

Current Research Issues in German Biodiversity Research on aspects of the *Sustainable Use of Biodiversity*

National Review Germany
For the SSA BioSTRAT



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A Introduction

A.1 Focus

Due to the high number of research institutions and activities in Germany in the field of biodiversity and landscape related research it is almost impossible to give a complete overview of German research in such a broad field. Moreover, research in this area is carried out by different types of institutions: Besides numerous institutes and departments of universities, applied universities, and larger research centres, there are also significant contributions coming from institutes affiliated with ministries and administration at the national as well as the level of federal states. Their research is concentrated towards direct policy issues and often is less accessible due to its publication in the grey literature and in numerous small German journals.

A.2 Selection criteria of publications and main topics for the review

To carry out this study, two main steps were taken

- 1) a call for contributions was sent around via email inviting the research community to send in information on ongoing and completed research projects in the main areas of the reviews
- 2) an in-depth literature review was carried out, using
 - national databases and websites of major institutions,
 - The search engine "google scholar"
 - The Web of Science and SCOPUS for English, peer-reviewed papers with a German perspective

The retrieved information was compiled in a database of papers and other references and the database entries were analysed according to their relevance to the topics of the review. The review that follows below focuses on major research projects carried out in Germany or of relevance to Germany. The complete database is available on the Biostrat-website.

A.3 Reference to COM (2006) 216

The structure of this report follows the structure developed for all national reports (see B.1):

- Identifying high value farmland (and forest) areas (Action A 2.1.3)
- Influence of national plans of CAP implementation on biodiversity, including aspects of cross-compliance (Action A 2.1.4)
- Develop indicators and monitoring schemes

Additionally, we summarize the work in two different important fields of research:

- Research on effects of land use practices and landscape structures on populations of species and community assemblages (see B.2)
- Fragmentation (see B.3.)

Both fields are highly relevant in the densely populated landscape in Germany.

B Main results of the selected studies

B.1 Specific topics of COM 216

B.1.1 Identifying High Nature Value farmland (and forest) areas (Action A 2.1.3)

A huge amount of German literature exists on biodiversity conservation or management of specific High Nature Value farmland or forest areas in Germany, especially the management of grassland (e.g. see references in Mühlenberg & Slowik, 1997). From 1992-2004 the German Ministry of Education and Science funded a larger research program on the Management of Open Cultural Landscapes. In particular the second phase focused on concepts how to keep landscapes open by means of large scale pasturing systems and/or enforcement of natural dynamics to preserve specific conservation values. (for some reports of the project (in German), see http://pt-uf.pt-dlr.de/277_221_DEU_HTML.htm) Despite this, we are currently not aware of major research projects specifically addressing the identification, distribution, and status assessment of High Nature Value farmland (and forest) areas, except of one conceptual study on the high value farmland concept in two federal states (Lutze et al. 2006). Notwithstanding, in all German states selective habitat mapping programs existed and/or are still running. These programs include the identification of High Nature Value areas in agricultural landscapes and in forested areas.

B.1.2 Influence of national plans of CAP implementation on biodiversity, including aspects of cross-compliance (Action A 2.1.4)

In two recent reviews, the current status and potential future pathways of agri-environmental schemes and other measures were analysed by German scientists (Hampicke 2006, Lehmann et al. 2005). Hampicke (2006) showed for Europe as a whole that current payments for agri-environmental measures are rarely related to their environmental effects but mainly are used to continue established activities. Therefore, economic incentive instruments need to incorporate much more explicitly monitoring of their effects (see Young et al. 2003). It is also essential that in the development of such measures, regional and local aspects are considered, including a suitable institution building.

Several projects developed economic incentive instruments that can support cross-compliance in the implementation of CAP. Richter et al. (2005) developed an approach for auctioning ecological goods among farmers within agri-environmental schemes (see also Holm-Müller 2003; Holm-Müller & Hilden 2004). Within the EU-project AEMBAC, Bastian and colleagues included this concept into a methodological framework for the implementation of agri-environmental policies in Germany (Bastian et al. 2003, Bastian & Lütz 2004, Lütz et al. 2006). This framework includes measures on acceptance and monitoring of the effects of these schemes (Lütz et al. 2006).

Examples of successful result-oriented payment schemes for High Nature Value grassland areas in Germany are given by Oppermann (2003), and Oppermann et al. (2005). In general, the federal structure of Germany has led to a high diversity of agri-environmental measures in Germany on the Länder-level and thus cross-national comparisons are difficult. Marggraf (2003) presented a framework to approach this problem from an ecological as well as an economic perspective. Freese & Steinmann (2005) and Eggers et al. (2006) analyse the role of local action groups and regional administration in this context.

Research on the cost-effective design of agri-environmental payments for measures to conserve endangered species has been done by Johst et al. (2002). They developed an ecological-economic modelling procedure to design cost-effective payment schemes for the conservation of the white stork (*Ciconia ciconia*). Drechsler et al. (2005) apply the scheme to the conservation of the large blue butterfly (*Maculinea teleius*) and develop a decision support tool for cost-effective Maculinea-management, which can be downloaded (<http://www.macman.ufz.de>). As part of the European MULTAGRI project, Lehmann et al. (2005) provided an overview of policies to support multifunctionality of landscapes in Germany with relation to the different governance levels (EU, national, Länder, regional, and local level). The review intensively reviewed the relevant German literature and discusses new market approaches and new institutional arrangements that are currently tested in Germany by different projects. They evaluated several main debates in this field: the allocation of property rights and incentive based policies, the appropriate degree of centralisation and decentralisation, policy and scheme design, acceptance and demands of policy, monitoring, and enforcement. The review is available online (http://www.ufz.de/data/Disk_Papiere_2005-122648.pdf).

Tscharntke et al. (2005) reviewed the relationship between different management regimes in agricultural landscapes and agri-environmental schemes in terms of their effects on biodiversity and ecosystem services.

Two on-going large German funded projects deal with biodiversity in agricultural landscapes: BIOPLEX, funded by the Federal Ministry of Education and Research, analyses the interaction of spatial complexity of agricultural landscapes with global change in terms of their effects on biodiversity.¹ The National Science Foundation programme SFB299 - Land Use Options for Peripheral Regions, aims at developing an integrated methodology for the assessment of site-specific economically and ecologically sustainable options for land use.²

B.1.3 Develop indicators and monitoring schemes

In Germany a huge amount of literature is devoted to the development of indicator and monitoring schemes and a range of monitoring activities exist, the majority for species distribution. Many of the installed schemes can be found, as for other European countries, in the database of monitoring schemes of the EUMON project (<http://eumon.ckff.si/>).

In Germany, the federal states are responsible for monitoring (for details see German section in the ALTER-Net report (Sorges & Bredemeier 2005). Attempts to harmonize monitoring schemes among federal states have been made for at least two decades but were successful only in few cases. Therefore, only few nationwide monitoring and indicator schemes are in place. The Federal Office for Statistics (Bundesamt für Statistik) and the Federal Agency for Nature conservation commissioned a study to develop a German wide biodiversity monitoring system (Ecological Random Area Sampling (Ökologische Flächenstichprobe - ÖFS)³. Based on statistical sampling methods landscape structures, habitat types and species composition has been analysed, but no feasibility assessment had been included (Statistisches Bundesamt & Bundesamt für Naturschutz 2000, see also Hoffmann-Kroll 2003), a deficit characterising also most other conceptual studies. New attempts to improve this situation are made within a national Biodiversity Strategy in 2007 (Küchler-Krischun & Piechocki 2005).

An extensive German literature on indicators in the agricultural landscape exists. An overview is presented (with a German focus) in the Special Issue (2003) of the Journal Agriculture, Ecosystems and Environment 98 (1-3), including aspects from the habitat to the landscape scale level, with perspectives for application (see Büchs 2003 for a detailed background).

Indicators developed can be grouped into two categories:

¹ for details, see <http://www.uni-giessen.de/bioplex/> (accessed 15-3-2007)

² for details, see <http://www.sfb299.de> (accessed 15-3-2007, mainly German)

³ <http://unfccc.int/resource/docs/natc/gernc3.pdf> (accessed 15-3-2007)

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- Biotic indicators for assessing the ecological effects / benefits of agricultural practices or agri-environmental measures
 - Biotic indicators for assessing the biodiversity of a given system

Osinski et al. (2003) reviewed existing indicators of the first type with a German perspective and beyond. Oppermann et al. (2005) evaluated 38 indicators to assess the ecological state of biotic resources on the farm land. The system developed by him can be used from the farm level to the national level.

Different studies concentrate on the evaluation of agricultural grasslands with respect to their management and conservation value using indicator species. For example, Wittig et al. (2006) introduced a method of relating plant indicator species to agri-environmental schemes to facilitate the identification of High Nature Value grassland for conservation. Braband & van Elsen (2006) discussed a similar approach for arable fields. Hildebrandt et al. (2005) analyse different taxa for the applicability as bioindicators in floodplain ecosystems. Hoffmann et al. (2003) stressed the importance of regionalisation of indicators to take into account the conditions of different landscapes and their land use systems.

For the indication of biodiversity in the broader landscape and across different systems various suggestions have been developed. Dierssen (2006) discussed the combination of different aspects of plant diversity in different landscapes and Purtauf et al. (2005) analysed the diversity of carabid beetles in agricultural landscapes. A new statistical method has been introduced by Buhk et al. (in press), using a combined approach of alpha- and beta-diversity on different scales.

B.2 Research on effects of land use practices and landscape structures on species population and community assemblages

A wealth of studies in German ecological research exists dealing with effects of land use practices and especially the influence of spatial structures on species abundances and community assemblages.

A main focus in this work with international relevance is on invertebrate species and have been carried out in the context of the above-mentioned programmes BIOPLEX and SFB 299. For example, Kruess & Tschardtke (2002) and Clough et al. (2005, 2007) compare the influence of different local and landscape factors on insect communities as well as insect and spider species. They stress, that a diversification on the landscape scale is important for the diversity in different groups. For other examples from this field, see e.g. Tschardtke et al. 2002, Steffan-Dewenter & Leschke 2003, Krauss et al. 2004a,b, 2005, Dauber & Wolters 2005, Diekötter et al. 2006).

Another integrated project (DIVA - The relationship between Biodiversity and Ecosystem Functioning in Grassland Ecosystems)⁴ analysed the relationship between plant community composition and arthropod assemblages in different montane grassland in the context of their productivity (Perner et al. 2005). In this study, plant species composition rather than their diversity explained arthropod diversity and land use management aspects influenced different functional groups within the communities differently. The project also addresses aspects of soil biology and effects of climatic extremes on the grassland communities.

B.3 Fragmentation

Fragmentation of the landscape is one of the main reasons for biodiversity decline in Germany, especially for endangered mammal species (see for example Roedenbeck & Köhler 2006; Kramer-Schadt et al. 2004 for the lynx). Systematic research on the effects of fragmentation started in the 1980ies. Three lines of systematic research have been developed and various research projects have addressed different aspects of fragmentation. The first line addresses the effects of fragmentation and isolation by traffic lines and the development of mitigation measures such as amphibian tunnels (e.g. Mader 1986, Reck et al. 1991, Kramer-Schadt et al. 2004). The second line assesses the importance of habitat size, habitat quality, and isolation for population viability with two major projects funded by the German Ministry of Education and Science FIFB (Settele et al. 1996, Amler et al. 1999) and UZLAR (Baier et al. 2005). A third line of research developed landscape indices to assess the degree of fragmentation. The Journal GAIA summarizes some of the latter work in the Special Issue 14(2) (Jäger et al. 2005). Schupp (2005) introduces common indicators, Penn-Bressel (2005) summarizes the development of fragmentation in Germany and discusses ways to slow down the increasing process of fragmentation. Grau (2005) introduces plans for large-scale defragmentation plans in Germany. One main indicator for landscape fragmentation (Meff- "effective Meshsize") has been developed over the last years in Germany (Jaeger 2004, Jaeger et al. 2006).

The textbooks of Amler et al. (1999) and Baier et al. (2006) (in German) summarize results from major research projects on fragmentation in Germany and places the results into the context of conservation planning and environmental impact assessment.

⁴ see for details: <http://www2.uni-jena.de/biologie/ecology/biolog/english.htm> (accessed 4-4-07)

C Conclusions

C.1 Main messages of the review (with a view on COM 216)

With the focus on the issues raised in the action plan of COM 216 it is obvious (and not too surprising), that knowledge and research on the topics are still rather scattered between different “spheres” of knowledge gathering: Work directly related to political measures is normally only available in German and produced by a diversity of colleagues, including state institutions, consultancies and research institutions. Due to the federal structure in Germany (and, for example the resulting differences in agri-environmental schemes), it is also hardly impossible to identify general trends in the work (see for example Lehmann et al. 2005).

On the other hand, the work on indicators for biodiversity in agricultural landscapes shows a clear trend towards regionalisation of indicators and measures, based on new ecological insights. This shows, that different levels and disciplines of scientific work need to be further integrated in order to improve the management of biodiversity in the wider landscape (see for example Tschardt et al. 2005, Kleijn et al. 2006). Such differentiations are for example also needed to make use of the high nature value farmland concept in Germany (pers comm. K. Robinet, Federal Agency for Nature Conservation).

A main problem, which is still far from being solved in densely populated central Europe is the problem of fragmentation of landscapes and the resulting effects on biodiversity. Indicators for fragmentation are well developed (e.g., Jaeger et al. 2005), but concepts to reduce its impacts are still rarely implemented.

C.2 Gaps of knowledge and need for further research – in a national as well as European context

As already outlined, the combination of ecological and socio-economic research is still scarce and most often concentrated on big, third-party funded research projects (e.g, BIOPLEX, SFB 299). Further investment in this area is needed, including a European perspective.

Lehman et al. outline in their analysis of multifunctional purpose policies that knowledge is still lacking whether such approaches are more efficient or effective than policies with separate goals (Lehmann et al. 2005). For example, they state, that it is still unclear whether cross-compliance indeed efficiently promotes income and environmental goals simultaneously. Developing the suitable institutions and governance structures are rarely considered in policy development as well. The development of new “biodiversity” markets should be further investigated.

Additionally, main EU directives such as the Water Framework Directive and the Natura 2000 implementation are in place for only a few years and need to be backed with research on their effectiveness and efficiency as well, especially when linked to other policies such as agri-environmental schemes.

In the fields on indicators and monitoring, national schemes are still lacking, including an implementation of a continuous funding and the link between the indicator development on the administrative level and further research which might improve schemes in the future.

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A complete list of articles screened in the process to develop this review is available via the Biostrat-Projekt website.

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