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Synopsis of system approaches to environmental research – German contribution to ecosystem management

by

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SUMMARY

Background and target objectives

In order to enable the conceivement and enforcement of efficient measures for environmental precaution and protection, it is necessary to undertake an environmental systems analysis. Against the background of this assumption, a concept for a federal ecosystem research program has been initiated by the Federal Ministry of the Interior in 1978. Cooperating on this project was the Federal Ministry of Research and Agriculture. On this basis, ecosystem research projects have been implemented by the Federal Ministry of Education and Research and the Federal Environmental Ministry, in Berchtesgaden, Munich, Bayreuth, Göttingen and Kiel. The latest joint project of the Federal Environmental Ministry - the Ecosystem Research Project on the Wadden Sea - has been promoted in cooperation with the States of Schleswig-Holstein and Lower Saxony and with the Federal Ministry for Education and Research. The project has been completed in 1999.

The completion of these research projects brought up the following questions:

- Which contribution did the German ecosystem research make to the international discussion on a systems oriented environmental management?
- In which areas did politics, planning and consultancy profit from the methods and results of ecosystem research and what are the reasons for the current insufficient use of their potentials?
- Which recommendations can be derived from these experiences for the conceptional, organizational and methodological alignment of potential future research projects?

The research and development project “Synopsis of Approaches to Environmental Research – German Contribution to Ecosystem Management“, which has been commissioned by the German Federal Environmental Agency in 2001, was aimed at a clarification of these question. The project has been implemented in cooperation of Bosch & Partner and the Ecology-Centre in Kiel. It has been completed in March 2003.

What is ecosystem research?

In the following, ecosystem research projects are understood as projects, that comprise an integrated examination of biotic and abiotic ecosystem components as well as a combination of examinations on different environmental media, that consider water and element flows as well as energy transformations and that use empiric methods. Moreover, an important characteristic of ecosystem research projects is, that several working groups cooperate within an interdisciplinary working schedule and that they subsume the partial results under a project synthesis.

Methods

Informations on the worldwide conducted ecosystem research projects and on the incorporation of their results into environmental politics and environmental management stem from the following sources:

- **Questionnaire**

Within the frame of the R+D project, a questionnaire has been carried out in the beginning of 2002.

The questionnaire, which is subdivided in three parts, has been sent away by e-mail to 190 German and international experts between February and April 2002. Addressed were: known experts in ecosystem research (among others project supervisors from the world wide inquired ecosystem projects have been contacted);professors and university employees that are responsible for teaching and education and have insight into ecosystem research; representatives from environmental politics, administration – or planning (f.i. from planning offices or the environmental administration or from public authorities and institutions in the area of environmental observation and environmental reporting)

The questionnaires, which have been filled in by 35 interviewees, have been analysed against the background of the project‘s central problem

- **Research on the internet and of research literature**

Broad research on the internet and of research literature has been conducted with the aim, to gain an overview on completed and ongoing ecosystem research projects. The information on the researched projects has been systematized with the use of a database. Currently, the database offers information on 275 projects, the respective research institutions, the projects' finances, their duration, their conceptional and methodological focal points, the location of the researched areas as well as details on the contact persons, publications and addresses on the internet. It is principally open for further information.

- **Workshop**

From October 22-24 2002, an international workshop has been organized, that took place at the Cultural Center Salzau, nearby Kiel. At the workshop, about 60 experts from research, planning and administration debated about the results and the perspectives of ecosystem research. Besides participants from Germany, even representatives from Italy, the Netherlands, Denmark, USA, Canada, Lithuania and Russia have taken part in the workshop. The workshop was structured in plenum sessions with key-note lectures and four working groups, that focused on “Conceptional, Methodological and Strategic Experiences and Problems within Ecosystem Research“, “Ecosystem Research and Ecosystem Management – Guidelines for an Integrative Environmental Practice“, “Experiences and Problems from Politics and Planning“ as well as on “The Future Ecosystem Research“. The discussions were supported by a theory paper and have been summarized in reports.

Results

Due to ecosystem research, the knowledge about the ecology of systems, populations and organisms has increased. In a lot of areas, ecosystem use has fundamentally changed with the increase in knowledge and awareness. Ecosystem research produced and proliferated knowledge on the economic and social consequences of changes within ecosystems. Even if many productive impulses have emanated from ecosystem research to the science system and the environmental practice in the past, in many cases the results are indirect and hard to

quantify. In many areas there are still very strong efforts to put into the transformation of ecosystem results into practice, and great potentials are still awaiting a concrete implementation.

- **Impulses from ecosystem research to the science system**

Ecosystem research has made a major contribution to the stimulation of networked thinking and acting, it has promoted interdisciplinary ways of thinking and, thus, has had a strong impact on the science system. The consideration of the „human" aspect, and, thus, a broadening of the object of investigation, came along with the ecosystem research. The characteristic combination of measurements and model construction as well as the scientific and practical expert knowledge and the cooperation of different faculties have changed research practices in general.

- **Impulses from ecosystem research to environmental politics**

With regard to environmental politics and environmental management, ecosystem research has promoted a more integrative view and treatment of environmental problems. The increased awareness of the complexity and interactivities of ecosystems has had the effect, that no longer narrow solutions stand in the focus of debates. Due to the knowledge from ecosystem research, environmental development nowadays is understood as a dynamic process, that hardly can be controlled by the determination of „hard" goals and by the implementation of single measures. But the influence of ecosystem research on environmental politics can only be proven by a few concrete examples. The influence is rather implicit, theoretical and indirect, and it leads to „collective" effects as f.i. the increasing acceptance of the idea of sustainability and a growing readiness for the consideration of possible consequences following environmental use. The potentials of ecosystem research for concrete changes in the actions of politics and administration, has not yet been fully tapped.

- **Significance of ecosystem research for environmental planning**

Following the debate of the models for sustainable development and the stronger orientation of environmental planning on this model, the ecosystem way of thinking has become more important for environmental planning. Central conceptional demands, that are connected with the idea of sustainability, can only be met by using ecosystem approaches. Examples are f.i. the development of target concepts respectively environmental quality goals or the determination of ecosystems' carrying capacities. Planning has also profited from the methodological instruments and technical aids for the description and evaluation of ecosystems and for a prognosis of changes, which have been developed by ecosystem research. The area-wide introduction of Geographical Informationsystems within planning and their competent use can be assigned to the successful advancement and application of these instruments by ecosystem research.

In spite of the positive examples for the transformation of research results into environmental planning, the interface research-planning still needs to be developed. The demands set by the Law on Environmental Assessment and the EU guideline on strategic environmental assessment, that refer to the solution of planning problems on the basis of ecosystem approaches, have not yet been realized in a satisfactory.

- **Contribution of ecosystem research to environmental observation/environmental monitoring and the derivation of indicators**

The important result from ecosystem research, that the environment as a complex system can only be understood by using interdisciplinary approaches, has directly led to the demand for an integrated sector spanning environmental observation. Environmental observation, as it exists now, is focused on single problems and sectors, which leads to the fact that the demand for effect statements and trend prognoses cannot be fulfilled. Reasonable interactions between environmental observation and ecosystem research are especially seen in the conceptional, methodological and technical input, that ecosystem research gives for the development of observation programs and measuring networks, as well as for the evaluation of observation results. On the other hand, environmental observation can only be used for a long-term testing of the models and theories from ecosystem research and for a determination of the need for research.

There are a lot of examples for the transformation of research projects into the every day practice of environmental observation. One of the most known examples is the Forest Ecosystem Research, f.i. within the frame of the ICP, that led to the Forest Monitoring (Level I and II). Still, even in this area, many possibilities for interaction remain open. The causes can be ascribed to financial, organizational, technical and methodological problems, but another reason is, that environmental observation is regarded as an uninteresting field of work by many researchers. A consequence is, that there is a lack of creative ideas for environmental observation. Within the routine business of environmental observation, sometimes the understanding and the readiness for an acceptance of the results from ecosystem research as well as for the formulation of demands to research, is missing.

- **Contribution of ecosystem research to the indicator discussion**

Especially since the Rio Conference in 1992, methods and approaches are attempted to be found, that are able to describe the environmental situation and their changes due to quantitiy and quality and in order to control the fulfillment of environmental and developmental goals. Chapter 40 of the Agenda 21, which has been signed by representatives from the community of states at the Conference in Rio de Janeiro, demands the development and the application of measurement sizes and evaluation criteria, with which national and international developmental processes are to be examined, following the question, if they account for the goal of sustainable development. At the latest since such catalogues of measurement sizes have been started to be worked at by the OECD in 1993, the term „indicator“ is mentioned in this connection.

The determination of reasonable indicators for political consulting and public relations is – especially with regard to the multiple and sometimes contradictory demands to indicators – the result of a selection process, for which also normative criteria are important. Therefore, contribution of ecosystem research for the development of indicator systems cannot be exactly determined. This applies for indicators, that are based on a very high data, respectively indicator aggregation. Key indicators or headline indicators and aggregated indicators are some of these indicators, because for their selection, professional aspects play a major role (knowledge on the special significance of certain measures within the ecosystem as well as the correctness and traceability of aggregation).

- **Impulses from ecosystem research for environmental education and public relations**

The importance of system oriented ecosystem research on the level of ecological systems and ecosystem complexes will not be acknowledged by the public and by political decision makers. Thus, the strengthening of its societal and political acceptance and relevance for all target groups by using a preferably clear presentation and by keeping the information constantly flowing, has to be a main interest of ecosystem research. Apart from this, ecosystem research is a suitable field for the learning and training of system oriented thinking, i.e. the consideration of coherences, interactions and feedback-loops, as ecosystem research and its understanding principally crave the combination of very different talent and knowledge.

In the past, there have been cases, where the combination of ecosystem research, environmental education and public relation has not been accomplished. One reason for this has been the lack of personnel and financial resources for qualified educational and public related work, as these resources have not explicitly been considered in the project proposal, respectively in the research program. In a lot of cases, education and public relations were restricted to single, regionally limited activities, while long-term oriented educational and information strategies have not been developed.

- **Impulses for "ecosystem management"**

Ecosystem research has made major contributions to the development and specification of concepts and guidelines of "ecosystem management". The "ecosystem approach" of the Convention on Biodiversity f.i. has been largely influenced by the results from ecosystem research. This does also apply for the idea of "ecosystem health" and the guideline "ecological integrity".

Recommendations

For a forward-looking continuation of ecosystem research – even with concern to the financial provision - it will be necessary to develop attractive structural and conceptional perspectives for ecosystem research. Within the questionnaire and within the scope of the workshop, structural and conceptional perspectives for ecosystem research have been debated.

Basically, both researchers and users want a closer, interactive communication. Research activities should much more integrate the empiric knowledge from the users of landscape. This does imply a stronger orientation of ecosystem research on application-oriented issues, but it does not at all reject fundamental research. Only if it is possible to continue working on basic issues without being pressured to consider the direct possibilities for application, theoretical, so far unsolved problems can be worked at, that could open up important perspectives for application in the remote future.

As concerns recommendations for methods, especially methods and techniques for the transformation of research results to regions, that are not yet investigated much, are desired. Also the prognoses from ecosystem research could be improved by methodological advancement.

The most desired conceptional ideas are (on the part of the experts) the investigation of the significance of (genetic) biodiversity for the long-term functioning of ecosystems as well as

an increase of knowledge on the generation and prediction of catastrophes and on global changes of ecosystems with the respective consequences. With regard to a stronger connection between ecological research and social sciences, ecosystem research should dwell on the problems as the value of material ecosystem goods (as drinking water from pure ground water) or ecosystem services (f.i. flood protection) to society, or the ecosystem relevance of politics and programs.

So far, ecosystem research has set a main focus on ecosystems of the temperate zone, for which ecosystem types a lot of surveys are existing. But there are still large deficits with concern to research and knowledge on ecosystems in development or newly industrializing countries, especially in the tropics and the subtropics. In these regions, there is a blatant disproportion between the knowledge about ecosystems and the serious problems that come about with the changes in land use. Besides a regional enhancement of ecosystem research to these climate zones, the experts recommend a regional, rather than a conceptional intensification of research.

Ideas for the improvement of structure and organization within ecosystem research are especially directed towards the creation of suitable conditions for a strengthening of interdisciplinarity and for a more effective knowledge transfer from ecosystem research to practical application.

The future of ecosystem research is closely linked with the provision of financial resources. In this context it will be decisive, if ecosystem research succeeds in diversifying their financing (FBE 2002). On the part of research, a more stringent orientation on application as well as an increased endeavoring for the production of applicable results, that react to demands on the part of planning, environmental observation, politics etc, could be the key component for the opening up of new financing sources. Furthermore, it is recommended, to stimulate an intensified communication between basic and application-oriented research, in order to profit from the positive interactions. A precondition for this would be a more intense cooperation of promoting institutions, as f.i. the German Research Association, the Federal Environmental Agency or the German Federal Institute for Hydrology.

The provision with new financial resources for ecosystem research could, according to the expert's judgement, also be supported by a consequent and transparent evaluation of the ecosystem research practice. Conceptional ideas for such a measure are already existing.