIMZUG wants to pool the strengths of the stakeholders in these cooperative networks and integrate anticipated changes in regional planning and development. This will contribute to timely climate adaptation of long-term sustainability and strengthen the German economy (http://www.klimzug.de/en/160.php, 15.12.2009). The Innovation Network for Climate Change Adaptation Brandenburg Berlin (INKA BB) is funded by the KLIMZUG program.

The Brandenburg region is among the most vulnerable regions in Germany to the impacts of climate change due to relatively low annual precipitation, a high area of surface water and the dominance of sandy soils with low water capacity. The Berlin metropolitan area is especially affected by more intense and prolonged heat waves. Additionally, heavy rainfall events, with the consequence of short-term deterioration of water quality, strongly affect the wastewater management of urban areas (Knierim et al., 2009).

The common goal of INKA BB is to ensure the sustainable use of land and water resources in the region under changing climatic conditions and empower actors in business, administration, public agencies and civil society to react to the emerging climate change with strategic flexibility.

The development and methodological support of the network is substantiated by the following hypotheses:

1. Strategic adaptation to climate change requires a transdisciplinary approach

Climate change is recognized as a complex problem including several dimensions with ecological, economic and social implications. Thus, strategies for adaption to climate change need to be variable and diverse and require the involvement of many actors representing different interests and perspectives regarding perceived challenges. Adapting to climate change is a problem marked by uncertain knowledge about the future and at the same time, represents a serious challenge for the whole society. Still the perception of the problem differs among societal groups, the scientific world, policymakers and administrators. Thus, a transdisciplinary approach is necessary to address the problem of climate change adaptation.

Sustainable development research shows that inter- and transdisciplinarity are constitutive elements for the scientific support of regional change projects (Knierim et al., 2010). Contribution to sustainable solutions at regional landscape level needs exchange among practitioners, regional stakeholders and decision-makers. As stated by Tress et al. (2003:190), an integrated approach can produce new knowledge that makes a significant contribution to solving complex problems. Furthermore, new challenges need innovative strategies. Innovations are generated best by merging previously separate knowledge areas and technologies (Payer, 2002:6). The involvement of practitioners in the process of innovation development enables the network to focus on the practical problem and facilitate implementation.

In our context, we understand transdisciplinarity as the cooperation of scientists from various disciplines with non-scientists. The latter is comprised of stakeholders and especially practitioners in the proper sense, representing their own interests within the research and action process (Nagel et al., 2004). Furthermore, it is the inclusion of practitioners, and especially entrepreneurs, which has clear consequences for tailoring the joint process: it has to be of practical relevance and strategic value. Strategic orientation means a mid- and long-term allocation of resources to realise deliberately chosen solutions. Strategic analysis and planning are, therefore, essential tools of any business entity (Aeberhard, 1996). A guiding scheme for a strategic climate change adaptation process is presented in Fig. 1. This procedure with its step-stones and phases forms the basis for transdisciplinary cooperation in INKA BB. The phased planning will allow the adjustment of strategies and activities after the first implementation and evaluation phase.

Problem definition:
The participation of non-academic actors helps to address life-world, socially-relevant problems. The project takes into account different perceptions of problems and calls for conducting mutual problem identification and analysis. Thus, the research process is designed in transdisciplinary modules within the network. In the initial phase within each module, all relevant partners update the problem definition by applying the SWOT analysis instrument. Strengths and weaknesses are analysed on an internal level, helping to identify strong points such as the expertise of diverse partners, institutional advantages, etc.; and on the other hand, reveal weak points such as missing

relevant partners or the actors' different risk assumptions. On an external level, opportunities and threats are evaluated in a transdisciplinary manner, focusing on future climate change implications and other institutional changes (Knierim and Siart, 2009).

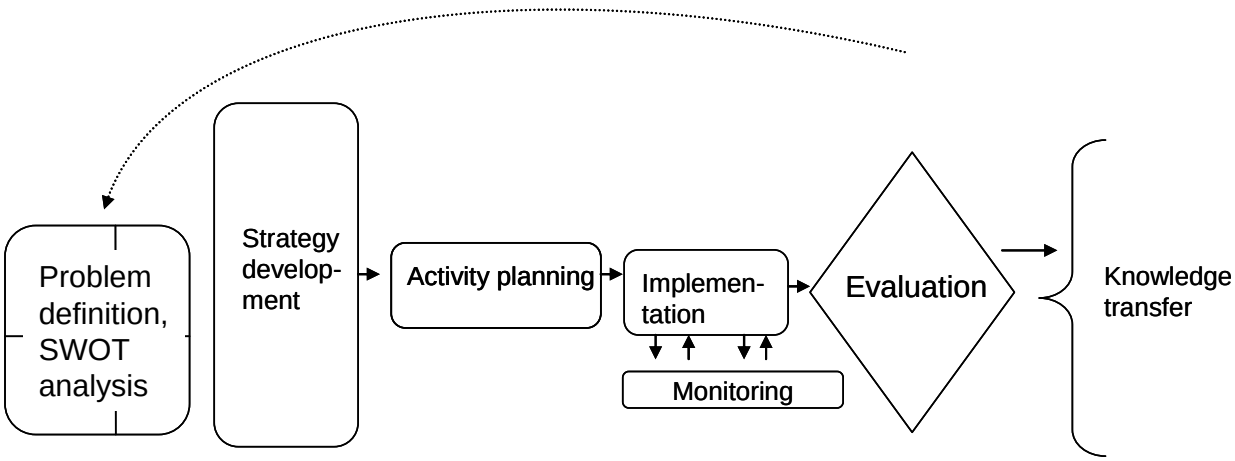

Figure 1. Strategy process (Knierim et al., 2009).

Strategy development and activity planning:
Climate research deals with prognoses and scenarios, which are variable and insecure especially at a regional level and covers periods at least 30 years in the future. Thus, a strategic, long-term perspective for the development of activities is needed. In addition to the uncertain knowledge about the future, risk perceptions are different among project partners. Here, risk evaluation from different perspectives should allow adequate and coherent planning of activities. Furthermore, the network integrates diverse knowledge (societal and academic) for the development of innovations and flexible strategies.

Activity implementation and evaluation:
An important aspect of transdisciplinary research is an implementation-oriented approach. The inclusion of local actors facilitates the development of activities that are relevant for practitioners and thus, enables their implementation. Furthermore, an iterative research process is planned to allow mutual reflection of strategies and adjustment of activities. The evaluation of strategies and activities will be realised again with the SWOT analysis instrument. The first analysis is the point of reference for the following two analyses (each after two years) and will allow the concretisation of objectives and the adjustment of planned activities.

The coordinated process design of the network's strategy development is based on an action research approach, applying relevant instruments and methods for content and process management.

Content management is based on strategic organisational development principles with iterative stages such as a) situation analysis looking at strengths and weaknesses, b) common perspective by the development of objectives and an overall mission and c) testing and evaluation of innovations as a master plan. Process management is based on observation, evaluation and intervention, where steps of reflection and self-evaluation together with external feedback are combined and orientated at the network-internal need for learning.

The methodology emphasizes the integration of practice partners to develop strategies and activities as well as support the network structure. The network management designs and promotes the ongoing internal process of learning and change management.

In summary, we believe that the transdisciplinary approach is a great opportunity for successful development of climate change adaptation strategies. However, it requires additional resources in terms of time for mutual understanding, learning and cooperation (Balsiger, 2005).

2. The transdisciplinary approach has to be organised as a network

As stated previously, transdisciplinary cooperation of scientists, entrepreneurs, public agents and professional stakeholders is essential for the development of appropriate climate change adaptation strategies. Here, the aforementioned diversity of actors not only has institutional origins but also is rooted in the manifold aspects related to the use and management of water and land(scape) resources. The latter are (frequently) public goods and provide multiple functions to society, which are two determining factors for a multi-actor setting.

Successful management of public goods is usually a result of collective negotiations and agreements that are condensed over time to accepted norms and institutions (Ostrom, 2005). Manifold forms of institutional arrangements exist all over the world, especially in the field of water management, but also in the management of low productive landscapes such as alpine meadows, poor grasslands and extensive woods (Ostrom, 1990). Usually several different individual actors or groups are involved in these linkages, frequently at a communal or regional territorial level of decision-making. Complexity is added when referring to the multifunctionality concept, which has been recently elaborated and discussed with regard to landscapes and European agriculture (Helming and Wiggering, 2003; Müller et al., 2008). Through similar analysis and tackling of a resource's multiple functions, the number of concerned actors, both individuals as well as groups, can increase considerably.

These types of diverse structures and institutional regimes have also formed the organisational setting in INKA BB since 2007. Given the situation that partners from science, various forms of land use, water and health management, and others from public agencies intended to cooperate, it was unlikely that all the actors could be incorporated in a single hierarchical structure or that interaction could be coordinated only through markets. On the contrary, the appropriate manner to link all these various partners was a network organisation.

Under the above outlined context, the structure of a network has advantages over other forms of governance such as hierarchies and markets. In networks, interactions are flexible, competencies are bundled over organisational boundaries, and equality and diversity enhance learning and innovation processes. One major characteristic that differentiates networks from other organisations is the structural linkage between subsystems.

In INKA BB, it is the common goal of all partners to ensure the sustainable use of land and water resources under changing climate conditions. To reach this goal, network partners rely on each other, although they are only loosely linked within the network structure. The network aims to bundle the competencies of all partners. Thus, the network links theoretical and practical knowledge and develops new strategies based on existing and newly-obtained know-how. The network partners are 12 research institutes in Berlin and Brandenburg, 15 interest groups in the fields of land and water management and more than 30 individual businesses as well as a number of administrative bodies from both Brandenburg and Berlin.

3. Networks can not be steered or directed but only fostered and supported

In our context, INKA BB is considered a social network. Here, it is not the individual who constitutes one unit or network element but groups of people. These core elements or sub-systems are modules, which are always composed of one or more scientific partners and one or more practical partners (transdisciplinary modules). Again, these partners are frequently previously-existing groups and working teams, although they can either have a formal or an informal structure, e.g. a faculty department, a county agricultural board, a water management association or a group of voluntarily cooperating farmers. Further on, communication and cooperation takes place among the modules

within and across action fields (Fig. 2). This cooperation is guided by the topics and objectives of different partners and is top-down ordered by the project coordination and management team. In summary, we consider INKA BB a social network in which the subsystems are either mostly transdisciplinary teams, or individual organisations that are represented by the different partners within the modules' teams.

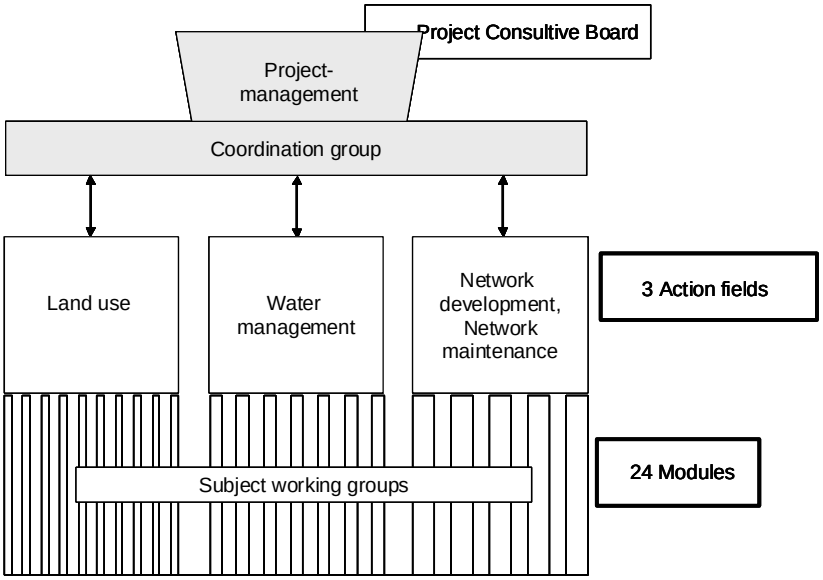

Figure 2. The project's network structure (Knierim et al., 2009).

Social networks are meta-organisations that consist of a certain number of subsystems, which in their purpose, structure and behaviour may considerably differ from one another. Hence, understanding a network organisation means acknowledging that the utmost diversity is possible and that *a priori* no assumption of common subsystem behaviour should be made. Unlike in formal organisations, where the transmission of content and action impulses (orders, agreements, persuasion etc.) follows explicit and implicit channels and routines, a network has no predefined and institutionalised ways of communication.

To influence relevant structures within a network, we need mechanisms that are different from those within hierarchically-steered organisations to foster cooperation. Relevant literature refers frequently to establishing a common perspective, based on joint objectives and an overall mission to support coherence and cooperation (Orthey, 2005 referring to Baecker, 1994). In the present project, the network is based on the coordinated process of strategy development for climate change adaptation, which has to be designed and implemented. Here, the network mechanisms leave space for the development and implementation of ideas from single partners.

Since planned steering of the network is not possible, changing the autonomous dynamic of a system should be reached by intelligent intervention (Mayntz 1997; Wiesenthal 2006). Therefore, the network partners are methodologically supported. One module in the 'network development' action field (see Fig. 2) accomplishes tasks in the domain of content and process management. It consists of preparing guidelines and manuals on social research and participatory methods and instruments, such as SWOT analysis (Knierim and Siart, 2009), moderation and planning techniques, as well as conducting trainings for transdisciplinary groups. Furthermore, the module attends module-specific workshops, gives guidance for analysis and discussion of objectives, and provides feedback based on reports, summarizing the results of transdisciplinary SWOT analyses. Additionally, a further module in this action field provides information about regional climate development. This information is used for the actors' perceptions of climate change risks and opportunities.

The methodological approach supports the development and maintenance of a network, which is action-oriented and competent in dialogue.

4. Knowledge is the medium of network coordination–trust is a prerequisite

Based on concepts related to system theory, we consider the INKA BB network to be a 'functionally specialised' system where the relation of the subsystems (elements) is characterised similarly by the principles autonomy and interdependency (Willke, 2001:114). Hence, a network is an intermediary coordination system which reveals characteristics not only of markets and hierarchies but also of horizontal, equal partners' integration. In such an organisational context, cooperation between partners is based on the general acknowledgement that there is complementarity between subsystems and additional benefits from the exchange of knowledge. This exchange within networks is organised by the medium 'knowledge', and the personal bases for knowledge exchange are interest and mutual trust among the partners (Willke, 2001:146).

Starting from the idea that the handling of knowledge, its acquisition, operationalisation, transformation and dissemination, is critical for a science-practice network to function well, transdisciplinary knowledge exchange becomes a relevant analytical topic for network support. In the context of extension and innovation research, there are two concepts that will guide our analysis and action: (i) the knowledge systems concept and (ii) the differentiated understanding of knowledge that was developed in sustainability research.

In the context of agricultural extension, the knowledge system concept has gained broad reputation and is applied worldwide (Nagel, 1979; Röling, 1988; Engel and Salomon, 1997; ARD/IBRD, 2007). Its merits are the introduction of a user-oriented perspective in the analyses of organisational landscapes, its focus on the system's functions (elaborated e.g. by Nagel, 1979) and a clear orientation toward the performance of linkages and interactions between organisations and actors (Engel and Salomon, 1997). One problem with this concept is that it prescinds individual agency from observation; another more important gap in our context is the restricted differentiation of the concept of knowledge. Here, we propose to make use of the analytical categories for knowledge that were introduced by sustainability and risk management research.

Research and action in the sustainability field address real world problems and develop knowledge for several objectives at the interface between science and society. Therefore, the knowledge needed for such an applied approach, may be defined as follows (Hayn et al., 2003):

- normative knowledge to develop goals and targets,
- analytical knowledge to understand functions, systems and interactions and
- practical knowledge, how to reach the defined goals and how to successfully implement measures (Hayn et al., 2003).

In contrast to this functional designation, epistemological distinctions are made in theories from the sociology of knowledge (e.g. Berger and Luckmann, 1997; Wehling, 2002; Weingart, 2003). These authors also analysed positivistic thinking and criticised it for its mere material and reductionist approach. Also, with reference to the biology-based, auto-poiesis concept from Maturana and Varela, other theorists have argued that information and knowledge are dependent on the perceiver's viewpoint and hence are subjectively- and socially-constructed (e.g. Röling, 2002). Again, critics deplore a complete neglect of the natural world within the community of social constructivism (Wehling, 2006). Hence, a 'postconstructivistic' perspective should be adopted which conceives knowledge as the result of "practices of generating, attributing and justifying knowledge" instead of assuming that there is 'pure' knowledge, either in an objective or in a subjective sense of meaning (Wehling, 2006:86-87, own emphasis). In this rationale, knowledge exists in relation with one or several 'knowers' who successfully apply it both in discourses as well as in action. In addition, the existence and significance of non-knowledge, especially of 'unknown unknowns', increases the challenges of knowledge handling because it extends "the accountability of the sciences beyond what is explicitly known or not known, thus encompassing the material configurations in which scientific practices are enacted" (Wehling, 2006:95, emphasis in the original). Similarly, action

researchers insistently plead to adopt a multi-perspective, extended epistemology that integrates positivism "in arguing that there is a 'real' reality" and constructivism "in acknowledging that as soon as we attempt to articulate this we enter a world of human language and cultural expression" (Reason and Bradbury, 2008:7).

In summary, for the success of the transdisciplinary network INKA BB, knowledge exchange and knowledge generation at manifold interfaces will be of crucial importance, and the continuous creation and maintenance of transparency and trust will be priorities for all actors involved. As Willke (2001) further elaborates, our knowledge about the possibilities of 'governance and coordination by knowledge' are still very limited compared to that by the media 'money' and 'power'. Science as a (sub)system holds an important role in this new setting, but still more important are the (practical) consultancy and advisory capacities of scientists (*ibid*). Handling knowledge in a network context is above all, a personal capability and only secondly, a question of data accesses and data storage. These individual preconditions constitute a strong restricting factor, given the government limitations presented in thesis 3.

References

Aeberhard, K. (1996) *Strategische Analyse, Empfehlungen zum Vorgehen und zu sinnvollen Methoden-kombinationen*. Bern: Peter Lang Verlag.

ARD/IBRD (Agriculture and Rural Development/International Bank of Reconstruction and Development) (2007) *Enhancing Agricultural Innovation: How to go beyond the strengthening of Research Systems*. Washington DC.

Baecker, D. (1994) *Postheroisches Management*. Berlin: Merve Verlag.

Balsiger, P.W. (2005) *Transdisziplinarität. Systematisch-vergleichende Untersuchung disziplinüber-greifender Wissenschaftspraxis*. München: Wilhelm Fink Verlag.

Barnett, J. (2001) Adapting to climate change in Pacific Island Countries: The problem of uncertainty. *World Devel.* 29(6), 977–993.

Berger, P.L. and T. Luckmann (1997) *Die gesellschaftliche Konstruktion der Wirklichkeit: eine Theorie der Wissenssoziologie*. Frankfurt am Main: Fischer-Taschenbuch-Verlag.

de Loe, R., Kreutzwiser, R. and L. Moraru (2001) Adaptation options for the near term: Climate change and the Canadian water sector. *Global Envir. Change* 11, 231–245.

Engel, P.G.H and M.L. Salomon (1997) *Facilitating Innovation for Development: A RAAKS Resource Box.* Amsterdam: KIT Press.

Hayn, D., B. Nölting and J.P. Voß (2003) Methodenfragen der Nachhaltigkeitsforschung – normativ, integrativ, partizipativ – aber wie? In: Volkens, A., C. Fischer, A. Karmanski, S. Bartelt, H. Heinrichs (eds.) *Orte nachhaltiger Entwicklung: Transdisziplinäre Perspektiven*. Tagungsband zum Kongress 20.-22. Juni 2003.

Helming, K. and H. Wiggering (eds.) (2003) *Sustainable development of multifunctional landscapes.* Berlin: Springer Verlag.

Ikeme, J. (2003) Climate change adaptational deficiencies in developing countries: The case of Sub-Saharan Africa. *Mitigation and Adaptation Strategies for Global Change* 8: 29-52.

Knierim, A. and S. Siart (2009) *Leitfaden zur SWOT Analyse und Strategischen Planung in INKA BB. Arbeitsdokument für die Teilprojekte in INKA BB 1. Fassung*. Müncheberg: Leibniz-Zentrum für Agrarlandschaftsforschung.

Knierim, A., V. Toussaint, K. Müller, H. Wiggering, J. Bachinger, S. Kaden, W. Scherfke, U. Steinhardt, T. Aenis and F. Wechsung (2009) *Innovationsnetzwerk Klimaanpassung Region Brandenburg Berlin – INKA BB. Rahmenplan gekürzte Version*. [Elektronische Ressource], Müncheberg: Leibniz-Zentrum für Agrarlandschaftsforschung.

Knierim, A., M. Pintar, S. Skerratt and H. Wiggering (2010) The InnoLand approach – experimental research and action in Europe's rural regions. In: Wiggering, H., H.P. Ende, A. Knierim, M. Pintar (eds.) *Innovations in European Rural Landscapes.* Berlin: Springer Verlag, pp. 11-24.

Mayntz, R. (1997) *Soziale Dynamik und politische Steuerung. Theoretische und methodologische Überlegungen.* Frankfurt, New York: Verlag Campus.

Müller, K., H. Wüstemann and S. Mann (2008) Grundlagen des Konzeptes der Multifunktionalität. - In: Wüstemann, H.S. Mann, K. Müller (eds.) *Multifunktionalität: von der Wohlfahrtsökonomie zu neuen Ufern.* München: ökom, pp. 10-36.

Nagel, U.-J. (1979) (1979) Knowledge Flows in Agriculture: Linking Research, Extension and the Farmer. *Zeitschrift für Ausländische Landwirtschaft* Vol. 18, No. 2, pp. 135-150.

Nagel, U.-J., T. Aenis, A. Dosch, K. Prager and V. Toussaint (2004) *Zur Wirkungsanalyse trans-disziplinärer Forschung: ein Untersuchungskonzept der Nachhaltigkeit des Landnutzungs-projektes GRANO.* Weikersheim: Margraf.

Orthey, F.M. (2005) Lernende Netzwerke? Überlegungen zum Netzwerkbegriff und seiner Anschlussfähigkeit für Lernprozesse. *Gruppendynamik und Organisationsberatung* (36) 1: 7–22.

Ostrom, E. (1990) *Governing the commons. The Evolution of institutions for collective action.* Cambridge: Cambridge University Press.

Ostrom, E. (2005) *Understanding institutional diversity.* Princeton: Princeton University Press.

Parry, M.L., O.F. Canziani, J.P. Palutikof and Co-authors (2007) Technical Summary. In: Parry, M.L., O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (eds.) *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge: Cambridge University Press, pp. 23-78.

Payer, H. (2002) *Wieviel Organisation braucht das Netzwerk? Entwicklung und Steuerung von Organisations-netzwerken mit Fallstudien aus der Cluster- und Regionalentwicklung.* Universität Klagenfurt.

Reason, P. and H. Bradbury (2008) Introduction. In: Reason, P. and H. Bradbury (eds.) *The Sage handbook of action research: participative inquiry and practice*. London: SAGE Publications, pp. 1–13.

Röling, N. (1988) *Extension science—Information systems in agricultural development.* Cambridge: Cambridge University Press.

Röling, N. (2002) Beyond the aggregation of individual preferences—Moving from multiple to distributed cognition in resource dilemmas. In: Leeuwis, C. and R. Pyburn (eds.) *Wheel-barrows full of frogs: social learning in rural resource management.* Assen: Van Gorcum, pp. 25–47.

Tress, B., G. Tress and G. Fry (2003) Potential and limitations of interdisciplinary and transdisciplinary landscape studies In: Tress, B., G. Tress, A. van der Valk, G. Fry (eds.) *Interdisciplinary and transdisciplinary landscape studies: Potential and limitations.* Wageningen: DELTA Series 2.

Wehling, P. (2002) Was kann die Soziologie über Nichtwissen wissen? Antwort auf Klaus Japp. *Zeitschrift für Soziologie* 31, pp. 440–444.

Wehling, P. (2006) The Situated Materiality of Scientific Practices: Postconstructivism—a New Theoretical Perspective in Science Studies? *Science, Technology & Innovation Studies*, Special Issue, 1, pp. 81–100.

Weingart, P. (2003) *Wissenschaftssoziologie.* Frankfurt am Main: Athenäum Verlag.

Wiesenthal, H. (2006) *Gesellschaftssteuerung und gesellschaftliche Selbststeuerung.* Wiesbaden: Verlag für Sozialwissenschaften.

Willke, H. (2001) *Systemtheorie III: Steuerungstheorie*. Stuttgart: UTB-Verlag.

Web links:

http://www.klimzug.de/en/160.php