CLIMATE CHANGE AND THE COMMUNICATION BETWEEN SCIENTISTS AND STAKEHOLDERS

Towards a participatory notion of communication

by

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This work is dedicated to the memory of my friend Tim Kandert.
Abstract

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Communication is an increasingly acknowledged feature of contemporary science. As a means of connecting science to the outside world, it can be interpreted in different ways, according to the goals we associate with it. In environmental science in general and in climate change impact assessment specifically, the complexity, uncertainty and large temporal and spatial scales of the issue imply a strong urge for an adequate notion of communication. Starting from the analysis of knowledge, power and interest, in the first part of this study, the author develops a participatory notion of communication, based on three basic rationales:

1. Expanding the knowledge base
2. Realising a broad representation of interests and
3. Creating legitimacy.

The second part of the study is dedicated to the organisation, translation and application of participatory communication. A review of different scientific projects about science-stakeholder interactions in the field of environmental science, including climate change, helps to organise the concept into its procedural and knowledge related spheres, to formulate respective criteria and conditions for participatory communication, and to finally apply it to a research project on climate impact assessment and stakeholder dialogue, called the ATEAM\(^1\). Interviews with Swedish decision-makers and the observations made at a ATEAM-workshop on stakeholder-dialogue showed the practicability of the concept of participatory communication and provided the opportunity to integrate practical experience with the conceptual framework.

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\(^1\) ATEAM: Advanced Terrestrial Ecosystem Analysis and Modelling
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1 Introduction

“There is at least one philosophical problem all thinking humans are interested in: to understand the world we live in [...] (Popper 1958)” and we can see this as the most fundamental motivation behind science. This study represents a scientific piece of work and its interest according to the idea presented above, is to better understand the relation between research in computer-based understanding of Global Change on one side and the stakeholders on the other. But there is more behind it: my hidden agenda is certainly to write this thesis in accordance with the scientific codes of my scientific peer group (LUMES) in order to attain the scientific degree of a Master of Science. Maybe I also think that my specific topic is instrumental in increasing my personal value on the job-market. And one more point is certainly my basic ideas about the role of science in society (I will come back to this point later). But how did I proceed with my research?

To develop an analytic focus that is more specific than just stakeholders, the integration of policymakers with climate change research and the successful communication and interpretation of modelling results in order to diffuse into the decision-making process were analysed exemplarily.

The starting point is the development of a conceptual framework for the communication process, systematically analysing approaches chosen in Climate Change (CC) and in other, preferably environmental science cases in order to identify the governing principles, effective tools and prevailing barriers for the science-policy dialogue in general and in CC specifically.

At the heart of this analysis is the understanding of how scientists and decision-makers relate to science and how they relate to one another. This basically means, before we start to think about the communication process we consider its components and its basis. Or, taking the system-theoretic standpoint, when analysing the system of communication between scientists and stakeholders, we have to identify and discuss the system elements, the system boundaries and the initial conditions.

The whole context of the generation of “knowledge” is to be analysed before the analysis of the involved actors and the communication between them.

Figure 1-1: Flow of information in the climate impact discourse
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This work should reflect the whole conceptual picture of the science-policy dialogue in Climate Change issues.

Figure 1-1 shows the conceptual understanding of research – stakeholder interactions with regard to environmental (or climate change) impact assessment and modelling. The arrows constitute the links that are of major interest for the flow of information between the scientists and the stakeholders, which refers to the original thesis question, i.e. how the communication of (preliminary and final) results to stakeholders at different stages can be achieved most effectively.

The next step is then to scrutinise our understanding in the dimension of application. Our scientists become real members of a real research project and our stakeholders real people (decision-makers) in existing institutions.

In the dimension of application, a big European Research Project (Advanced Terrestrial Ecosystem Analysis and Modelling, ATEAM, incl. i.a. Lund Universitet) in the field of CC plays the science part and policy- and decision-makers in Sweden one group of stakeholders.

1.1 Objectives

How can the ATEAM most effectively communicate its research to policy-makers was the research question that we tried to answer from the beginning!

The major research tasks were:

1. Elaboration of a theoretical framework of science-stakeholder communication
2. Literature review about other projects of science-stakeholder communication
3. Interviews with stakeholders and evaluation of the interviews
4. Documenting the first ATEAM-workshop on stakeholder-dialogue and evaluation of the workshop
5. Integrative analysis of the research tasks
6. Formulating a strategy for effective science-stakeholder communication

A strategy for effective communication – strategic with regard to which effects?

"Any procedure can be represented as a game by assuming that each voter makes a plan in advance regarding the course of action he will take in every division which can arise" (Farquharson 1969, Theory of Voting, in: OED online 2001). The Oxford English Dictionary gives i.a. this reference to explain the term strategy (The quote relates to the Theory of Voting) and we conclude that the plan for the intended courses of action is formulated in order to maximise the probability to produce the effects that are preferred by the respective actor.

We might – in discussing and analysing a strategy for effective communication in the field of climate change research (with special regard to the ATEAM) – draw the conclusions that we want to be strategic alone about the goals of the scientists (or the ATEAM) in communicating their research but this would not account for the author's concept of science and the role of science in society. Social accountability and thus, participation are dominant motifs in climate impact research that – per definition – is dealing with what is perceived (constructed) as an impact (or problem) for society (Bäckstrand 2001, Hajer 1995, Hannigan 1995).

So, apart from the – legitimate – interests and goals of the ATEAM-scientists, we want to consider and elaborate on our interest in science contributing to the solution of the problem. This needs an expansion of our understanding of communication to an interactive and participatory mechanism. Interactive in that it is not limited to communicate results but that communication starts early in the research process and constitutes a dialogue, a mutual exchange of ideas on a regular basis. Participatory in a sense of not limiting participation to the policy-making process [as demanded in the Rio Declaration (UN 1992a, Principle 10), the Agenda 21 (UN 1992b, p.1), the fifth European Community programme of policy and action in relation to the Environment and sustainable development (European Communities 1993, p.22) i.a., see van den Hove 2001] but to actually start at the research level, where the knowledge-, information- and/or data-basis for decision-making is
created. “For the stakeholder in order to formulate respective needs of the assessment, insight in climate and climate change and in climate research might be necessary” (Jones 2001, p.8).

Epistemic empowerment as a means inter alia, to use lay-knowledge and other kinds of non-conventional or non-scientific knowledges to improve the research (Bäckstrand 2001, p.61; Stern and Fineberg 1996, p.23;) to represent the whole of society (actors, people) and to build trust in a more negotiated and commonly generated “truth” (Wynne 1996, p.46!)

This more comprehensive understanding of science-stakeholder communication forces us to shift our originally intended research question from the special case of a strategy for the effective communication of ATEAM-research to stakeholders to communication between scientists and stakeholders as a means of participation:

How can the communication between scientists and stakeholders in the field of climate change be integrated with the concept of participation in order to form a participatory notion of science-stakeholder communication?

Our hypothesis is:

Communication between scientists and stakeholders in the field of climate change has to be participatory!

First, the understanding of knowledge, the roles of scientists and stakeholders and their interests and motivations will be analysed in this study to underpin and support the importance of broad, participatory communication and to further develop the hypothesis.

Then, the analysis of the communication process, comparing different approaches and experiences with communication or stakeholder dialogue so far and integrating it with findings from the interviews (conducted for this study) and the analysis of the stakeholder-workshop will be used to elaborate on “effective participatory communication” and to show the best ways of doing it. These two main strains of analysis will prove the hypothesis on all systematic levels.

2 Methodology

The steps of the analysis presented in this thesis, have been outlined above. But what is the methodology behind?

System theory is a key word in the Lund University Master’s Programme in Environmental Science/Studies and it also reflects the understanding and organisation of the studies of Geocology at the “Technische Universität Braunschweig”\(^2\) in Germany, where I have received my academic training before this Master’s Programme.

Choosing a system theoretic approach is highly adequate in trans-disciplinary research due to its meta-disciplinary character. Systems theory is unspecific to start with, it simply delivers the basic understanding of an object (of research) on a meta-level where all relevant ideas, traditionally related to different, specific fields and disciplines, can still be easily incorporated.

We are identifying the system elements for the research objective; we establish the links between the elements and draw the system boundary around the selected elements, according to their relevance (and not according to discipline).

System analysis means being systematic about the analysis. After defining the system with its elements, links and boundary, we have a strong means to position all steps and questions during the research process within the system and relate them to the research question and to one another. This also allows for reflecting the dynamics of the research process itself, and changes that have been identified with one system element might shift the focus of the whole system (research).

\(^2\) Braunschweig Institute of Technology
We have approached the task of writing a Master thesis in Environmental Science by first of all, identifying a field of interest, the object of research and formulating a research question. The important actors and factors were identified and the best tools, considering the time-boundary of the research, were chosen accordingly. The conceptual work and the elaboration of the hypothesis was realised through the study of literature, selected according to the system elements and links that were found to be the most fundamental. From the fundament of the system (the understanding of knowledge, power, interests and the main actors) we worked our way through the different levels:

1. Organising the hypothesis into tractable terms, differentiated according to theory and practice
2. Translating the general terms into specific issues and analyse the actual translation as it is done in the ATEAM.
3. Applying the findings to specific cases and analysing them in practice.

The cases for the application were the interviews and the workshop. Here, due to the time-boundary of our research project, the empirical part of the study could only be realised as qualitative, not as quantitative (statistically significant) analysis.

The final analysis integrated the literature-based and the empirical parts.

3 The conceptual understanding of communication between scientists and stakeholders

3.1 The Problem of Climate Change

The Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCCa 2001) refers to climate change as “any change in climate over time, whether due to natural variability or as a result of human activity”\(^3\).

Based on past assessments (e.g. the second assessment report, IPCC 1995) and new research, the IPCC report gives evidence for climate change, which is characterised by changes in some of its major aspects over (different) time scales. The most prominent are:

1. The increase in global average surface temperature (and rising temperatures in the lowest eight kilometres of the atmosphere, together also commonly referred to as global warming), (see Figure 3-1)
2. Global average sea level rising, and
3. A decrease in snow cover and ice extent.

The anthropogenic emissions of so called greenhouse gases (GHG) and aerosols is altering the composition of the atmosphere and is expected to play a role in these effects on the climate through radiative forcing.

The temperature of the lower atmosphere and the Earth surface depend basically on the balance between incoming solar radiation and outgoing or reflected radiation. The atmosphere, acting as a huge natural greenhouse, traps some of the otherwise outgoing radiation, protecting and sustaining “life on earth” (Parry and Carter 1998, p.5). Radiative forcing describes two opposite impacts related to this radiation balance: Negative radiative forcing, which can be caused by aerosols, tends to cool the surface (e.g. through reflecting the short-wave incoming radiation, due to its physical properties, more effectively than the outgoing long-wave radiation) while greenhouse gases (GHG) such as CO\(_2\), Methane (CH\(_4\)), Ammonia (NH\(_3\)) or Nitrous Oxide (N\(_2\)O) tend to trap more (long-wave) heat (-radiation).

The IPCC report shows that “concentrations of atmospheric greenhouse gases and their radiative forcing have continued to increase as a result of human activities” (IPCCa 2001, p.7) and regarding the last 50 years, global warming can more and more significantly be linked to this increase and thereby, to human activity (ibid. p.10).

\(^3\) In the report, it is pointed out that this definition is different from the definition used in the UNFCCC (United Nations Framework Convention on Climate Change) where the term climate change refers to a change in climate that is attributed directly or indirectly to human activity that “alters the composition of the global atmosphere and that is in addition to the natural climate variability observed over comparable time periods” (ibid. p.2).
With regard to sea level rising, the report states that temperature increases observed during the 20th century are very likely\textsuperscript{4} to play a significant role through “thermal expansion of sea water and widespread loss of land ice” (ibid. p.2).

How can these observation treated in a systematic way to improve our understanding of the effects and the underlying causes and processes?

3.1.1 Computer-based modelling of climate change

To analyse climate change systematically computer models are used to simulate the climate on different spatial and time-scales. On the historic time-scale for example the simulation results for the 20th century can be compared to measured changes in order to find out more about the underlying causes of e.g. the temperature variations. These ‘historical’ simulations are very important to control the quality of a model; as for the past, measurements of major climate aspects are available which can be used for means of validation\textsuperscript{5}.

\textsuperscript{4} For the definitions used in the report for likely, very likely etc see p. 5 (e.g. very likely reflects a 90-99% certainty, with a 5% statistical significance level and a 95% confidence level)

\textsuperscript{5} Validation can be seen as a ‘reality check’ to control the plausibility of model outputs. One way of doing this is to compare them to available empirical data. For physical, process-based models for example we would like to know whether or not the model was based on the ‘right’ understanding of the physical processes. Does the model reflect ‘reality’ (as reflected in the measurements)?
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Figure 3-1: Variations of the average surface temperature of the globe and the Northern Hemisphere over the last 140 and 1000 years respectively

The IPCC report has found that “simulations that include estimates of natural and anthropogenic forcing reproduce the observed large-scale changes in surface temperature over the 20th century” (IPCCa 2001, p.9) and the understanding of climate processes has been improved.

While it could be argued that measurements and observations as classical tools of science are the most reliable and reflect ‘reality’ the best, they are usually reflecting a specific time- and spatial scale and they deliver no guidance in terms of future projections.

Computer models are integrating different scales, scaling down from global climate dynamics to regional features or employing the understanding of small-scale processes like photosynthesis and soil respiration for regional vegetation modelling.

But the main advantage and application of computer models is not just to simulate the past but also to produce reliable projections of future climates. The understanding of the processes and dynamics of the climate system, which is based on the procedures described above, is extrapolated into the future. As “there is little doubt that the increases in greenhouse gases observed over the last century will
continue well into the 21st century“ (Parry and Carter 1998, p.17; IPCCa 2001, p.12), it is important to get a better idea of the extent of climate change and its impacts and to understand how different ways of reacting towards the human influences could lead to different states of the climate.

To systematise projections for future climates and the role of human interference, the computer simulations have to be based on plausible assumptions about future paths or what BOSSEL (2000) calls "riverbeds of the future". Scenarios is the now commonly used term for sets of plausible assumptions and in 1992 the IPCC presented the IS92 scenarios – six projections of future global GHG-emissions to the year 2100 (Parry and Carter 1998, p.18). These scenarios have been evaluated and in the new IPCC report 2001 a new set of scenarios is presented that incorporates changes in methodologies and the drivers of emissions (IPCCb 2001, p.3).

Different scenarios are based on different plausible developments of the driving forces behind climate change, such as “demographic development, socio-economic development, and technological change” (ibid.). Scenarios help in assessing climate impacts, possible ways of climate change mitigation and adaptation. SMITH and LAZO (2001, p.5) underline the importance of “baseline (socio-economic) scenarios [to] help understand how vulnerabilities to climate change may be affected by changes in population, income, technology etc.”.

Figure 3-2 shows different scenarios that are arranged according to storylines (A1, A2, B1, B2). These storylines are a way of integrating the different assumptions that have to be made e.g. about population growth and economic development in a plausible way that also reflects the interdependence of the driving forces. It would be inefficient and implausible to use all possible combinations of all the different options for each driving-force. “Each storyline assumes a distinctly different direction for future developments, varying between, roughly, high-tech and high economic growth (A1) and solutions to economic, social and environmental sustainability (B1 & B2) (IPCCb 2001, p.5).

### 3.1.1.1 Modelling of Vegetation and Climate Interactions

The global vegetation plays a major role in the Carbon cycle of the atmosphere, in that “up to 40% of the carbon in the atmosphere passes through stomata each year (Ciais et al., 1997) and approximately

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6 Stomata (pl.) or Stoma (sing.) describes the chink in the plant-leafs through which water- and gas-exchange are regulated (Nultsch 1996, p.241)
16% (129 Pg C) is assimilated in vegetation (Gross Primary Production, GPP) (Sitch et al. 2000, p.1).

Digital Global Vegetation Models (DGVM) are using “explicit representations of vegetation processes such as resource competition and production, growth, mortality, establishment, soil and litter decomposition (Steffen et al., 1992, Woodward, 1996)”.

One of the core models of the research project (the ATEAM) that will be discussed later, is representing the latest generation of DGVM.

3.1.2 The ATEAM – not the A-Team!

The ATEAM stands for Advanced Terrestrial Ecosystem Analysis and Modelling and as a research project is funded by the EU and led by the Potsdam Institute for Climate Impact Research (PIK). ATEAM partners from 13 and sub-contractors from 6 different universities and institutes are responsible for the research and – as integral part – a stakeholder dialogue.

What are the deliveries the ATEAM is going to produce?

Ecosystem-services and their vulnerabilities to global environmental changes are the research object of the ATEAM and they are analysed in an ecosystem-modelling framework. Different computer models are intended to be used for the analysis, in order to provide for means of comparison and validation of the model outputs. Europe-wide maps, on basis of a coarse, 10-minute grid are supposed to illustrate vulnerability of ecosystem services.

For the purpose of this study it is not relevant to describe all the project parts and the scientific details, but in order to get a better idea of the kind of information that will be delivered and is already being delivered by the ATEAM, we want to refer to Olle of the core models that are used for the ecosystem modelling.

The LPJ- (Lund-Potsdam-Jena-) DGVM-model (Sitch et al. 2001), which has been jointly developed by scientists at Lund University, the PIK in Potsdam and the Max Planck Institute for Biogeochemistry in Jena, is a process-based Carbon-cycle model, which is driven by climate parameters. Ecosystem-processes are represented independently in a modular framework, “with individual modules describing key ecosystem processes” (Sitch at al. 2000).

Vegetation dynamics, carbon and water cycling are expressed through the following major outputs:

- Net Primary Productivity (NPP)
- Net Ecosystem Productivity (NEC)
- Runoff

While NPP and runoff are intuitively interesting parameters for scientists and stakeholders to look in, it might have to be pointed out here, that NEC is a way of expressing the Carbon-balance of the vegetation.

The first part of the modelling exercise in the ATEAM was to run the model over a historic period, to be able to compare the model outputs with existing data. These runs have been partly completed for the so-called ETEMA-window for Europe.

The following graphs (Figure 3-3 - Figure 3-7) show maps for NPP for the contrasting years 1911 and 1912 for total vegetation and for a selected plant functional type, C3-grass (Sitch et al. 2000), maps for net carbon emissions and soil respiration and major weather patterns for the two years.

\[\text{Pg (Peta-gramme) } = 10^{15}\text{ g}\]

\[\text{The popular gang around Mr. T out of the TV series “The A-Team” are known for pursuing their goals with slightly different and maybe more drastic means than the ATEAM, but the mixture of different characters might be reflected in the composition of the ATEAM, including scientists from 19 universities and institutes!}\]


\[\text{The climate parameters are derived through interpolation from a historical, global climate data-set, delivered by the Climate Research Unit at Norwich University (http://www.cru.uea.ac.uk/)}\]

\[\text{ETEMA: European Terrestrial Modeling Activity was a consortium funded by the European Commission. The ETEMA-window represents the geographical frame of the modeling (35-55° N/10°W-20°E) (Cramer et al. 2000)}\]
functional types are a way of representing the vegetation, according to phenology, physiology and physiognomy in a simplified way (in that not all different species are actually distinguished). We can try to interpret the differences in NPP and NEP according to factors like weather patterns, which show significant differences for 1911 and 1912 in terms of precipitation (total amount and distribution) and temperature. Without giving a further interpretation, we simply want to illustrate the way the model outputs can be used to illustrate the dynamics of the climate-vegetation system.

Figure 3-3: NEC of the whole vegetation in the years 1911 and 1912
Climate Change and the Communication between scientists and stakeholders

Figure 3-4: Net Carbon Emissions for the years 1911 and 1912

Figure 3-5: Weather patterns temperature (black line) and Rainfall (blue bars) for the years 1911 and 1912
Figure 3-6: Soil respiration for the years 1911 and 1912

Figure 3-7: NPP for the plant functional type C3-Grass
Climate Change and the Communication between scientists and stakeholders

We are going to come back to the ATEAM later, when we discuss their approach to stakeholder participation and the ATEAM Stakeholder workshop.

3.2 Science – Knowledge – Communication

There is nothing such as science as such or the scientific community. And I am not going to give a concise definition of science, as it is not science itself but the interactions between science and policy that are object of this study.

In the analysis of science and its role in environmental policy-making, the 3 different perspectives on science as power-based, interest-based and knowledge-based are put forward as competing concepts (Bäckstrand 2001, p.67).

In our study we seek to understand science and the science-policy dialogue as being mutually constructed by and as expressing or reflecting all – power, knowledge and interests – and their interrelatedness.

We are approaching science from a constructionist standpoint, sharing notions of science as a process and a product, as a social institution and as a body of knowledge (ZIMAN 1984; in: Bäckstrand 2001, p.24). The body of knowledge constitutes our point of departure, as knowledge is the basis for the understanding of and information about climate change – the objects of our communication process between scientists and policy-makers.

How are power and knowledge related? In how far is knowledge conditional to interests (in power)? Some see power and power structures as being conditional to the generation of knowledge and knowledge to constitute a source of power. This understanding of science as a struggle between autonomous, independent actors with well-defined interests has to be balanced with the much more complex realities of relations within the international scientific community which – in the case of climate change modelling and a trans-national, EU-funded research project – is constituted by sub-national research groups and international treaties (e.g. the UNFCCC) and bodies like the European Commission. In issues like climate change that are characterised by high uncertainties and complexities, not all actors can be assumed to have a defined interest – interests could also be seen as being constructed through the discourse (Hall 2001, p.73).

Simple adherence to one of the prevailing paradigms of science apparently does not represent the adequate approach to define the basis for our understanding of communication strategy; we have to discuss the relations of knowledge, power and interests in more detail.

In the following sections, we will thus discuss the context of knowledge:

1. Knowledge and its relation to power
2. The motivation and interests behind its generation and communication
3. The involved actors and their different roles and goals

3.2.1 Discourse theory, knowledge and power

Michel Foucault, the French philosopher and sociologist sees topics as being constructed by discourse. Discourse “defines and produces the objects of our knowledge” (Hall 2001, p.72, referring to Foucault).

"The same discourse, characteristic of the way of thinking or the state of knowledge at any one time (what Foucault calls the episteme), will appear across a range of texts, and a forms of conduct, at a number of institutional sites within society. However, whenever these discursive events 'refer to the same object, share the same style and [...] support a strategy [...] a common institutional, administrative or political drift and pattern’ (Cousins and Hussain, 1984:84-85), then they are said by Foucault to belong to the same discursive formation.”

(Hall 2001, p.73)

In analysing the relation between knowledge, power and truth, Foucault expanded the understanding of knowledge as a form of power to ‘define truth’ to the application and effectiveness of knowledge as an expression of the power to have real effects in the real world, i.e. defining conduct and shaping
disciplinary practice, “distinguish true and false statements” and give status to “those who are charged with saying what counts as true” (Foucault 1980, p.131; in Hall 2001, p.77).

Knowledge is defined “as a productive network which runs through the whole social body” (Foucault 1980, p.119; ibid.). “Without debating that the state, the law, the sovereign or the dominant class may have positions of dominance, Foucault shifts our attention away from the grand, overall strategies of power, towards the many, localised circuits, tactics, mechanisms and effects through which power circulates – what Foucault calls the ‘meticulous rituals’ or the ‘micro-physics’ of power.”

“Discourse is then seen as internally related to the social practices in which it is produced” (Hajer 1995, p.44). Where so in the discourse is the role for the agents or actors? Foucault gives the answer himself: “The subject can become the bearer of the kind of knowledge which discourse produces.”

Although Foucault regards the conscious, interest-driven actors as less influential in discourse formation, we will turn to these “subjects” as the first building block in our understanding-science-policy-communication-jigsaw. i.e.: We continue our discussion with our understanding of scientists, and their interests in climate change research and communication, and how they fit in the climate change discourse. This is, where we link the discussion of science to the discussion of stakeholders, developing an understanding of stakeholders’ interests and of stakeholders, how they fit in the climate change discourse and which roles they play.

Having constructed thus the common space of interests and an idea of the actors involved, we can then, in the next chapter, come to an integration of these ideas into the communication process and stakeholder participation.

3.2.2 Different Roles for Scientists

The firmness of scientific statements has been replaced by the insight in the conditionality of implied decisions, the dependence upon methods and the reliance on its context12 (Beck 1991, p.140). “Realities” are differing with “different computers, different institutes, different contractors” (Beck, ibid.).

Although a specific discourse can be characterised by homogeneity in the scientific (causal etc.) beliefs and agreement upon common validation procedures, we have to be aware of the different roles of different scientists at different levels and – being within different discourses

“[…] Conservation and environmental organisations typically have their own scientific advisory committees and call upon the voluntary support of university scientists and civil servants who are scientists” (Yearley 1992; in: Hannigan 1995, p87).

And even the international epistemic communities are constituted by scientists and groups of scientists (e.g. national or university research institutes) that are acting and exercising their science within a framework of varying scale (local, regional, national) and multiple dimensions (regulatory, legal, cultural).

The role of scientists in regime building is played on at least two grounds, being involved with international institutions (e.g. the secretariats to the conventions, the EC) and “national bureaucracies”(Bäckstrand 2001, p70).

These different or multiple roles of scientists are influenced by and in turn generating different interests and motivations.

3.2.3 Interests and Motivations

The motivations behind the research itself and for considering stakeholder dialogue as integral part of the research are multiple. These motivations have to be identified, as they are decisive for the realisation of the dialogue process and the exercise of power.

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12 The German original text is: “Die Eindeutigkeit wissenschaftlicher Aussagen ist der Einsicht in deren Entscheidungsbedingtheit, Methodenabhängigkeit, Kontextgebundenheit gewichen.”
Once we have (re-) constructed the *space of motivations or interests* within which the communication takes place, we have to understand the interaction of these motivations that might be mutually supportive as well as contradictory.

The sociology of science emphasises the relevance of interests (or what we have called motivations here) for scientific expertise:

"[...] Dominant interests control expertise and hence shape the available knowledge to reinforce their interests. [...] Scientific knowledge tacitly reflects and reproduces normative models of social relations, cultural and moral identities, as if these are natural." (Wynne 1994, p.176)

![Diagram](image)

**Figure 3-8: Scientific community and policy-makers and their goals and interests in communication**

Figure 3-8 reflects schematically the interplay of different interests and goals in the process of knowledge generation and communication. The communication process is situated in the centre of science-policy relations and is decisive for the different goals to be reached. How they are balanced depends on the communication process and the communication process on the knowledge that is generated in the first place.

But what are the major interests attached to *model-based understanding of climate change*? Can they be identified?

### 3.2.3.1 The interests of scientists in climate change research and communication

Foucault is expanding his idea of knowledge and power from *knowledge as a form of power* to ‘*define truth*’, to the struggle for power to shape the (public and scientific) understanding of a topic (in our case: climate change) as one major interest of scientists.

The social-constructivist point of view is expressed by BIRD (1987, p70 in: Risk, Environment and Modernity, p258) as follows:

"[...] Scientific paradigms are socio-historical constructs [...] Every aspect of scientific theory and practice expresses socio-political interests, cultural themes and metaphors, personal interactions, and professional negotiations for the power to name the world".

Obviously, for different authors, even if they might put different weights on the importance of power in science, power is one of the governing principles and the pursuit of power (in whatever expression) is one important interest behind the enterprise of science.
Other interests of the science-part can be expressed in four major motifs:

- Scientific interest in the field of preoccupation; curiosity, willingness to explore and understand
- Recognition by the scientific peer-group and accordingly a good scientific reputation
- Social accountability, i.a. to create useful knowledge
- Funding

It is obvious that these interests cannot be regarded as independent from reflections upon power. While funding and the epistemic interest (Popper 1958, p.4) can be assumed as being essential in the first place, the interest in recognition stems from the rules and rituals of scientific enterprise, (Shackley and Wynne 1996, p.279, Beck 1991, p.141). The success of “policy-oriented learning” depends on “prestige, professional norms and peer review (Hajer 1995, p.71) and to get published “in the right journal and to work within the academic discipline’s framework” can be more important than to establish or sustain the link to society (Vanderstraeten13 2000 in: Lothigius and Loughran 2000). In how far are these generally identified interests reflected in the aims and objectives of the ATEAM?

3.2.3.1.1 The interests and goals of the ATEAM

In the ATEAM Work plan, the main objective is defined as follows:

“The numerous interactions between ecosystems, competing land-uses and global change call for a highly quantitative integrated assessment of ecosystem responses and the consequent changes in ecosystem services. ATEAM addresses the vulnerability of ecosystems and ecosystem services under such environmental change.”

(ATEAM Working Plan 2000, p.4)

Then follows a list of more specific objectives:

- The development of a “comprehensive modelling framework”,
- An application of this framework “for the analysis of European terrestrial ecosystems” and
- The inclusion of a “strong dialogue with stakeholders”.

Questions to be answered during the project are:

- “Which are the main regions or sectors that are vulnerable to global change?”
- “What are the potential side-effects of land-use change […] for ecosystem services, water supplies or biodiversity?”
- What are the available robust (i.e., have a low probability of failure) options to alleviate environmental change?”
- What will be the effectiveness of afforestation as a means of sequestering carbon under the terms of the UN-FCCC Kyoto Protocol, given that some degree of climate change is inevitable, which will affect the carbon balance of all forests?”

The interests identified before, as they relate to these objectives, can be discussed singularly.

The fact that the interest in funding has been satisfied finds expression in the mere existence of the ATEAM as a


This funding is conditional to the compliance with the goals of the work programme, which is secured through addressing the following parts of the programme:

- “Key action 2 Global Change, Climate, Biodiversity”
- “2.2 To foster better understanding of terrestrial (including freshwater) and marine ecosystems and their interactions”
- “2.2.1 Ecosystem vulnerability, in support of the Conventions on Climate Change, Desertification and Biodiversity”

13 Martine Vanderstraeten, Belgian Federal Office for Scientific, Technical and Cultural Affairs, at the ‘Bridging the GAP’-conference in Stockholm
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We can see that the relationship to the funding body shapes the formulation of the objectives (or what we referred to in Figure 3-8 as goals) of the research, the role of funding appears important, even dominant. The question of funding should anyways not be discussed in a vacuum space – it is certainly linked to other interests discussed above.

First of all, funding is given on the basis of – in this case – the 5th Framework Programme of the EC and social accountability of the research is a strong concern, which is expressed both in the Programme itself and in the objectives of the ATEAM.

Second, while our discussion before referred to climate change research and model-based understanding in general (see for example Figure 3-8), this project represents a specific kind of policy-science interaction, where the policy-side (the EC) is contracting the scientists (the ATEAM). The focus on creating “a more sound basis for assessing potential future development” (ATEAM Work Plan 2000, p.3) and thus, for decision-making, is immanent of this kind of interaction.

Although the scientists in the ATEAM are mostly involved in other projects and other types of research besides the ATEAM, the role they play in this project is that of advisory scientists! For advisory scientists the balance within the above-defined interest-space must be biased in favour of the interests of policy-makers, which can be seen as one possible expression of social accountability.

Even if the official agenda or frame is set, within the actual project procedures there is still potential space for the scientists to exercise further interests and for social accountability (as a principle or interest) to gain expression in more of its meanings than just policy support, especially through the stakeholder dialogue.

In the analysis of the workshop and in turning to the actual communication analysis, we will elaborate on this space for social accountability and stakeholder participation.

Let us now try to put the drivers for scientists behind research in perspective to stakeholders in order to see the whole space of interest!

3.2.3.2 Stakeholders and their interests in climate change research and communication

Before we go into the interests of stakeholders in climate impact assessment, we want to define the term stakeholder.

3.2.3.2.1 What is a stakeholder?

A very general definition is given by ENGI and GLICKEN (1995, p.1, cit. in: Glicken 2001, p.307): “A stakeholder is an individual or a group influenced by – and with an ability to significantly impact (either directly or indirectly) – the topical area of interest.”

As a stakeholder, individuals are rarely representing themselves as an individual person, but participate through a group of individuals with common goals. In that sense, the group (or organisation, institution, association) are considered as the stakeholder, usually represented by an individual person.

WELP (2000) gives a definition through four independent characteristics that constitute a stakeholder:

“A stakeholder can be defined broadly as one who: (a) is affected by or affects a particular problem or issue and/or (b) is responsible for problems or issues and/or (c) has perspectives or knowledge needed to develop good solutions or strategies, and/or (d) has the power and resources to block or implement solutions or strategies.”

We want to emphasize the independence of the characteristics in the second definition. While the first definition implies the power to have a significant influence in order to ‘gain’ the status of a stakeholder, the latter definition includes also those who are simply affected. In the latter sense, stakeholder participation is more open for a broader inclusion not only allowing for those in power but – the other way around – empowering and representing the whole of society.

To shed light on the relations of these definitions of participation to the research process, we can employ our conception of knowledge discussed above. Participation in the context of research as different from the traditional notion of participation related to political decisions means to equip citizens with the “argumentative ammunition” (Hajer 1995, p.62), the necessary knowledge to confront these political decisions under more equal terms (Bridging the Gap 2000, p.12).

The other point in WELP’s definition that also goes beyond the more traditional notion of participation and which also gains impetus from our understanding of knowledge as discussed above, is the potential
on sides of the stakeholders to provide input to improve and develop new ideas. This point is also expressed in the view of stakeholder dialogue as being a “two-way flow of knowledge and information” (Hisschemöller and Mol 2000).

These two points provide two very strong arguments in favour of broad stakeholder participation (or what CORTNER (2000, p.1) calls “meaningful public involvement”). Although we side with GLICKEN that “stakeholder is a relative term” and participation is so accordingly, being “specific to time, site and issue” (Glicker 2001, p.307), it is in the nature of environmental issues in general and climate impact assessment specifically, that the uncertainty, complexity, long time- and spatial scales (van den Hove 2000, p.458; Walker 2001, p.11) of the issue relate to a rather unspecific set of stakeholders.

We will see later in the analysis of the actual process (especially the workshops) that the view of participation that we have presented here is shared by ‘practitioners’ in the field of stakeholder communication and climate change.

3.2.3.2.2 The focus on the stakeholder ‘policy-makers’

In our study, the analytical focus is on policy-makers as stakeholders that play a somewhat intermediate role in the communication process in the European Climate Change arena. This approach is more built on the necessity (limited time and resources!) to focus on one group of stakeholders then on basis of a conceptually legitimised prioritisation of policy-makers before other stakeholders. We have argued earlier that broad participation is more adequate to i.a. the nature of the topic and the analysis of the communication process in general and of the workshop specifically will show that especially for closing the loop of knowledge from stakeholders back to science and for equitable empowerment the interactions with all stakeholders are essential.

Anyways, it can be argued that – as the ATEAM (the “scientific community” of this study) is operating on a European level, the interactions with policy-makers reflect the principle of subsidiarity, as the other stakeholders are less prominent actors on the international playground. Accordingly, the policy-makers are the relays-stations, which through their own channels interact with the other (mostly national) stakeholders as well as reflecting the stakeholders’ ideas and demands back to the ATEAM.

3.2.3.2.3 The interests of policy-makers

The interaction between policy-makers and citizens (stakeholders) is basically twofold: informative and regulative and – concerning climate change – the ‘success’ of these interactions depends on information.

![Figure 3-9: Policy-making and the role of climate change information](image-url)
In Figure 3-9 the flow of information and influence between actors/factors is expressed through black (darker) arrows and the links between ‘good’ communication and policy-goals are expressed in terms of causal loops as orange (lighter) arrows. The pluses on the arrows represent the positive feedback between two system elements, for example: The ‘better’ the communication → The ‘better’ the information disseminated → The ‘better’ the information → the higher the legitimacy → the higher the compliance → the better the policy-goals are achieved.

As the figure shows, there are two major inputs of information or (scientific) knowledge into decision making: Directly, it helps to define policy-goals, which are supported by regulation and information dissemination. Indirectly, first in that this information dissemination aims at increasing the legitimacy of the policy-goals, makes them more acceptable and thus, more likely to be successful (compliance); second in making regulations best reflect the available knowledge (make it ‘reasonable’) and so increasing the probability of compliance, too.

The diagram focuses on the flow of information, not on the participation. On the “Bridging the Gap” – Conference in Stockholm, Margot Wallström, the EU Environment Commissioner emphasized that: “As a policy-maker I can try to protect the environment [...] but it is up to you in the research community to make sure that I can do this in the best way possible” (Lothigius and Loughran 2001).

Kjell Larsson, the Swedish Minister for the Environment, pointed out that he “couldn’t envisage another policy area being more dependent on research than environmental policy (Lothigius and Loughran 2001). In the light of the traditional conception of science-policy interaction, the interest of policy is to employ science in order to make decision more rational (Brooks and Cooper 1987; in: Bäckstrand 2001, p.56), especially in areas “with high stakes or high ‘error costs’ (Bäckstrand 2001, p.58).


WYNNE and SHACKLEY (1996, p.275/276) point out that “many decision-makers” want scientific knowledge to build and strengthen consensus around environmental policy-issues and to reduce scientific uncertainty in order to reduce policy-uncertainty – social consensus as a necessary consequence of reduced technical uncertainty (Wynne 1994, p.175).

In their “Guide to the IPCC Approach” to “Climate Impact and Adaptation Assessment”, PARRY and CARTER (1998, p.3) state “Policy-makers require climate impact assessment to provide them with the necessary scientific information for policy decisions.”

The demand for knowledge or information can be channeled into different underlying interests:

- Generally, as a base for decision-making
- Help with problem-formulation
- Support for decisions already taken (“Legitimising already favoured policies”, Bäckstrand 2001, p.58)
- Support for specific actors in their own views
- Design and evaluation of alternative policies

How do these interest align with scientists’ interests that have been identified before?

3.2.4 Bringing together the analysis of the interests of science and policy – The common interest space

Figure 3-10 sketches the interest-space around model-based understanding of climate change. The interests directly linked to the object of scientific activity (the model-based understanding) are the motivations of the scientists to get involved in this type of research. They are in the left part of the diagram (green/lighter font).

If the role of stakeholders with regard to the knowledge generation were to be reflected, more links had to be shown, which would have decreased the readability of the diagram. Besides, these other aspects will be discussed later anyways.
The interests of non-scientists (in the right part of the diagram, black font) are linked to the object of research indirectly, via the scientists’ interests (which is pretty trivial as the non-scientists are simply not modelling climate change themselves!). Instead, they can demand the consideration of their interests through funding (which in most cases is conditional to the satisfaction of the interests of the funding body) or in postulating social accountability of the research (even though their interests might be considered, as scientists themselves see an urge to be socially accountable (Bäckstrand 2001, p.59)), i.e. to demand from science to produce useful, relevant information. Scientists, in order to be able to pursue their interests, will either seek to comply with the conditions of the funding agency (IF the funding is conditional) or they just operate according to their ‘other’ interests, which means compliance with the scientific codes of their (scientific) peer group, exploring their favourite field of science or securing social accountability (see chap. 3.2.3.1).

![Diagram of the interest-space of model-based Climate Change Research](image)

**Figure 3-10: The interest-space of model-based Climate Change Research**

The most realistic picture is a combination of all interests, the way of balancing and weighing depends on the scientists’ self-understanding, which is usually somewhere between the independent, epistemologically motivated researcher and the socially accountable problem solver. It also depends upon the chosen or designated role within the science-policy continuum.

Stakeholders’ (especially policy-makers’) call for research to inform policy-making is widely heard, although the concepts of how this should take place, depend very much on the views of the relevance of different kinds of knowledges (“the cultural/hermeneutic character of scientific knowledge”, non-expert knowledge (Wynne 1996, p.45/46)), the policy-science interface, the policy process and its content (Van Daalen et al. 1998, p.9; Welp 2000, p.43; Bäckstrand 2001, p.53 ff).

In the above section though, knowledge has been treated as something generated and delivered by experts to non-experts (or in our case more specifically, policy-makers). Developing our understanding of communication from this idea, the interaction is all about the results that have to be presented in an understandable way. Scientists use their perception of policy-needs to ensure the usefulness and applicability of their data. SHACKLEY et al. describe the influence of concerns of policy makers – in this case, for long-term scenarios – on the modellers’ decisions:

“[…] If it [influence of policy-makers' concerns on decisions of modellers] occurs, it does so through indirect influences more than via explicit policy-led demand. Such indirect avenues could operate via research funding agencies – especially when such
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agencies are also government departments – and through indirect pressure from scientists’ participation in policy-orientated scientific assessment organisations, especially the IPCC. To the extent that institutions like the IPCC and its deliberations constitute an important arena for negotiation of status, credibility, and influence, perceptions of policy needs are built seamlessly into scientific interactions. Internal and external audiences for scientific research become blurred.” (Shackley et al. 1999)

How can we constructively employ our understanding of the construction of knowledge and of the interests of scientists and policy-makers that we have developed so far, in order to step away from a dualistic one-flow mode (as described and criticised by Shackley et al. above) to an integrated, interactive and participatory communication model?

The first step will be to integrate the analyses of the interest spheres and actors in the context of our concept of knowledge developed above and science-policy relations. In the next step, we will employ experiences from our interviews, the workshop and literature-review to construct successful mechanisms of communication and interaction to an interactive and participatory mechanism.

3.2.5 Knowledge/power and a few relevant ideas about the science-policy interface

Our analysis so far has tried to show the importance of the intertwining of knowledge and power and the roles of scientists, policy-makers and their interests within the discourse(s). Knowledge as a form of power to ‘define truth’ (Hall 2001, p.77) and interests of science and policy-makers “as a struggle for discursive hegemony” trying to “secure support for their definition of reality” have been argued to be important factors governing the enterprise of science in general as well as climate impact assessment more specifically. Still, we do not want to over-emphasize – in line with Foucault’s understanding of the ‘subject’ – the role of the actors in science and policy as conscious, autonomous and stable entities that define the problems and the solutions and set the agenda. “[Subjects] are operating within the limits of the episteme, the discursive formation, the regime of truth, of a particular period and culture. [...] [They] must submit to its [the discourse’s] rules and conventions, to its dispositions of power/knowledge.” (Hall 2001, p.79)

Anyways it has been discussed earlier that the “positions of dominance” (Foucault 1980, p.119) that scientists and policy-makers hold, are decisive for the constitution of boundaries between their domains, which are “critical for the stabilisation of the prevailing forms of power” (Wynne 1996, p.75). Even if these boundaries are not clear-cut and we have been arguing against their continuity and dominance, we have to acknowledge that indeed not just theorists may define these boundaries (which is what we have criticised), but scientists and policy-makers may perceive policy and science as separate domains. It is the meaning that the actors attribute to this divide, which is part of the reality of science-policy interactions, too.15

We can summarise this point by our observation that the balance between the actual differences of positions of actors in relation to power within the discourse and the more or less active and conscious “role of actors in science and policy” to hold or define these positions is very delicate and discourse-specific.

It is beyond the scope of this study to deliver a complete conceptualisation of the science-policy space, to explore the competing interpretations of the science-policy interface and to develop a synthesized idea to most accurately frame the science-policy interaction on a meta-theoretical level. Without fully presenting the ideological, disciplinary framing, we simply employ ideas that we find useful to sketch the space within which we operate in developing our understanding of communication

15 This point is analogical to LAU’s and KELLER’s (2001, p.90) criticism of Latour and his ‘equalisation’ of nature and humans. They point out that ‘the meaning of the nature-human-differentiation for human actors” is part of the webbing (of nature and humans or nature and culture) that is necessary for its understanding.
While the traditional understanding in International Relation Studies and in Political Science define separate domains of facts (science) and values (policy) (Merritt and Jones 2000, p.83) and the exchange between them as objective and neutrally produced knowledge to make policies more rational, the “question of how scientific knowledge can shape interest, further interest, frame problems and empower actors is ignored” (Bäckstrand 2001, p.79).

To step away from the (realist-positivist) view of science and policy as two entirely separate entities, separated by a sharply defined border, a whole range of ideas have been formulated in order to more properly describe the science-policy relations in terms of a continuum of different domains of core science and applied science that are intertwined with policy in a “hybrid activity”, where “research agendas and policies are mutually constructed” (Bäckstrand 2001, p.77).

SHACKLEY ET AL. strengthen this view – they take the case of use of flux-adjustments in Global Climate Models (GCM) to emphasize their view of a deep intertwining of science and policy:

"[...] The scientifically do-able problem and the needs of policy may have been constructed together, and the validation of flux adjustments as a [scientific] technique cannot, we suggest, be divorced entirely from policy requirements. Use of flux adjustments therefore may imply an implicit model of policy, and of its knowledge-needs; likewise, policy may contain an implicit version of what is credible and good science in the climate change modelling domain (Shackley et al 1999, p.24)."

LATOUR (1995, p.14) describes the divide between science and policy (as a product of modernity) as purely ontological. A „zone of blending“ where hybrids exist parallels this ontological divide of the world. LATOUR questions not only this divide, he goes further: In his actor-network theory he offsets the polarity not only between the actors which are engaged in techno-scientific developments, he postulates the equivalence of human and non-human actors (‘actants‘): “The ozone hole is too social and narrative, to really be nature, the strategies of companies and heads of states depends too much on chemical reactions, to be reduced to power and interests alone, the discourse of the ecosphere is too real and social, to be completely absorbed in the effects of [its] meanings”. [...]. Nature and culture are treated as a seamless webbing” (Lau and Keller 2001, p.90).16

Without exploring his ideas further, we find Latour useful in giving a radical notion of the intertwining of nature/culture and science/policy as opposed to the atomistic and exclusive definitions presented by realist scholars. Still, we side with Lau and Keller in that Latour by completely giving up the concept of intentional behaviour, simplifies and thereby taints important differences, as for example different types of action and reasoning (Lau/Keller 2001, p.89/90).

A whole range of different role-specific actors can be identified between and within the different domains: trend-spotters, theory-builders, science communicators and policy analysts. Having their own agendas and tasks, their roles still overlap frequently (Hannigan 1995). WALKER ET AL. (2001) differentiate between managers, planners and researchers.

The different domains or spheres or actors are connected in a space of mutual dependence (see the interest space, Figure 3-10).

The ATEAM’s position in the continuum is closer to policy-makers, employing tools developed in a more core-scientific setting and evaluating and employing these for scientific advisory, not only to policy-makers but to the whole range of stakeholders in ecosystem services in Europe.

3.3 Integration of results from the conceptual analysis of communication between scientists and stakeholders

Our hypothesis is that the communication process can be a means of bridging the gap between science, policy and the public, the gap between different discourses when all interests and all types of

16 The source text in German: „Das Ozonloch ist zu sozial und zu narrativ, um wirklich Natur zu sein, die Strategien von Firmen und Staatschefs zu sehr angewiesen auf chemische Reaktionen, um allein auf Macht und Interessen reduziert werden zu können, der Diskurs der Ökosphäre zu real und zu sozial, um ganz in Bedeutungseffekte aufzugehen’. Natur und Kultur bilden demnach ein nahtloses Gewebe."
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knowledges are considered in the process of problem formulation and problem solution. It is the communication process that can bring together the societal actors and their knowledges to negotiate "reliable knowledge of nature" (Wynne 1996, p.77) and decision-making (Grove-White 1996, p.270) in an inter- or trans-discursive way.

While these conclusions are valid for science in general, the call for participation is even more urgent in environmental issues and climate impact assessment, where problems are characterised by their complexity, uncertainty, (Walker 2001, p.11; Zillessen 1998, p.49) large temporal and spatial scales and irreversibility" (van den Hove 2000, p.458).

4 Communication and Participation

4.1 From the analysis of knowledge and actors to the analysis of communication

As shown in the analysis above, the generation of knowledge is not limited to the science domain alone and for our communication process this implies an extension from a simple one-way flow of information from science to stakeholders to an early participation of stakeholders in the research process (Wynne 1994, p.74).

The concepts of stakeholder dialogue or participation have gained ground since the United Nations Conference on Environment and Development 1992 in Rio de Janeiro, where it was included in the Rio Declaration (UN, 1992a) and the Agenda 21 (UN, 1992b).

In the context of climate impact assessment, participatory integrated assessment has incorporated the idea of broad involvement of different actors (or stakeholders) to add meaningful information (COOL 2001, p.10) and to acknowledge the more substantive intellectual status of lay knowledges (Wynne 1994, p.74).

To summarise the discussion about the reasons for stakeholder participation, we can formulate three main rationales for broad participation:

- **Substantive:** To create a better, vaster knowledgebase for decision-making
- **Normative:** To realise the legally guaranteed right of participation and empower more people by including their interests in the negotiations about knowledge and decisions
- **Instrumental:** To build trust in knowledge and decision-making


The question we have to answer now is how to translate our findings about the importance of stakeholder participation into practice?

Discourse theory gives us the "story-line" around which we will organise our analysis of experiences with stakeholder participation so far (comparable cases taken from relevant literature) and with the ATEAM-workshop and the interviews conducted during this thesis.

4.2 Story-lines

"To be able to analyse this inter-discursive communication the argumentative approach puts forward the concepts story-line and discourse-coalition as middle-range concepts that can show how discursive orders are maintained or transformed. The political power of a text is not derived from its

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17 The concept of story-lines as presented here, is not identical with the one presented in the context of scenarios (in chapter 3.1.1 Computer-based modelling of climate change). The latter can rather be seen as an application of the more theoretical concept that is presented in this following part.
consistency alone but comes from its multi-interpretability. SCHÖN points at the widespread use of generative metaphors in politics to reproduce scientific findings in non-scientific discourse. They are considered to provide a common ground between different discourses, enabling actors to develop their own understanding of the problem (Schön in: Hajer 1995, p.62).

Story-lines are ways of integrating elements from different discourses in a “narrative on social reality” (Hajer ibid.) that – through symbolic power of expression – delivers a common base for understanding. The story-lines have the function to “facilitate the discursive complexity of the problem”, to combine knowledges and to position actors in relation to each other. “Analogies, historical references, clichés, appeals to collective fears or senses of guilt” and metaphors are the practices of discourse that meet under the umbrella of the story-line to form communicative networks.

Climate change can be seen as a story-line that, “as a causal story [...] gives meaning to previously singular and unrelated events” (Hajer 1995, p.64, on acid-rain), as changes in forest-productivity, agricultural practice and emissions from transport and heating. With the story-lines of climate change and global change, actors might be able to make sense out of unexplainable events, also being able to position themselves in relation to CO₂-emissions and climate change.

“The discourse [...] is thus empowering in the sense that it gives the fisherman and the forester a focus for protest and the argumentative ammunition to argue their case” (Hajer ibid. p.62).

Still, as shown in the chapter before, even in the process of participation, we have to regard the actors as being driven by specific interests, thereby limiting the potentials for cooperation (Ueberhorst, p.402).

4.3 A TEAM and the participation of stakeholders

In the A TEAM, stakeholder involvement is seen as an important part of the work plan (ATEAM work plan 2000, p.9).

In a report about a stakeholder-workshop at the Potsdam Institute for Climate impact assessment, it says:

“Science on Global Environmental Change has left the ivory tower and is increasingly evolving in a dialogue with policy-makers, citizens and other stakeholders (Jaeger 2000). Researchers must follow and take part in societal debates, in order to avoid the danger of losing touch with reality. But researchers can also give a scientific forum for a structured dialogue. This means organising and facilitating workshops and other events, which provide the opportunity to develop and exchange new ideas, which can be tested by interdisciplinary science at a later stage.

The Potsdam Institute for Climate Impact Research (PIK) intends to establish long-term relationships with various stakeholders, including private enterprises, government agencies and non-governmental organisations.” (Welp 2000, p.8)

The PIK is the leading institution in the A TEAM hierarchy and its ideas about the role of stakeholders can be regarded as important for the conceptualisation of the stakeholder-dialogue within the A TEAM-project.

In the A TEAM it is indeed through a series of workshops that stakeholder integration is intended to be achieved, as these workshops are seen to enable a “face-to-face dialogue between stakeholders and the project team.” (ATEAM work plan 2000, p.9) and the first workshop has been completed in the end of October 2001.

As the final focus of this study is the development of a participatory notion of communication that can be applied to the work of the A TEAM, we will concentrate on workshops as means of science-stakeholder interaction. Workshops are considered to be a very suitable tool to provide a forum for participation and that is why also in the comparison to similar or at least comparable projects about climate change and stakeholder dialogue we will focus on the workshops.

18 With the EC being the “funding agency” of the ATEAM, this can be seen in the context of the 5th Framework Programme of the European Commission and the EC’s earlier demands for participation (European Commission 1997, p.120 in van den Hove p.459).
As a second element of the communication process in the ATEAM, interviews will be conducted (and have been conducted during this study, although they were part of the preparatory work and this study, not of the ‘official’ interviews as part of the communication process).

Before we turn to the practical dimension of how to actually organise the interactions, we want to discuss the conditions for successful communication that will have to be considered in the organisation process.

4.4 Science-stakeholder interaction in the scientific literature

In the following part, we are evaluating the results of different processes of science-stakeholder interaction in environmental science and climate impact assessment to draw general conclusions for the communication between scientists and stakeholders. This evaluation will then be integrated with the experiences from the ATEAM-workshop to finally develop the participatory notion of communication.

As well as the ATEAM-project, the projects discussed below are all characterised by computer-based climate change research, using computer-modelling as analytical tool for the generation of the information that is then used as basis for the communication processes.

To pursue the aggregation of results from the different processes, in a systematic way, it will be divided into two parts:

1. Criteria for the information to be communicated or the topics to be discussed
2. Procedural aspects of the workshop

4.4.1 Criteria for the type of information employed in the communication process

JONES ET AL. (1999, p.3) identify four necessary conditions for the integration of scientific information and policy-making:

- Research results have to be: relevant, compatible, accessible
- Policy makers have to be receptive

In order to determine whether the conditions are fulfilled, criteria are formulated. The most important and relevant for our purpose are:

- Matching time-scales
- Uncertainty
- Compatibility to existing policy-making procedures
- Credibility

Matching time-scales of computer simulations with policy-planning horizons are critical to the relevance of the data. In the first workshop within the Delft-process19 for example (van Daalen et al. 1998, p.5), the policy-makers pointed out that the “consequences of various long-term emission profiles” which had been analysed by the modelling team, “did not adequately address their needs”, as they were more interested in “issues related to the necessity of short-term actions”.

Uncertainty is one of the most important “challenges to the authority of science” (Jones 2001, p.21; Shackley and Wynne 1996, p.275). In the UKCIP20 stakeholders were to be reluctant towards taking adaptation measures due to uncertainty about the climate impacts (UKCIP 2000, p. viii). Also in the DELFT process, questions of uncertainty and reliability concerning the model were raised (DELTFT 1998, p.14).

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19 The Delft process constituted a series of five workshops between 1995 and 1997, where the IMAGE 2 model was used in “support of international climate negotiations. The name stems from the major involvement of scientists from Delft University in the Netherlands (see: van Daalen 1998).
20 The UKCIP: United Kingdom Climate Impact Programme
JONES (2001, p.21 and 27) identifies uncertainty and stakeholders’ perception of uncertainties as one of the major difficulties in communicating risks under climate change. This uncertainty in climate change relates to (Tol 1999, p.221):

- Imperfect understanding of the mechanisms at work
- The stochastic nature of the system(s)
- Long lead-times of cause and effect

From her analysis of natural resource management, WALKER concludes the necessity to manage and communicate uncertainties and ignorance (which stem from the high systems’ complexities), “so that they become recognised inputs to the decision-making process” (Walker 2001, p.11). The same conclusions can be made for climate impact assessment.

**Compatibility to existing policy-making procedures** “Translating basic research into the terms that will be understood by policy makers requires resources and expertise. As a result, available information is more likely to be used, the less translation that is needed.” (Jones et al. 1999, p.4).

In the COOL process (COOL 2000), the authors emphasize 3 parameters to measure the usefulness of knowledge, where of 2 relate to the compatibility-criteria. The “strategic parameter” expresses the need for a “matching” definition of the research problem with the definition of the policy-problem. The “implementation parameter” refers to the potential influence of the research, i.e. whether the information relates to elements that could possibly be changed or influenced by policy. The third parameter relates to credibility.

**Credibility** is of major importance for science-stakeholder interactions ((Hajer 1995, p.59) and one building-block is the “scientific quality of the work” (i.e. validity, reliability) or the “epistemological parameter” (COOL 2000, p.17). In the Delfi-process, the recognition of the used computer-model (IMAGE 2) as “representing ‘best available knowledge’” de-emphasized the relevance of model reliability and uncertainty, and the conclusion was drawn that “the credibility of analysts/advisers and adequate communication may be more crucial to the policy-oriented use of model results than the qualities of the models themselves” (van Daalen 1998, p.15; see also: Greenberger 1976).

An analysis of the knowledge utilisation in the National dialogue shows that the many participants are receptive to use the information they are offered, only after they have had the possibility to express their own opinion and viewpoint (For an elaboration on the issue of knowledge utilisation is referred to Hisschemöller and Mol 2000, p.30).
Figure 4-1: The basic understanding of participation in climate change research

Figure 4-1 tries to summarise the most important relations between the factors, which characterise the role of participation in science. It establishes the most important causal links between different levels of our analysis to explain how they work together.

The arrows represent causal links, constructing causal loops between the system elements. The ‘plus’ at the inside of the arrowheads indicates a positive causal link: increasing A → increasing B (e.g. better research → higher credibility).

These criteria and conditions are very useful for scientists to understand their policy-counterparts in the communication process or to prepare for interviews.

After presenting the major conditions for the information or the content of the communication we want to turn to the practical side of how to realize the science-stakeholder interaction, i.e. the interviews and workshops.

4.4.2 Procedural aspects of the workshop

4.4.2.1 Criteria for selecting the relevant stakeholders

In a work about the planning of ecological risk assessment, GLICKEN comes up with a set of “Guidelines for stakeholder inclusion” (Glicken 2001, p.5).

1. Is the purpose of the solicitation of input from stakeholders clearly stated and communicated?
2. Are all the appropriate stakeholders identified and included?
3. Are the information elicitation tools used appropriate to the type of information requested?
4. Are the tools rigorously applied?
5. How are the resultant data analysed?
6. Is the entire process (including the methodology) documented?

This set of questions can be useful as a checklist for preparing workshops as well as interviews.

There are different ways to systematically approach the question of which stakeholders to include in the process:

In the COOL national process, stakeholders were divided into 4 sectors - Industry & Energy, Built Environment, Traffic & Transport and Agriculture & Nutrition – and then the stakeholders were
selected for each of the sectors, including representatives from different businesses, municipalities, Ministries and non-governmental organisations (NGOs) (Hisschemöller and Mol 2000, p.24/25).

The Delft-process was set up in a more concrete context, to provide scientific support for international climate negotiations (van Daalen et al. 1998, p.2) and even more specifically, of the “Ad-Hoc group on the Berlin Mandate (AGBM)” (ibid. p.3) which was involved in the preparations of the Kyoto protocol.

The criteria for stakeholder selection in an EC organized set of five workshops, also in the context of scientific inputs into the pre- and post-Kyoto periods (van den Hove 2000, p.468) were:

1. The awareness of Climate Change in the participants organization or institution
2. A personal focus on climate change policy issues in the person’s “professional capacity”

SHACKLEY (2000, p.47/48) defines the integration of different stakeholders in an integrated manner with the other process participants, as an “actor network”, including different knowledges, such as academic, bureaucratic, local/site-specific and political knowledge.

Although the general guidelines – as formulated above – could be recognized throughout the stakeholder processes, differences between them are obvious in the way of approaching the homogeneity versus heterogeneity – dichotomy.

The fact that “problem-solving requirements” for policy-makers have been met so successfully can be attributed to the more homogeneous and output-oriented character of one of the processes (as described by van den Hove 2000). In the COOL process, participants found the inclusion of “stakeholders who are not involved in the existing dominant science-policy network” being useful for the dialogue. (Hisschemöller and Mol 2000, p.31)

4.4.2.2 Evaluation and Monitoring of the workshop

Quality control is important for the success of the communication process, the more, as it is not easily quantifiable. The two categories of controlling the quality of the process and the documentation of the process and results (point 6 of the guidelines used above) are (Hisschemöller and Mol 2000, p.9):

1. Monitoring during the workshops and
2. A continuous evaluation of results.

These categories give also expression to the idea of applying the same rigour in the evaluation of the communication process as in “scientific data collection” (point 4 of the guidelines, Glicken 2000, p.310).

We are not going into detail with the procedural details of how this should be done during the workshops, but GLICKEN and HISCHEMÖLLER AND MOL give examples, including “formal project documents” as well as “videos, brochures, briefing packages, newspaper articles” (Glicken 2000, p.310).

In the COOL process, the evaluation-sources were (Hisschemöller and Mol 2000, p.22):

1. “The minutes of the project team meetings,”
2. The reports of the dialogue group meetings (both content and process reports),
3. The evaluation forms filled out by the participants after each meeting and
4. “The observations of the project team members during the group meetings”

The gain from these procedures is basically twofold: Firstly, it is easier to include new participants into the process, as they can be brought to the same level of understanding and locate themselves in the ongoing process.

The second more fundamental point has to do with the basic understanding of learning and this evidently includes the learning from the communication process (the workshops, the interviews) as well. This is best achieved by establishing continuity as a basis for science-stakeholder interactions.

The stakeholder dialogue is seen as a continuous process for two major reasons: First, to develop an atmosphere of trust between the participants (Hisschemöller et al. 2000; van den Hove 1999) and second, to establish a learning process that employs mechanisms of monitoring and evaluation to
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ensure permanent improvement. Figure 4-2 shows the basic understanding behind this learning-process (van Daalen 2000, p.28)

![Figure 4-2: The learning loop](image)

4.5 The actual stakeholder dialogue of the ATEAM

There are apparently different ways of approaching the stakeholder selection, but the general ideas about participation that have been discussed in the previous chapter should be reflected. Although the purpose of a specific project might be directed towards a specific target group (as was the case in the Delft-process), the general ideas developed above are compatible with the criteria and conditions that have been identified from this literature review.

These criteria do not include any automatism regarding the implementation of our broad, interactive and empowering concept of participation. Whether they can be used accordingly, we will try to answer in the last part, where we apply these criteria and ideas to our case of the ATEAM and the experiences from the ATEAM workshop and the interviews.

Our analysis of knowledge, power, of the interests of scientists and policy-makers and the characteristics of model-based understanding of climate change led us to the conclusion that communication and broad participation is important. Three major reasons were identified:

- To broaden the knowledge-base and improve understanding for climate impact assessment and to secure the usefulness and compatibility of research for society
- To reflect all interests, not just those of scientists and policy-makers
- To build legitimacy and trust in research as a basis for well-informed decision-making

As has been pointed out before, stakeholder-dialogue is considered very important in the ATEAM. But how dare the ATEAM’s reasons related to the generally identified reasons for the inclusion of stakeholders?

4.5.1 Stakeholder participation in the work plan of the ATEAM

The aim of the ATEAM is the assessment of European terrestrial ecosystems and their services depending on “broad-scale environmental changes” (ATEAM work plan 2000, p.6). Services are services to somebody, and the stakeholders for the ATEAM are defined as users and policy-makers depending on specific ecosystem-services.

The knowledge of the stakeholders is used in the first work-package to help define ecosystem vulnerabilities (problem definition) and in work-package five to help assess ecosystem vulnerabilities (interpretation of results). The involvement of stakeholders is regarded “indispensable” in representative and utilitarian definitions of vulnerabilities, underlining the ATEAM’s concern with a broad interest base.
Moreover, the project team wants to understand the requirements of stakeholders (ibid. p.9) in order to provide compatible information for the potential users.

The workshops are the tool for a successful stakeholder dialogue and two principles shall be combined: "collective learning and specific interests" on the search for "areas of mutual concern."

We can see that the goals of the ATEAM regarding their stakeholder dialogue are reflecting the major reasons for participatory science-stakeholder interactions that were derived from the analysis above. The focus thereby, seems to be on the exchange of knowledge, while the intermediate effect of providing legitimacy through pluralizing the knowledge base for decision-making is not of primary concern.

The next question inevitably is: How were these goals reflected in the actual process, i.e. the workshop and the interviews?

4.5.2 The ATEAM stakeholder-workshop

The most important objective of the stakeholder workshops is the identification and definition of “a workable set of indicators that link ecosystem response, ecosystem services and environmental change” (ibid. p.10).

The initiating workshop for the ATEAM stakeholder dialogue was conducted Monday and Tuesday, October 22 – October 23, 2001 in a Hotel outside the small town ‘L'isle sur la Sorgue’ in the South of France, 30 km East of the city of Avignon. Most members of the research team arrived earlier, as Sunday and Monday morning were dedicated to the preparation of the actual stakeholder workshop. On Wednesday, the first evaluation of the workshop by the members of the research team took place.

The following section will not be ‘a thorough empirical study’ to proof the findings of the conceptual and literature based work presented before. That was beyond the scope of this thesis. What we are trying in this part is to take the practical experiences and impressions as a level of application to see if the theoretical framework is applicable and how we can utilise it in a real stakeholder dialogue.

The workshop (as an expression of the ATEAM as such) was a pool of knowledge, represented by scientists and other experts who to a large extent have been involved in science, management and decision-making in all the different kinds of relevant fields for a long time. Experiences and knowledge could simply be “gathered” from the formal and also (or especially) the informal conversations (during dinners, breaks etc.). Even if this type of knowledge is not peer-reviewed and published in a well-recognised, scientific journal or presented in an official presentation in a conference, it constitutes a very valuable source of information.

In our discussion of how knowledge we pointed out how it is constructed and how different types of knowledge are available and relevant. In the workshop we found i.a. sources of non-conventional knowledge and we are here trying to incorporate it into our study!

4.5.2.1 Participants

The Scientists

The scientists were chosen first of all according to have representatives from all sectors to be able to communicate to the respective stakeholders. Moreover, scientists involved with the core computer model of the ATEAM, the LPJ- (Lund-Potsdam-Jena-) Model were present to provide for the expertise directly related to the vegetation modelling. Then, the Potsdam Institute for Climate Impact Assessment, as the institute leading the ATEAM and organising the workshop was also represented by the scientists responsible or in charge of the stakeholder dialogue. These scientists were also directly responsible for the organisation of this workshop, for monitoring and the in situ-realisation. The last group that could be defined separately consisted in PhD-students who had just joined the ATEAM. I was holding an observer-status.

The Stakeholders/experts

The invitation of stakeholders (or experts – the term used during the workshop) was done according to different sectors, involving “managers and decision-makers from the agricultural, forestry, energy, water, nature conservation, recreation and tourism sectors” (ATEAM 2001).
The following organisations and institutions were represented by one participant each (listed according to sectors):

**Forestry:**
Forest Owner Association, Spain  
Centre de la Proprietat Forestal, Spain  
Confederation of European Paper Industries

**Agriculture:**
Federation of European Land Owners, France

**Nature Conservation:**
Parc Naturel Regional du Luberon, France  
Royal Society for Protection of Birds, UK

**Energy**
The International Institute of Industrial Environmental Economics, IIIEE, Lund, Sweden

**Policy-advisors:**
Environmental Adviser to the Prime Minister, Portugal  
Umweltbundesamt, Germany

In the preparatory meeting, the first thing to do was to remind and/or refine the aim of the actual meeting with stakeholders. It were basically the ideas from the work plan that were put on the agenda:

**The general goals were:**
1. To start the dialogue
2. Identify expectation
3. Collect users' needs
4. Indicators required
5. Determine gaps in modelling and assessment approaches

**more specifically:**
1. Explain the ATEAM’s assessment framework (by sectors)
2. Identify indicators and the relevance for stakeholders’ decision-making process
3. Learn about the time scales and also the spatial scales for decision-making
4. Identification of vulnerable ecosystem-services
5. Can thresholds for the vulnerability of ecosystem-services be identified?
6. Suitable variables to be mapped/communicated
7. How to represent uncertainty
8. Who are other potential experts/stakeholders (incl. organisations)
9. What information is lacking?

**and above all,** to begin the establishment of good relations between scientists and stakeholders.

The dilemma *simplicity vs. complexity* was discussed: It was pointed out that the scientists in their presentations (and during the whole workshop) should avoid detailed, technical issues and too complex scientific issues. On the other hand the high level of the models applied should be pointed out in order to convince the stakeholders of the quality of the research.

One scientist for each sector did the presentation of the ATEAM’s assessment framework. Three of them were presented on the first day, in the afternoon and were followed by a summary of the day. The other two presentations were given on the second day, in the morning, followed by a plenary discussion. After lunch, the discussion was shifted to break-out groups (one group per sector), which lasted 1 ½ hours. Then one hour was reserved for reporting from the groups and further sectoral discussions, before all groups came together in a final 2 ½ hour plenary discussion.

In the preparatory meeting, as well as during the actual workshops, all the criteria that had been formulated above (see chapter 4.4) were referred to:
Credibility and trust building were proposed to be approached through acting as one unit (and avoiding controversies about technical details), convincing the stakeholders that the A TEAM is using the best available models (BAM!), and being clear about uncertainties and knowledge gaps (Transparency!). As especially decision-makers are very much used to deal with it, in that regard there should be no problem of understanding of the concepts of uncertainty.\textsuperscript{21}

Presenting the data to the stakeholders – compatibility, relevance, usefulness
The idea of story-lines was presented as a “narrative on social reality” (Hajer 1995, p.62), including i.a. historical references which use the symbolic power of e.g. an event to help finding to a “common base for understanding”. The integrative power of this concept is the opportunity for every actor (or stakeholder) to identify her or his own, personal associations to the ‘story’ (of e.g. climate change). Regarding the selection of years for the data presentation, one of the scientists suggested in order to make the data more meaningful to the stakeholders, the selection of special years would be helpful, years, that people remember or have associations with (e.g. the year 1976 as having been a very dry year in France that everyone remembers). This specific idea about choosing special years to make use of people’s associations was an eye-opener for the practicability and applicability of the concept of storylines and all related practices of discourse.
Concerning the format of the presentation, it was pointed out that people can relate to maps and to the use of colours, green for carbon sinks and red for sources. The appropriate level of detail was discussed.
The relevance issue was discussed in terms of whether the indicators chosen by the A TEAM (like e.g. agricultural productivity) were actually sufficient and the most relevant to stakeholders. To ensure the usefulness of the data, the representation of vulnerabilities (of the ecosystems and their aspects) have to be linked to the services and uses, as what might from a scientific point be defined as a function of a ecosystem is not necessarily perceived as a service to stakeholders! Increasing relevance is thus not only a task of adapting the data and the research but also pointing out and communication the relevance of the data by establishing and explaining the links to the stakeholders.
With regard to the indicators, they do not necessarily need modelling or include a modelling exercise; it is important to look at and identify the interests of different stakeholders and then adapt the indicators accordingly; the modelling itself cannot include all the linked areas of interest of the stakeholders, it is rather a question of compatibility of our data with their analyses/needs/actions/modelling!

The potential contribution of stakeholders
The aspect of mutual learning was emphasized during the whole workshop. Still, the discussions were very much focused on presenting data to the stakeholders. One idea to address the stakeholders’ part was to present a list (e.g. in each sectoral presentation) with what the scientists think, are potential contributions of stakeholders. ‘Reality checks’ were seen as one important point.
To actually deal with the stakeholder contributions, it was proposed to pick up stakeholders remarks and start from there to ask new questions, to find links to the European scale and to use their questions actively.
Considering the regional (European) scale of the ATEAM-data and the different scales the stakeholders are operating on (representing for example the German government (national scale) or forest owners in a region in Spain (local)), the transfer of knowledge between different scales is important, drawing conclusions and abstracting from their information.

\textsuperscript{21} This last argument in favour of communicating uncertainty was pointed out to me in the first coffee-break by one of the scientists involved in the Delft-process discussed above (see chapter 4.4)
The perspective of the individual stakeholder might differ totally from the European perspective; if – through geographic shifts – the optimum for wheat for example is shifting from France to Sweden – the European perspective is different from the French;

Further points of potential stakeholder contribution were proposed:

- Suggest further outputs and interpretations, for example:
  - Study species
  - Relevant explanatory variables
- Contribute to scenario development
- Contribute to a reality check (on model results)
- Suggest coping (adaptation) strategies
- Comment on the vulnerabilities
- Key indicators of vulnerability
- Specific concerns

4.5.3 The Interviews

Interviews were not originally mentioned in the work plan of the ATEAM, but they will be part of the stakeholder dialogue in the future of the project.

In the frame of this study, the interviews were conducted in order to find out about the effectiveness and role of this type of interaction for the communication of research results in Climate Change Modelling to policy-makers. In this sense, the interviews were regarded as a means of exchanging information. The collection of representative information, i.e. identifying the needs and interests of policy-makers generally and specifically for Sweden, as a purpose was limited again by the scope of this thesis. Due to limited resources (before all TIME) the number of interviews could not and was never intended to represent a statistically significant set of ‘samples’ (interviews). But as has been argued before in relation to the workshops, first of all the role of the interviews, as a methodology applied within this study is to provide for a level of application for the conceptual understanding developed in the study. Secondly, they are used as a source of non-scientific (in strictu senso, considering the statistical significance) expert knowledge.

The presentation of data during the interviews, which was intended before, was inhibited by delays in the availability of data, so that preliminary maps from the ATEAM could only be shown in one of the interviews. Thus, the role of interviews in presenting data to stakeholders (see chapter 4.4.1: data accessibility) was not analysed.

Four interviews were conducted, including eight decision-makers at four different ‘institutions’, representing different levels and roles in the decision-making process. They were all chosen with regard to climate change and impacts being part of or relevant to their professional work.

The representatives were asked for interviews according to their assumed roles in the policy-making process:

1. **Miljö Departmentet** (Swedish Ministry of the Environment): decision-making on a national scale
2. **Naturvardsverket** (SNV, Environmental Protection Agency): policy-advice at the national level; meditative role between scientists and policy-makers
3. **Länsstyrelsen Jönköping** (Jönköping Regional Planning Authority): regional decision-making; implementation of national policies
4. **Skogsstyrelsen** (National board of forestry): decision-making in the field of forestry

Before the interviews were actually conducted, a one-page document, stating the purpose and the rough outline of questions and topics, was sent to the interviewees (see appendix A). The main question was: “How can research results in Climate Change most effectively be communicated to policy-makers?”

The main topics were:

- The work of the interviewee and the institution and the role of science
In the following part, we will present short summaries of the most relevant insights from the single interviews and then draw some general conclusions. The summaries present the opinions and statements of the interviewees.

4.5.3.1 Interview No. 1

(at the Miljö Departmentet (Swedish Ministry of the Environment))

The work of the interviewee and the institution and the role of science
Science is very important as a driving force behind multilateral negotiations, laying the basis and providing the rationale. As an example, the impact of the IPCC and its 1995 reports in supporting the climate change negotiations i.a. in Kyoto was enormous.
The relevance of natural scientific research for decision-making regarding for example climate change mitigation, are indirect, as drivers for the social sciences. The scientific knowledge would be integrated into decisions through for example pricing-mechanisms for petrol and traffic.
An important role for the flow of scientific information plays the good cooperation with the Naturvardsverket (Environmental Protection Agency).

The role of climate change for the work of the interviewee and the institution
Environmental issues were promoted through influential persons and their role in Swedish policymaking, e.g. Ingvar Carlsson, who was in charge of the agricultural ministry (which included environmental issues) before he became president of Sweden.
Climate change plays a pronounced role in Swedish policy-making. During the Swedish EU presidency, climate change was one of the most important issues.

Experiences with climate change research and scientists
① The GEF leadership award was given to the interviewee ('policy-maker') and the then scientific advisor together, which underlines the close and successful cooperation
② A parliamentary commission on climate change published a report by the end of 2000 that is now part of the basis for decisions of the parliament.
③ Data presentations so far have been very efficient
④ GCMs are better than regional models
⑤ A good reputation is important for a scientific group and their data to be considered
⑥ The question of carbon sinks has proved difficult due to high uncertainties

Interest in and needs for information and data
① Natural sciences are needed to decrease uncertainty
② There is an increasing interest in the economics and its role for climate impact assessment
③ How could the social impacts of adaptation and mitigation be accommodated for?
④ The data need of the ministry is rather for social sciences; the ATEAM data is of higher relevance for the Svenska Energimyndigheten (STEM) and the SNV

4.5.3.2 Interview No. 2

(at the Naturvardsverket (SNV, Environmental Protection Agency))

The work of the interviewee and the institution and the role of science
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The SNV does not engage itself directly in any research at all! SNV is rather fulfilling the job of a moderator/mediator between policy and science.\textsuperscript{22}

"Bridging the gap"
The task of Mrs. Liliesköld in the SNV is coordinating research in climate change, i.a. to identify good research with policy-relevance.

She also is the Swedish focal point for the IPCC, which means:
- Technical reports for Sweden to the IPCC
- Nomination of experts
- Review of IPCC material

The role of climate change for the work of the interviewee and the institution

The SNV was running a programme on climate change in the 1990s. At the moment they have four programmes running, but they are not climate change related; they have a rather "social science orientation", but in the planning for the future for a Swedish national environmental programme, the UNFCCC\textsuperscript{23} is one aspect.

Experiences with climate change research and scientists

The following barriers to communication have been identified in the past:
- The policy side has already drawn its conclusions; they might not want to change their strategies
- Uncertainty

Scientific engagement in climate change research partly lacks the necessary extent of continuity, while for politics it seems difficult to 'get all things together', i.e. to integrate all available information.

Interests in and needs for information and data

The focus in climate change research should/will be with:
- Feedbacks to the climate system
- Full Carbon-budget
- Carbon-sinks
- Important is knowledge for the implementation of the Kyoto Protocol. The responsibilities of the SNV are with policies and implementation

What is lacking from the science community is the flow of information not only to the decision-makers but also to the public, e.g. through universities, establishing a closer link between the public and the scientific community.

4.5.3.3 Interview No. 3

(at Länsstyrelsen Jönköping (Jönköping Regional Planning Authority))

The work of the interviewee and the institution and the role of science

Work in the environmental field is defined by the 15 national goals\textsuperscript{24}!
- Most scientific information is received from the SNV.
- Own data requisition focuses on regional monitoring:
  - 15-20 own scientists
  - Research on traffic and heating as drivers for CC
  - Work on indicator-development
- Apart from the own scientists within länsstyrelsen, partly sub-contractors are employed

\textsuperscript{22} One recent example was the "Bridging the gap"-workshop held in Stockholm (9-11 May 2001) and organised by the SNV (URL: http://www.bridging.environ.se).

\textsuperscript{23} UNFCCC: United Nations Framework Convention on Climate Change

\textsuperscript{24} These national goals have been decided by the government on the basis of a proposal by the SNV
A lot of scientific information is taken from national databases.

The role of climate change for the work of the interviewee and the institution

- Most important for Jönköping is acidification.
- Biodiversity (due to small-scale farming, the Jönköping region has a relatively high biodiversity).
- CC is 1 of the 6 most important questions that have been formulated as guidelines for the work of länsstyrelsen.
- Research on traffic and heating and heating as drivers for climate change. One major goal is traffic reduction, as part of a national project. Data research takes place on a municipal, regional and national scale. The Statistisk Central Byrå (SCB) delivers reliable data on a regional scale but not applicable on the small (and for länsstyrelsen most relevant) scale.

Experiences with climate change research and scientists

Historically not much work on CC!

Interests in and needs for information and data

- Interest in natural background emissions from marshlands: CH₄
- Growing interest in what to do about climate mitigation and adaptation.

The dissemination of information on climate change to local authorities and the public is the main task of länsstyrelsen and schools will be a focal point in the future.

4.5.3.4 Interview No 4

(at Skogsstyrelsen (National board of forestry))

The work of the interviewee and the institution and the role of science

The work of the interviewee is focused on the provision of skogsstyrelsen and other authorities with data and knowledge about climate change.


Interactions with e.g. forest owners is rather regulative than informative.

The role of climate change for the work of the interviewee and the institution

~60% of her work is dedicated to CC AND forestry.

CC does not seem to increase the number of regulations; it might mean a release from regulations regarding the choice of species, as higher flexibility for forest owners in their response to climate change is considered to be favourable to strict and binding regulations, due to high uncertainties.

There is relatively high awareness of CC in the policy-arena, but acceptance of CC data problematic, also in the skogsstyrelsen.

Since the future ifmore uncertain, the awareness of risk will affect the valuation of forestland now!

Major uncertainty will remain; droughts might increase vulnerability.

Experiences with climate change research and scientists

The diffusion of knowledge often just takes time!!

Example of communication of scientific knowledge: a SWECLIM scientist was invited to skogsstyrelsen, to give a presentation on CC & very successful!

E-news are sent to the heads of the regional administrations (länsjagmästare): they have to be short and not too frequently; they include e.g. a short list of impacts until today, from the IPCC.

Interests in and needs for information and data

- Decreasing uncertainty: Major problem: survival of trees in the first years. With higher certainties in the projection of storm event frequencies, forest owners could/would select treespecies accordingly.
Research in comparing the impact of using forests as sinks vs. the production of bio fuel on the carbon balance
CO₂-tax

4.6 Integration of the results from the workshop and the interviews

How can we summarise the insights from the workshop and the interviews with regard to the overall goal of developing a participatory notion of communication? What did we learn by applying our criteria and conditions of good communication to the practice and what type of extra-knowledge have we gained?

Throughout the thesis, we have operated on different levels (organisation, translation, application) and in different dimensions (theory and practice) (compare Figure 5-1: The conceptual understanding of the thesis). The hypothesis has been developed and then been applied progressively through the levels and dimensions.

We have seen that the criteria are practicable, i.e. they can be translated and applied. The substantive or knowledge-related notion of participatory communication is dominant in our little case study of the ATEAM and of Swedish decision-makers:

The two-way flow or dialogue-character of the participation is emphasized in the work plan as well as in the actual workshop and the interviews: Evidently in the interviews, where the focus is on gathering information from the stakeholders (or in our interviews, from the policy-makers). In the workshops the importance of the non-scientists' knowledge for problem definition (identifying vulnerabilities of ecosystems, defining indicators) and for the interpretation of results (determining the usefulness and the gaps in the data so far) was pointed out. This knowledge gained from the stakeholders is supposed to help improve the work of the researchers with regard to relevance and compatibility of the data, e.g. with regard to spatial and temporal scales and data formats (especially in the workshop) and by learning about the existing policy-making procedures (especially in the interviews).

In this sense, the application combines two of our main notions of participation: The knowledge added by stakeholders is a means of including the interests of stakeholders (the normative or interest-related notion of participation).

The receptivity or willingness of the stakeholders to take part in the dialogue and to receive and use the information provided by the scientists, has not been broadly discussed in the workshop. The credibility issue was still addressed. We had pointed out earlier that the overall authority of the scientists (i.e. the credibility of the scientists, the trust in the (perceived) quality of the computer model) is crucial for the receptivity of the non-scientific actors. Uncertainties were identified as barriers.

During the workshops it was pointed out that (considering competition with other research groups) the quality of the computer models (developed and used by ATEAM scientists), representing best available knowledge, has to be communicated.

Transparency (regarding uncertainty and knowledge gaps in the research) was also proposed during the workshop as a good way to create trust and credibility.

The question of accessibility was expressed in the discussion of procedural aspects, as the access to the data is most effectively achieved during the workshops. A few ideas were developed of how the data can be presented in a most accessible (understandable) way.

The presentation of data during the interviews was inhibited by delays in the availability of data, so that preliminary maps from the ATEAM could only be shown in one of the interviews.

With regard to the procedural aspects, a lack of consideration in the ATEAM's planning and realisation process of the stakeholder dialogue was evident.
The parts of the guidelines for stakeholder inclusion (Glicken 2000) that were related to the scientific monitoring during the workshops and the evaluation afterwards had no prominent status at all. While the monitoring was only covered by protocols written by two of the scientists during the discussions, the evaluation was limited to the scientists. Although all participants that were still present in the final session were asked for their opinion, there was no systematic collection of stakeholders' responses and their evaluation of the workshop (through e.g. questionnaires), as proposed in other stakeholder interactions (Hisschemöller et al. 2000, p.10, Glicken 2000, p.310).

This discussion has shown the links between the different levels of analysis down to the application in the practical dimension. The participatory notion of communication has been treated in the practical and the theoretical dimension. Criteria and conditions have been identified, its potential for translation has been proven both in relating the criteria/conditions to specific issues and to the ATEAM work plan and finally, on the application-level the practicability of the higher, conceptual levels was shown.

Knowledge generation from the more practical interactions was the other main point in the practical dimension. So what did we learn from this process?
The function of the interview process – apart from exploring upon the applicability of the conceptual framework – was to use the interviews as a source of non-conventional knowledge. Different from the workshop, the interviews were primarily regarded as a means of exchanging information.
The conclusions were related to the four main topics.
- The work of the interviewee and the institution and the role of science
- The role of climate change for the work of the interviewee and the institution
- Experiences with climate change research and scientists
- Interest in and needs for information and data
While the detailed results of the analysis have been given before, in this part we want to extract the points of major relevance for the objective of the study.

Science has been shown to be very relevant for decision-making about climate change on different levels. The role of scientific research in decreasing uncertainty for example has been addressed.
Climate change is considered – throughout the different policy-levels – as an important issue, but the focus has shifted from the understanding of the mechanisms of climate change to climate change mitigation and adaptation.
While climate change is now widely accepted by different decision-makers, the focus is on the social and economic aspects related to its consequences. In this sense, the data delivered by the ATEAM will be of minor relevance for Swedish policy makers.

5 Conclusions
We started out to explore the communication process between policy makers and scientists. And we soon found out that the inclusion of policy-makers is just one of the pieces in the whole communication-puzzle.
The first part of the thesis was dedicated to the development of a thorough understanding of the knowledge as a basis for communication between scientists and stakeholders. The understanding of the interests of the actors involved was developed accordingly.
From this analysis, we constructed our understanding of communication as a means of participation.
The main rationales for broad participation were:
- To create a better, vaster knowledgebase for decision-making
- To realise the legally guaranteed right of participation and empower more people by including their interests in the negotiations about knowledge and decisions
- To build trust in knowledge and decision-making
The analysis was developed further from this understanding. After the theoretical foundation was developed, the further interest of this thesis was to explore the idea of participatory communication on
all relevant levels. Figure 5-1 presents the conceptual understanding of the thesis and shows how the work was structured and the parts of the analysis are logically linked.

We have shown successfully that the ideas of participatory communication that have been developed in this thesis, can be applied to the field of science-stakeholder communication in climate impact assessment – on all relevant levels and dimensions of abstraction.

A review of relevant studies about stakeholder participation in the field of climate change was our starting point for the following analysis.

On the most abstract level, we have organised the rationales of participatory communication according to the notion of knowledge and information (representing theory) on one side and the actual procedures (representing the dimension of practice) on the other. The criteria and conditions for successful participatory communication developed were then translated into more specific issues and analysed as part of the ATEAM work plan.

Finally, the analyses of workshop and interviews completed the analysis of the hypothesis and proved its applicability and relevance.

The following major conclusions can be made:

① Communication can only be regarded in the context of knowledge and power; interests of different actors are decisive in defining the problems and the scientific solutions. If interest is so essential, the inclusion of ‘all’ interests in society has to be realised, for the sake of (democratically motivated) representative and utilitarian interpretation of scientific endeavour.

② The representation of ‘all’ interests and the increased transparency and credibility of science through participation creates a higher degree of legitimacy for research and decision-making.

③ Communication is a two-way process; while participation has traditionally been defined as the process of communicating scientific research to stakeholders (speaking truth (science) to power (policy)), non-scientific, non-conventional knowledge has been found to make science and research relevant, compatible and thus empowering for stakeholders as representatives of society.

④ Forms of interaction like interviews and workshops were shown to have the potential to facilitate this input.

That is why communication between scientists and stakeholders has to be participatory.

⑤ The two-way process of learning can also be interpreted in terms of mutual trust-building. While the workshop was seen as a means of building stakeholders’ trust in science, it could be observed that the workshop also helped the trust-building of scientists in the stakeholder dialogue.

The interviews with Swedish policy makers have made clear that effective communication is also an issue of addressing the right people. The diversity of different actors in the Swedish field of climate change, on a national and intra-institutional level, creates a need for very specific interaction.
The Participatory Notion of Communication

A. Substantive: Knowledge
B. Normative: Representation of interests
C. Instrumental: Legitimacy

Practice

Level of Organisation

Knowledge- and information

I. Relevance
II. Compatibility
III. Accessibility
IV. Receptivity

Procedures:

a. The purpose of stakeholder inclusion
b. The selection of stakeholders
c. Continuity
d. Monitoring and Evaluation

Level of Translation

Specifying I-IV – the main issues:

1. Credibility and Trust
2. Uncertainty
3. Matching scales
4. Matching procedures

The ATEAM-Workplan:
Participation of stakeholders for

1. Problem definition
2. Reflecting interests
3. Interpret results

Level of Application

Workshop realisation
Interview-Realisation

Conclusion

Integration of Organisation, Translation and Application

The Participatory Notion of Communication

Integration of Theory and Practice

Figure 5-1: The conceptual understanding of the thesis
Climate Change and the Communication between scientists and stakeholders

Bibliography


**Appendix**

**A. The pre-interview information** (stating the purpose and the rough outline of questions and topics)

The questions will be grouped around my research question:

*How can research results in Climate Change Modelling most effectively be communicated to policy-makers?*

From the interviews we want to learn about:

**The actual policy-making process:**
- What is your / your agency's / institution's etc. role in climate change (CC) policy-making?
- Does climate change play a prominent role in your policies?
- How much of an impact does the input from CC research actually have on the policy- and decision-making (considering e.g. uncertainty)?

**Experiences with CC research:**

1. Data and Research:
   - What type of data have you used before and what have you used it for?
   - In how far is the data we can deliver (maps of Net Primary Productivity and Carbon Balances) relevant to your work?
   - What data are you interested in (type (net primary productivity, C-balance), format of presentation (maps, time series, tables), temporal/spatial resolution)?

2. Communication:
   - Could you give examples for ways of communication that you feel have been successful?
   - What would be the perfect situation of communication?

**General Discussion**
- What role do uncertainty and risk play in your usage and perception of CC data?
- How do you see the relative weight/importance of science vs. policy in CC decision-making?