Contributions to Physical Geography: Thematic Diversity as a Present-Day Problem of Disciplines

Editorial to DIE ERDE 136, Issue 4

1. Introduction

Especially since about 1980, our academic disciplines have seen an increasing specialisation, which has substantially changed their appearance. Through specialisation, disciplines have expanded immensely with respect to their subject matter, thereby drifting towards other disciplines, even those which are very distant. Another cause for this process of diffusion can be seen in the increasing administrative, organisational and pecuniary pressure which is forcing disciplines to unite and organise themselves with others. In such a situation, the concepts of multidisciplinarity, interdisciplinarity and transdisciplinarity emerge. By now, these have become well-defined concepts. There is indeed a wide consensus among scientists, beyond the boundaries of individual disciplines, on what these concepts mean (*Jaeger* and *Scheringer* 1998; *Leser* 2002, 2006a, 2006b; *Thompson Klein* et al. 2001, among others; *Fig. 1*).

The methodological discussion in the German-speaking realm of geography gives evidence that this issue is being addressed – in geography more than in other disciplines, since geography itself constitutes "a wide field", *sui generis*. This is necessitated by the two columns which form the two main subdisciplines of geography, the "science" subject of physical geography on the one hand, and the "arts" subject of cultural, social and economic (human) geography on the other hand. And this is documented from a theoretical perspective by two recent textbooks of geography: *Borsdorf* (1999), and *Leser* and *Schneider-Sliwa* (1999). *Haggett* ([3]2004) must be mentioned as well, of course. This is, however, also documented by textbooks in landscape ecology – a field which is approached by a number of diverse disciplines (geography, geoecology, biology etc.). They all, however, start from the common notion that a broad and at the same time geographic approach is required as a basis (cf. e.g. *Leser* [4]1997; *Schneider-Sliwa, Schaub* and *Gerold* 1999; *Bastian* and *Steinhardt* 2002; *Steinhardt, Blumenstein* and *Barsch* 2005, among others). Authors outside of German-speaking geography have followed similar theoretical approaches (see especially *Naveh* and *Lieberman* [2]1994).

The fundamental idea of landscape ecology was propagated by *Troll* (1939) in this journal, still with a strong "science" bias at that time. It was only later that the theory was further elaborated upon, especially by *Neef* (1967, 1969, 1979). Very much in the sense of trans- and interdisciplinarity, man and society were then incorporated as well. This integrating concept has been evoked in a large number of recent publications (*Ehlers* 1998, 2000, among others) and has made its way into textbook collections, at least in the realm of German-

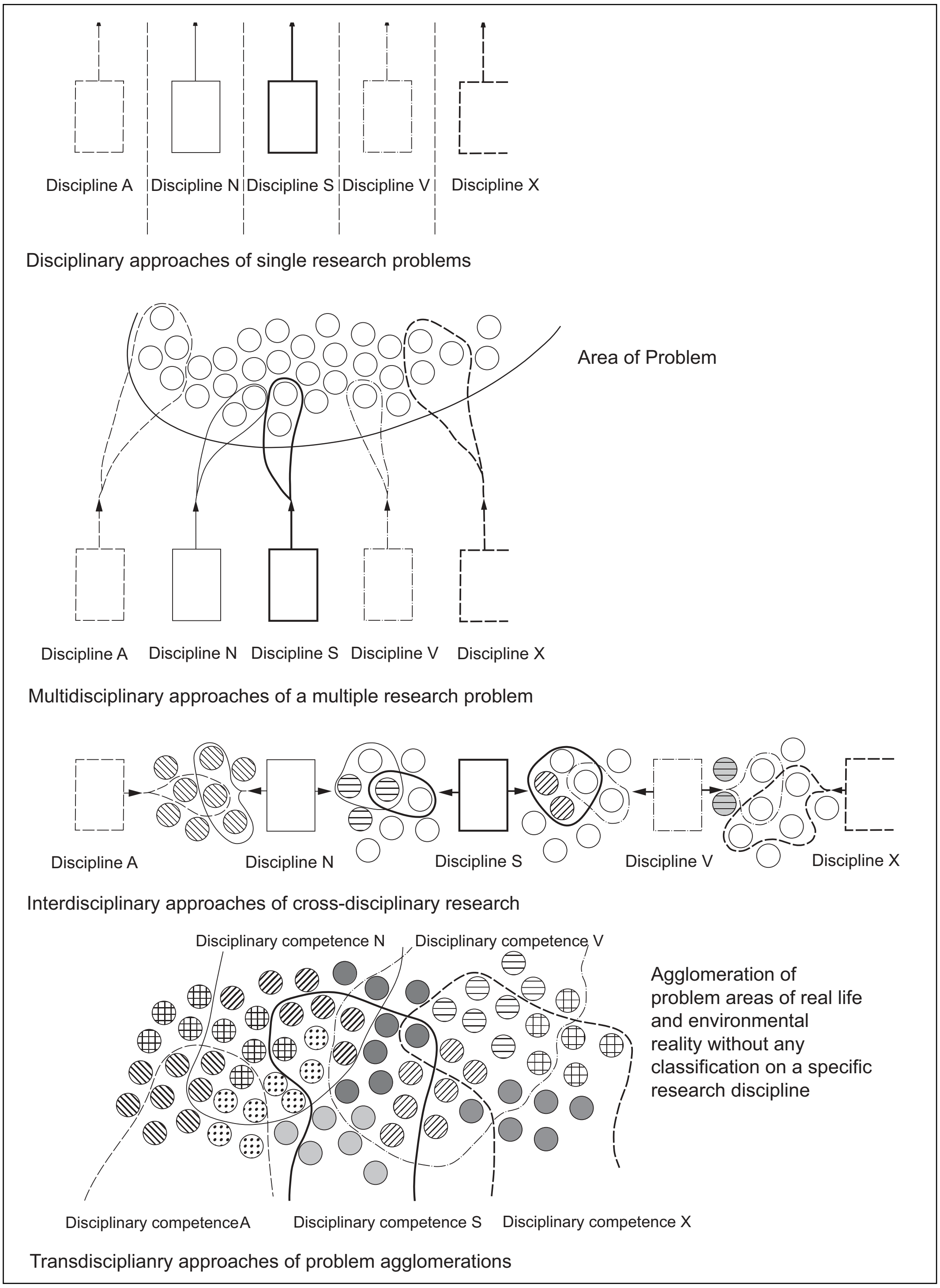
Discipline A
Discipline N
Discipline S
Discipline V
Discipline X
Disciplinary approaches of single research problems
Area of Problem
Discipline A
Discipline N
Discipline S
Discipline V
Discipline X
Multidisciplinary approaches of a multiple research problem
Discipline A
Discipline N
Discipline S
Discipline V
Discipline X
Interdisciplinary approaches of cross-disciplinary research
Disciplinary competence N
Disciplinary competence V
Agglomeration of problem areas of real life and environmental reality without any classification on a specific research discipline
Disciplinary competenceA
Disciplinary competence S
Disciplinary competence X
Transdisciplianry approaches of problem agglomerations

Fig. 1 Different approaches to research – from disciplinary to transdisciplinary modes (from *Leser* 2002; graphic design by *L. Baumann*). The simplified graph (modified according to several authors) demonstrates several possibilities of scientific and practical work. The graphs show that multi-, inter- and transdisciplinary approaches can be followed by different defined views and approaches. Sometimes it is difficult to distinguish between the different views. In research, therefore, a rather pragmatic approach to those views is taken. Usually the interdisciplinary approach is chosen, which means a multi- and transdisciplinary method and, equally, a "discussion of the problem".
Verschiedene Ansätze der Forschung – zwischen disziplinärem und transdisziplinärem Ansatz (aus: Leser 2002; Zeichnung: L. Baumann). Die einfache Übersicht, nach verschiedenen Autoren gestaltet, zeigt verschiedene Möglichkeiten von Ansätzen wissenschaftlichen und praktischen Arbeitens. Es zeigt sich, dass multidisziplinäres, interdisziplinäres und transdisziplinäres Vorgehen verschieden definierte Sicht- und Vorgehensweisen sind. Man kann sie nicht ganz streng voneinander trennen. In der realen Forschungspraxis wird daher recht pragmatisch und ohne solche Etikettierungen vorgegangen. Die Regel ist interdisziplinäres Arbeiten. Es bedeutet, wie das multidisziplinäre und das transdisziplinäre Arbeiten, eine „Begegnung am Problem".

speaking geography (*Ehlers* and *Leser* 2002, among others). This integration is far from being self-evident, which has been demonstrated by *Leser* and *Nagel* (1998) with the example of the usage of the diversity concept.

This view of the evolution of geography and landscape ecology offers a conceptual and theoretical framework for the contributions in this issue of DIE ERDE. With regard to both subject matter and contents, we are dealing with rather different articles: From a methodological point of view, they serve two theories of geography: (1) the "theory of the geographical complex" (*Neef* 1967; *Herz* 1994; *Borsdorf* 1999; *Leser* and *Schneider-Sliwa* 1999 and others), and (2) the "theory of geographical dimensions" (*Neef* 1963; *Haase* 1964, 1967; *Herz* 1973; *Leser* [4]1997 and others). The "geographical complex", that is, the totality of man, society, nature and space, has been being increasingly "discovered" by other disciplines since about 1990. This, in turn, offers new perspectives for cooperation between the disciplines, and this is by no means restricted to geography. In addition, this cooperation may be expanded into practical work, following the idea of transdisciplinarity (c.f. *Jaeger* and *Scheringer* 2006 and others)[1].

2. The Contributions to Physical Geography in this Edition of DIE ERDE

In papers on physical geography, the human impact usually remains in the background from a theoretical point of view, yet all contributions documented here are characterised at least indirectly by a man-environment context in the sense of the "theory of the geographical complex": Their subject matter is located in different dimensions, or projects are pursued on definite scales, which means that the "theory of geographical dimensions" is followed as well. These two perspectives are used to comment the individual contributions here: Common to all the articles is the observation that they are dealing with a concrete territory, which is either treated in a specific way, as a contribution to regional geography (*Schröder*, *Schmidt* and *Pesch*; *Kreja* and *Terhorst*; *Fiedler* and *Graw; Koch* et al.), or in a more general way, in the sense of a comparison of areas (*Holtmeier; Scheffers*).

F.K. Holtmeier starts from a landscape ecological perspective (*Fig. 2*). He regards the parameters of the landscape ecological systems as regulators and sinks in a system of processes. His essential material is observations and measure-

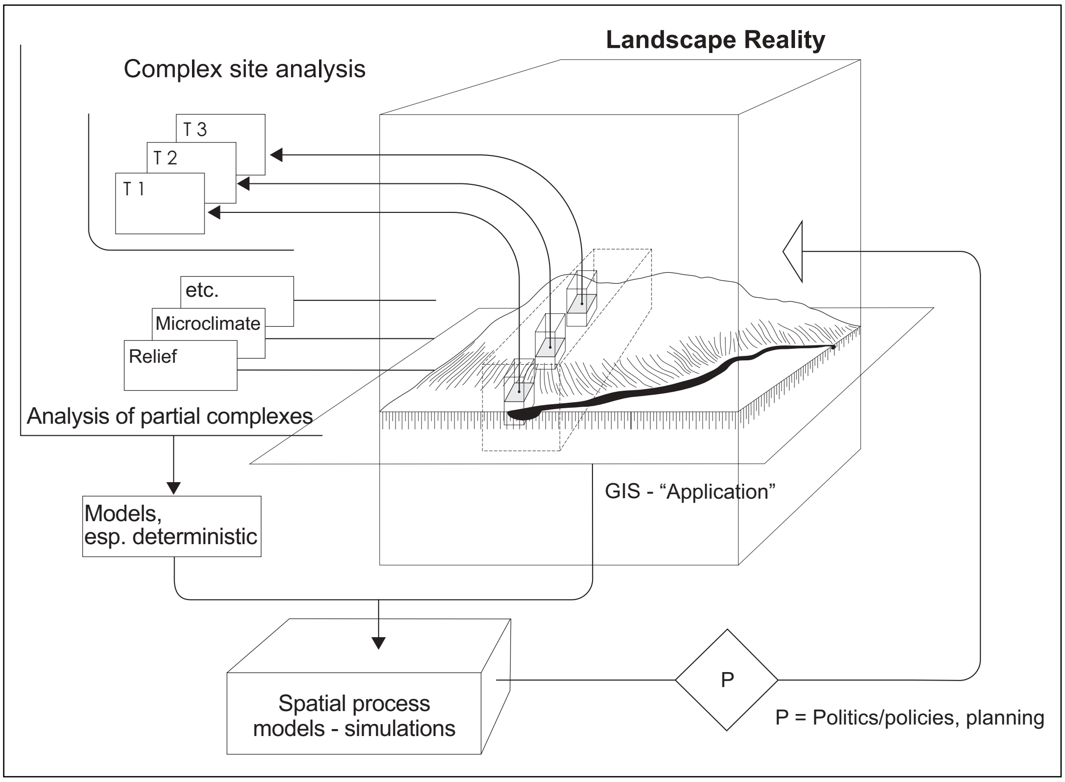

Fig. 2 Basic principles of landscape ecological method (initial design by *Leser* 2005; graphic design by *L. Baumann*). Here a part of the landscape in reality is shown which is at the same time the object of the investigation. One works on several levels of methods at the same time. Together they form the "landscape ecological complex analysis". Mostly static geofactors such as georelief, soil and microclimate are dealt with (mostly mapped) spatially within the framework of partial complex analysis. They are described with the help of geographic information systems (GIS). The measurement of the entire ecological household is carried out at landscape ecological sites (the places of measurement are so-called "tesserae") within the framework of complex site analysis. The sites are selected representative sites forming a catena on a slope. Both, the data referring to space as well as those referring to processes, feed for example deterministic models. They are partly caught up with in processing models referring to space with the help of simulation. These models in turn can be used by politicians and planners when it comes to forming landscape in reality. / *Grundprinzip der landschaftsökologischen Forschungsmethodik (Entwurf: H. Leser 2005; Zeichnung: L. Baumann). Gezeigt wird ein Ausschnitt aus der Landschaftlichen Realität, der zugleich Untersuchungsgegenstand ist. Gearbeitet wird auf mehreren Methodenebenen, die zusammen die Landschaftsökologische Komplexanalyse ausmachen. Flächenhaft werden (meist statische) Geoökofaktoren im Rahmen der Partialkomplexanalyse aufgenommen (meist kartiert), z.B. Georelief, Boden, Mikroklima. Sie werden mit Hilfe eines Geographischen Informationssystems (GIS) dargestellt. An ausgewählten repräsentativen Standorten, die am Hang als eine Catena angeordnet sind, erfolgt die Messung des ökologischen Haushaltsgeschehens an Landschaftsökologischen Standorten (deren Messplätze „Tesserae" heißen) im Rahmen der Komplexen Standortanalyse. Die Flächendaten und die Prozessdaten zusammen speisen z.B. deterministische Modelle. Sie werden in z.T. simulationsfähigen, raumbezogenen Prozessmodellen aufgearbeitet. Diese wiederum können von Politik und Planung für Gestaltungsmaßnahmen in der Landschaftlichen Realität eingesetzt werden.*

ments of small areas, in the topic (i.e. local) dimension (*Neef* 1963; *Haase* 1964, 1967; *Herz* 1973; *Mosimann* 1984). In *Troll's* sense (*Troll* 1939), but also in accordance with other methodological specifications of geography (e.g. *Borsdorf* 1999 or *Schneider-Sliwa, Schaub* and *Gerold* 1999)[2], observation comes first. This is followed by measurement, undertaken with a specific aim. This commonplace idea is often forgotten in these times of modelling and laboratory experiments, also in landscape ecology. Landscape ecology is fieldwork – especially on a local scale! But landscape ecology is also geography, that is, a spatial or regional discipline. *Holtmeier* works in regions in very different parts of the world, but with a similar climatic and ecological setting, and he applies an interregional comparison to these regions. Through this he transcends the local dimension and arrives at evidence on a zonal level – which leads to standards, to theoretical norms. In addition, he supports his statements with local evidence by other authors and positions them in a wider context.

A different approach in terms of territory and methodology is pursued in the contribution by *W. Schröder*, *G. Schmidt* and *R. Pesch.* They start off from a larger territory, which in this case is Germany. Since the 1950s, several versions of regionalisation into natural areas ("*Naturräumliche Gliederung")* have been produced. The procedures in these projects have all been located between two cornerstones: (1) purely empirical map interpretations (several maps of specific geofactors superimposed, drawing boundaries subsequently; *Neef* and collaborators produced a number of publications in various (small) scales, i.e. 1:200,000 and smaller[3]), and (2) a compilation of weighted characteristics of geoecofactors and their delimitation as areas[4]. Both procedures are applied worldwide, e.g. by *Naveh* and *Lieberman* ([2]1994) or *Bailey* (1996, 1998). Increasingly, researchers use statistical analysis and calculate territorial data regarding selected geo- and bioecofactors for spatial units on a small scale, using classification and regression trees. These mathematical models are now very popular internationally. The results are similar to the classic maps of "natural areas" ("*Naturräumliche Gliederung")*, because of the small-scale approach. Their advantage, however, lies in their relevance as aids in decision-making on quantitatively defined practical problems (here: SO_2 concentrations in immission measurement networks). In this context it is appropriate to mention *Burak's* work (*Burak* 2005) which also delivers a regionalisation of natural areas (also on a small spatial scale, 1:1 mill.) based on a process-oriented approach. A methodological pilot study for this project was produced by Renners, at the same small scale. These methodologies therefore substantially transcend the classical approaches of "*Naturräumliche Gliederung*" in Germany (e.g. *Meynen* and *Schmithüsen* 1953-1962).

Geomorphological questions have seen considerable change in Germany since the mid-1980s: The morphogenetic discussions focused on before have moved into the background somewhat, whilst present-day processes have met with an increasing interest. This is based on two development trends: (1) the more exact description and systematics of forms, also in the German-speaking realms, both qualitatively and quantitatively (above all by *Dikau*, e.g. 1994 or *Dikau* and *Schmidt* in *Schneider-Sliwa, Schaub* and *Gerold* 1991), and (2) the application of geomorphological results in practice (see also *Dikau* 2004 and *Dikau, Herget* and *Hennrich* 2005). Both trends have to be seen in the context of the possibility of depicting relief in GIS and GIS-supported process modellings. In addition, the consequences of global climate change have to be assessed – and to be taken into account – locally and regionally. The regional example of the Swabian Alb points in that direction. For this region, *R. Kreja* and *B. Terhorst* demonstrate that there are a large number of potential erosion areas which have already become elements of land use conflicts. Similarly to the landscape ecological methodology (see *Holtmeier's* contribution in this issue), research is undertaken in the topic and choric dimensions, starting off from observation (i.e. a detailed geomorphological mapping). The result is a product which may also be used in practice: a large-scale geomorphological hazard map. Meanwhile, such and similar projects are under way in all upland and mountain areas of German-speaking countries.

Even if tsunamis are the object of *A. Scheffers's* contribution, the approach is not oceanographic or geophysical, but geomorphological. This is a new perspective which is proven by the fact that there is hardly any geomorphological-sedimentological literature on this phenomenon. The article presents tsunami sediments and landforms produced by tsunamis along the coasts with a special focus on large sediments, i.e. blocks. The author's working group has been dealing with the problem on Cyprus, in southern Turkey, in Majorca, on the southern coast of the Atlantic in Spain, on Aruba, Curaçao, Bonaire, Grenada, Guadeloupe, St. Martin and Anguilla, as well as Eleuthera, Cat Island, Long Island in the Bahamas. Similarly to *Holtmeier's* approach, research is undertaken in different parts of the world. General conclusions of interregionally valid importance are drawn out of the interregional comparison. In addition, sedimented blocks are dated relatively to one another using those classic geochronological methods otherwise applied to glacial sediments or river and sea terraces. The absolute dating methods, also discussed in the article, are characterised by the major problem of finding traces of tsunamis apt to be dated. This leads from the present-day tsunamis to paleo-tsunamis. The problem presented may become even more important considering global climate change.

A special aspect of urban ecology, of the increasing shortage of land due to an increasing population, especially in densely populated areas, and the involved soil and soil-water problems, is presented by the contribution on the decomposition of corpses, an article originating from soil science. *S. Fiedler* and *M. Graw* investigate this problem with the example of cemeteries in Bavaria, comparing these to results from an earlier study on Baden-Württemberg. This paper also has a regional approach: The spatial distribution of soil-forming substrates and of the soils themselves as well as of their characteristics (structure of filters, air balance, soil water balance etc.) necessitate a precise assessment and presentation of regionalised data. As a result, conditions for rapid decomposition are very different from one site to another. Applying the methodology of landscape ecology (e.g. *Mosimann* 1984; *Leser* [4]1997), on-site investigations are undertaken in the topic dimension. This coincides with the statement that only few valid results with respect to local conditions can be deduced from large-area data. As a matter of fact, this means that small-scale modelling does not suffice; on-site investigation is essential. This leads us back to the well-known fundamental phrase in geosciences which tends to be forgotten too easily in the age of GIS-supported simulation – the potential value which is not disputed at all if applied in the appropriate situation: Geoscientific research is and remains, above all, field research.

The last contribution to this edition by *Koch* et al. starts off even more large-scale, that is, subtopic, and leads to another fundamental methodological problem of landscape ecology and physical geography, which is in turn linked to the problem of specialisation and increasing use of technology in field studies. There is no doubt whatsoever about the fact that in soil research, in the topic dimension, infiltration and its soil physical conditions are of prime importance for the soil's matter and water budget. The "heterogeneity of the landscape" (*Neumeister* 1999) is encountered at all spatial levels, including the topic dimension. At that level, however, there may be a chaotic structural pattern which cannot be analysed by the classic methods of field observation and measurement. Field experiments may serve as a methodological bridge which forms a link between observation and measurement in *Mosimann's* concept (1984) and laboratory experiments. The authors' team, however, sets these experiments into the context of land use, soil and relief investigated at the topic level. This yields a result which concerns land use directly. The article stimulates a lot of ideas about the chances and limits of landscape ecological fieldwork at the topic level.

3. Conclusion

The world is colourful and heterogeneous. This is also reflected in integrative disciplines like geography or landscape ecology. They are characterised by a multitude of objects, approaches and methodologies. This also holds true for the contributions in this issue of DIE ERDE. Heterogeneity, as a concept methodologically founded and systematically organised by *Neumeister* (1999), is a feature which has to be accounted for by a large range of methods. As a consequence, the contributions are located between observation, measurement, mapping, experiment and modelling. Independent of the so-called "modern techniques", linked to the application of electronic data processing and GIS, the approach is predominantly based on the real object "landscape" and its observable appearance – and rightfully so. This makes most of the contributions a plead for fieldwork as the classic approach in geoscientific research.

Notes

[1] This refers to "environmental research" (and its problems of definition and application), to be sure, but the focal problem is related to geography; see also the other contributions in the respective GAIA issue and following issues of 2006 which are not quoted here.

[2] The collection comprises several contributions explicitly dealing with methods and techniques of landscape ecology, e.g. *Th. Mosimann*, *F. Müller* or *U. Steinhardt*.

[3] See also the literature in the textbooks of landscape ecology mentioned above.

[4] See Note 3.

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