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## Sustainability



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# Sustainability

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After looking back at the early context in which the concept of sustainability arose in forestry, the background to international sustainability policy is elucidated, against which the debates on sustainable spatial development in Germany are presented. Finally, the challenges for spatial science as well as the planning science and planning practice are summarised through the commitment to the key objective of sustainable development.

# 1 The term and its origin

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The guiding principle of sustainable development, which was adopted by 178 countries at the Conference on the Environment and Development in Rio de Janeiro in 1992 and specified in Agenda 21, soon provided a decisive impetus for spatial and environmental research. The translation of the English term ‘sustainability’ into German was initially controversial. Following proposals to refer to the concept as ‘constant development’ or ‘future-oriented development’, the term ‘sustainability’ (*Nachhaltigkeit*) has finally become prevalent. The German term refers to the historical notion of sustainability in wood and forest economics in the 17th and 18th centuries. A look at these historical roots leads to a far-reaching understanding of the social challenges associated with the strategy of sustainable development – especially with regard to the development of space.

## 1.1 A look back: The principle of sustainability in forestry

Against the background of a timber crisis which threatened the existence of the mining industry, the Chief Officer for Mining, Hans Carl von Carlowitz, developed the idea of sustainability. His book *Sylviacultura Oeconomica. Instructions for growing wild trees naturally* was published in 1713 and is today considered the foundational work of silviculture (cf. Sächsische Hans-Carl-von-Carlowitz-Gesellschaft 2013). In the book, sustainability was formulated as an economic principle: Carlowitz rejected a short-term economy aimed only at ‘releasing money’. Instead, he demanded an economy that operates in a forward-looking and preventive way that is oriented toward the welfare of the community. This requires the careful handling of ‘benevolent nature’, and it is based on the insight that in the ‘bare and unsightly earth there is such a wonderful nourishing spirit of life at work’ as well as the ‘life-giving power of the sun’ (▷ *Forestry*). Humankind must explore ‘how nature plays and acts with them, not against them’ (cf. Grober 1999: 98; Grober 2010).

A look back at history enables a critical reflection on current debates on sustainability: as the ‘result of the crisis’, sustainability was initially an economic notion, the core of which is natural productivity and the aim of which is renewal through foresight and prevention. According to this concept, the productive functions of living nature are combined with human economic activities. Production is associated with restoration and renewal: wood production here also includes the reproduction of the forest ecosystem, the productivity of which must be secured and developed for future wood production. However, it is not only the quantity of the product to be harvested (preservation objectives) that matters, but also the quality of the soil. The concept of sustainability goes hand-in-hand with preserving stock and preserving quality.

The concept of sustainability in forestry shows that keeping an ecological stock of capital constant is not just a matter of preservation objectives, but also of shaping processes: in relation to stock and river components (cf. Birnbacher/Schicha 1996: 152), natural (forest) processes that change over time will be shaped in such a way that the resulting products have the desired qualities with a view to future exploitation interests. A sustainable economy means foresight and prevention.

## 1.2 Rediscovery of sustainability as a normative policy strategy

At the end of the 20th century, sustainable development became an internationally accepted guiding principle in drafting policies. Against the background of a complex crisis and the realisation that the phenomena manifesting as environmental, developmental and energy crises are a unique socio-ecological crisis (cf. WCED 1987: 8, section 11), sustainability was justified as a norm. ‘Our Common Futures’ (cf. WCED 1987), the final report of the World Commission on Environment and Development set up by the United Nations in 1983 – also called the Brundtland Commission after its Chair Gro Harlem Brundtland – tackled the idea of sustainable development and established the following understanding of the term: ‘To make development sustainable – to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs’ (WCED 1987: 1). Immediately after this definition, the Commission expressed its conviction that sustainable development is compatible with (market) economic growth – a thesis that continues to be strongly contradicted to this day.

In preparation for the first international Conference on Environment and Development in Rio de Janeiro in 1992, the notion of sustained livelihood was developed as a critical concept based on women’s initiatives from countries in the global south and was contrasted with the term ‘development’ which is often associated with growth: sustained livelihood aims at securing the needs of daily existence; besides material needs, the concept expressly includes the renewal of social and cultural resources, starts at the local level and emphasises the need to empower disadvantaged social groups (cf. Wichterich 2012). Here the understanding of the economy on which the concept of sustainability is based is expanded beyond market-centred processes and market-shaped goods and services. The particular importance of women in realising sustainability is reflected in the Agenda 21. This action programme is a result from the Rio conference and explicitly mentions the connection between global ecological problems and the social situation of disadvantaged groups. In particular, it addresses this issue in the context of social gender relations in society (cf. United Nations 1992: chapter 24).

In addition to the imperative of justice highlighted in the document, which has hitherto been the most important document for international sustainability policy, both intra-generationally and inter-generationally, Agenda 21 emphasises the integration rule: it is important to reconcile economic, socio-cultural and ecological development. This postulate challenges us to regard these three dimensions as interdependent. Only if these three dimensions are integrated will it be possible to develop and implement options for action in a broad social consensus based on democratic negotiation processes. A distinction is made between the three-dimensional model (*environmental* (▷ *Ecology*), *social and economic bottom line*) and four-dimensional models in which the cultural and/or political dimension is viewed as an independent dimension of development. In the policy discussion about sustainable development, two models in particular have prevailed with regard to the way in which these dimensions are to be integrated: the three-pillar model and the sustainability triangle. Both models are based on an integrative understanding insofar as the dimensions of development are understood as being of equal importance and are viewed in relation to one another. On the one hand, there is a critical objection that priority must be given to the ecological dimension because natural resources and services cannot be completely replaced (cf. Kanning 2013: 29). On the other hand, it is emphasised that if the dimensions of development were viewed in relation to each other, they would then have to be substantially rethought. An extensive understanding of the economy, society and nature

emerges: as laid out in the livelihood strategy, the economic development goes beyond market processes and thus includes unpaid work and work products; social development goals cannot be reduced to the creation of gainful employment and monetary income, but are directed towards the entire living environment; if social and economic objectives are to be achieved at the same time, ecological development must go beyond protection objectives and focus on the (co-) shaping of natural qualities and services (cf. Hofmeister/Mölders/Thiem 2014: 525). True integration is therefore not limited to equality, but necessarily leads to an expansion of the perspective of each of the dimensions. The integrative strategy of sustainable development, in which the sustainability dimensions are understood to be intertwined, mutually influencing and extensively dependent on one another (cf. e.g. Kopfmüller/Brandl/Jörissen et al. 2001), is regarded as another approach to the understanding of sustainability.

In addition to Agenda 21 and the Rio Declaration on Environment and Development, with which the signatory states committed to the principle of foresight and preservation and proscribed deterioration, four further documents emerged from the Rio conference that were to have a significant impact on the subsequent process: the Convention on Climate Change, the Convention on Biological Diversity, the Forest Declaration as well as the Convention to Combat Desertification. In addition, the monitoring and support for the Rio follow-up process as well as the  $\triangleright$  *Monitoring* for the implementation of the sustainability goals were institutionally secured by appointing the Commission on Sustainable Development (CSD). In the following years several UN follow-up conferences took place on various themes, including the European Conference on Sustainable Cities and Municipalities in 1992, from which the Aalborg Charter emerged, as well as the Habitat II Conference in Istanbul in 1996 and the Habitat III Conference in Quito, Ecuador in 2016. The international UN process on the environment and development has continued in three subsequent Rio conferences: 'Rio + 5' in New York in 1997, 'Rio + 10' in Johannesburg in 2002 and 'Rio + 20' in Rio de Janeiro in 2012. In particular, the notion of a green economy which resulted from the last Rio conference has thus far not been approved but has also often been criticised on the grounds that, despite the green rhetoric, it reflected an understanding of the economy that was reduced to markets and market processes. This criticism, which has persisted since the 1980s, of an economy oriented towards abstract value creation and growth and which is therefore unsustainable, came to a head again as a result of the debate about the financial crisis, which the global public has been increasingly concerned about since 2008.

Part of this conflict is the ongoing controversy over two fundamentally different understandings of the concept of sustainability: the position of strong sustainability from the perspective of ecological economics assumes that the stock of natural resources, the ecological capital stock, in principle cannot be replaced by human-made goods and services (cf. Costanza/Cumberland/Daly et al. 2001). This is called into doubt by representatives of the position of weak sustainability: in their opinion, the objectives in the ecological, socio-cultural and economic dimensions are of equal importance, as they are interchangeable. A controversial issue at the strategic level is the question of whether and to what extent sustainable development can and should be achieved through resource efficiency (efficiency strategy), through changed consumption and lifestyles (sufficiency strategy) and/or through a material and energy turnover in the anthropogenic economic space that is adapted to ecosystem processes (consistency strategy). There is a prevailing consensus that sustainability goals can only be achieved by combining all three strategies. However, there are different emphases with regard to the regulation of sustainability problems. There has been

criticism that because it is more closely connected with the (market) economic perspective, the efficiency strategy would be given priority, yet (due to rebound effects) that hardly contributes to achieving ecological sustainability goals (cf. Kanning 2013: et seq.).

In addition to these discussions about the theoretical interpretations of sustainability, which have not yet drawn to a close, and the associated path to sustainable development, the ethical implications of sustainability have also been discussed in the international sustainability process. The educational tasks necessary for sustainable development – Education for Sustainable Development (ESD) – are also in the foreground of scientific and educational policy debates, whereby reference is made to what is actually required for the process of sustainable development, as can be seen from the results of the Rio Conference in 1992: this is already mentioned in Agenda 21 (cf. United Nations 1992: chapter 23) under the terms ‘subsidiarity’, ‘participation’ and ‘empowerment’, expressing the conviction that sustainable development can only be achieved on the basis of real participation by all population groups. In accordance with this standard claim, sustainable development is understood as a process of negotiation in which decisions are made in a dialogue between stakeholders (assumed in principle as having equal rights and equal importance). The persistent discrepancy between this conceptually charged claim on the one hand and the rather weak implementation in policy action on the other is reflected in the scientific and political debates about ▷ *Governance*, which have intensified since the 1990s.

## 2 Sustainable spatial development

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In the spatial and planning sciences, the debate about sustainable development that began in the 1990s came at the right time. The standard premises linked to the notion of sustainability can also be linked to the conceptual and theoretical principles of spatial planning as well as to sectoral planning in relation to resources and the environment: thus, the imperative of justice is recognisable in the guiding principles and strategies of ▷ *Spatial planning (Raumordnung)*, such as in the orientation towards the ▷ *Provision of public services* and the goal of ensuring ▷ *Equivalence of living conditions across different areas* and in the notion of central places (▷ *Central place*). The cross-sectoral, interdisciplinary understanding that characterises spatial planning and is the basis of spatial analysis and ▷ *Spatial planning (Raumplanung)* corresponds to the imperative of integrative, cross-dimensional (spatial) development (▷ *Spatial development*).

### 2.1 Normative sustainability premises in spatial planning

The postulate of intra-generational justice as the first basic normative element calls for the development of spaces that ‘brings the social and economic demands on the space into harmony with its ecological functions and leads to a permanent, large-scale, balanced structure with equivalent living conditions across all areas’ (section 1(2) of the Federal Spatial Planning Act [*Raumordnungsgesetz, ROG*]). This means that access to (public) resources in space and to facilities of social and technical infrastructure must be guaranteed for the entire population. Paradoxically, this guiding principle has been under discussion since the beginning of the debates about sustainable development in spatial planning in the 1990s (cf. Hahne 2005). The feasibility of equivalent living conditions against the background of the globalisation of markets and the associated competition between regions (locations) as well as the considerably reduced

power of the state to shape such matters is being increasingly questioned. The management of spatial development (of settlements) through state regulation and investment is also much more difficult than it was in the 1960s to 1980s. The consensus, however, is that equivalence must not be equated with homogeneity if spatial planning is to preserve and develop the diversity and individuality of the different regions (section 2(2) no. 5 of the Federal Spatial Planning Act). Although the controversy over the guiding principle of the equivalence of living conditions may not be over, it is becoming apparent that it will continue to play an important role in the debate in connection with safeguarding the provision of public services (cf. *MKRO* [Conference of Ministers for Spatial Planning] 2016: 10 et seq.). With regard to the imperative of justice towards future generations, the resource- and ecologically-oriented principles of spatial planning, the preservation and development of the functions of the ecosystem and the landscape as well as securing healthy environmental conditions (section 2(2) no. 6 of the Federal Spatial Planning Act) are a prerequisite for inter-generational equal opportunities, which lie at the heart of sustainable spatial development. Accordingly, topics such as climate change (▷ *Climate, climate change*) and the energy transition are attracting more and more attention in the process of elaborating guiding principles (cf. *MKRO* 2013, *MKRO* 2016: 18 et seq.; cf. also *ARL* 2014).

The second basic normative element of sustainable development – the integration rule – which calls for economic, social and ecological development goals to be harmonised, is implemented comparatively well in spatial planning and planning law (section 1(2) of the Federal Spatial Planning Act). Spatial planning encompasses competencies and potential instruments that look back on a long tradition, both with regard to the integration of the development goals and the justice imperative: the comprehensive competencies of spatial planning are to assure that the political▷ *planning systems* can do what is necessary to create equivalent living conditions across space. In this regard, spatial planning is fundamentally integrative. It has the task of evaluating and balancing different and competing development goals and land use requirements. But this claim is not always met: as regards policy, among the institutions and stakeholders involved in spatial development, the trend of increasing sectorisation and specialisation continues; at the same time, the market economy development goals continue to dominate. In relation to sustainability, the development dimensions clearly cannot be brought together through spatial planning alone. Achieving integrated spatial development requires broad acceptance of the sustainability principle and close cooperation between the respective stakeholders, which has so far not been sufficient due to differing and occasionally contradicting interpretations of this key objective.

## 2.2 Independent and sustainable regional development

A look back at the debates on the operationalisation of the key objective of sustainable spatial development in the 1990s shows that the scientific discussion about the notion of sustainable development, which had just emerged at that time, was able to directly connect with existing strategies and approaches in spatial development. In particular, this applies in the case of independent regional development, which was widely discussed in Germany as early as the 1980s. The main ideas were that the region, as a manageable, socially and culturally determined field of activity, was the appropriate level to promote sustainable development and that the decentralisation of decision-making structures contributed to people being more confronted with the consequences of their own actions and thus more willing to take responsibility for the social and ecological environment (cf. Spehl 1998). A characteristic idea of independent regional

development is that the endogenous development potential is used to consolidate the material flows and to reduce transport routes through the regional networking of companies and through the deliberate establishment of regional value chains, thus contributing to preventing or reducing the use of resources and environmental pollution – which is directly linked to the strategy of sustainable development. In this approach, economic development goals are linked to ecological and social sustainability goals. The focus on the region also coincides with the principles of sustainable development, especially from a procedural point of view, because an integrated strategy only has a chance of implementation if its necessity and its effects can be experienced and influenced by each individual (cf. Spehl 1998: 23).

However, on the basis of the first projects in Germany and Austria, in the discourses within spatial science and the planning discipline on independent regional development, the obstacles and resistance that emerged in relation to the implementation of sustainability goals in  $\triangleright$  *Regional development* became apparent: for example, on the political-administrative level, the regions are unequally and less equipped to implement strategic decisions relating to sustainability; they have considerably fewer powers, fewer resources and less region-specific information than the local authorities and federal states. In addition, the tension between global orientation, regional economies and strategies aimed at intra-regional economic links do not always work in favour of independent and/or sustainable development. In this tense relationship, the international perspective on intra-generational and inter-generational justice can be conveyed programmatically, but the economic stakeholders involved in global economies are forced to develop their own models of the division of labour and cooperation on the various levels of action and responsibility, whereby it is possible to lose sight of the spatial context of business activities. Regional economic stakeholders in particular have to walk a tightrope: it is they who have to mediate between the need to prove themselves in global competition and the need to achieve ecological and social sustainability goals through localised, intra-regional cooperation (cf. Danielzyk/Deppe/Mose 1997).

### 2.3 The region as an action level for sustainable spatial development

The regional level was and is still primarily suitable for sustainability processes: on the one hand this works best above the municipal level, because cities and municipalities are considered too small to create the structures necessary for sustainable development, but have the necessary political-administrative resources; on the other hand, it works best below the federal state level, because the prerequisite for sustainable development processes of spatial identification and manageability is not met either at the national level or at the level of the federal states. Despite the obstacles that have been identified, the  $\triangleright$  *Region* represents the most suitable level. Accordingly, the first publicly subsidised model projects for sustainable spatial development were aimed at the regions: the ‘Regions of the Future’ programme from 1997 to 2000 and its continuation in the ‘Network Regions of the Future’ programme, which was funded by the Federal Office for Building and Regional Planning (*Bundesamt für Bauwesen und Raumordnung*) (cf. BBR 2003). However, after the completion of these programmes, it became apparent that the formal planning agencies, especially the regional planning agencies, were only marginally involved. For Ritter (2003: 3), one of the reasons for this was the assumption that ‘sustainability is a given in spatial planning’, because it creates the risk that new challenges associated with the implementation of



the sustainability principle in regional planning are not taken into account sufficiently (cf. also Hübler/Kaether/Selwig et al. 2000).

At an early stage, the operationalisation of the guiding principle of sustainability for regional policy and planning was promoted at the project level. In 1998/99, 1,650 sustainable regional development projects were identified in Germany (cf. Bräuer/Höher/Lucas et al. 2000). The Trier Sustainable Regional Development project (*Nachhaltige Regionalentwicklung Trier, NARET*) (cf. Peters/Sauerborn/Spehl et al. 1996; Spehl/Tischer 1994) played a pioneering role and focused on sustainable economic activity. The production types that are central to the regional economy were examined along the product chains with regard to their significance in implementing the sustainability principle in regional development. Recommendations for the networking of economic stakeholders, for the narrowing of material and energy flows as well as for the formation of regional value-added chains were developed. Further pioneering projects at the regional level were the Bergisches Land project, which enquired into the importance of agriculture for sustainable regional development (cf. Molitor 1997), as well as the Industrial Garden Realm project in Dessau (cf. Bauhaus Dessau 1994), which brought the mediation of industrial development together with the protection of the  $\triangleright$  *Cultural landscape* into focus.

## 2.4 Municipal and local sustainability processes

A similarly rapid development of the implementation of sustainability could be observed at the municipal level in the 1990s: initiatives to set up Local Agenda 21 processes (*Lokale-Agenda-21-Prozesse, LA 21*) were formed in many cities and municipalities – initially mostly informally, then in some cases with limited and temporary support from the local authorities. The cities of Dessau, Güstrow, Heidelberg and Münster were pioneers in this process (cf. Spehl 2005: 683). The Ulm Initiative Committee for Sustainable Economic Development (*Ulmer Initiativkreis für nachhaltige Wirtschaftsentwicklung*), which especially aimed at networking local economic stakeholders, also had a pioneering function (cf. UNW, undated).

Although in 2009 there were still 2,600 Local Agenda 21 processes in around 12,000 local authorities in Germany (cf. Kirst/Trockel/Heinrichs 2014: 552), there has been a decline in new initiatives since the early 2000s; existing Local Agenda 21 processes also started to lose momentum. It is currently stressed that the local authorities still play a central role in the sustainability process (cf. Kirst/Trockel/Heinrichs 2014: 549 et seq.). However, the prerequisite for lasting and effective municipal sustainability initiatives seems to lie in their institutionalisation in the local authorities' political-administrative systems. In order to implement sustainability policy goals across sectors through administrative activities, the sustainability policy needs to be considered important by the local authorities. By being established at a higher level in the political-administrative system, their status becomes significantly more relevant and their effectiveness increases. The city of Freiburg in Breisgau still serves as a role model today. In contrast, Local Agenda 21 initiatives which lack secure and/or supporting structures and which are not established permanently in local authority administrations have often been disbanded. They have been partially replaced by initiatives that have a similar political thrust in relation to urban development, but operate under different guises: the Citizen Community strategy and the Transition Town movement are examples of such informal sustainability processes.

## 2.5 National sustainability strategy and the strategies of the federal states

In the 1990s, sustainability policy in Germany had focused mainly on the regional and local levels, but since 2000 there have also been strategic approaches to implementing sustainable development policies on the national and federal state levels. The national sustainability strategy ‘Perspectives for Germany’ (cf. German Federal Government [*Bundesregierung*] 2002) was created in the run-up to the Rio + 10 conference in Johannesburg and was updated several times (2004, 2005, 2008 and 2012), each time with specific priorities. Following the resolution on the 2030 Agenda in New York in 2015, which was supported by the heads of state and government of the 193 member states of the United Nations, the sustainability strategy for Germany was reissued in 2016 (German Federal Government 2016). The federal states all drew up sustainability strategies or comparable documents by the end of 2016, as they were obliged to do by the implementation requirements of the 2030 Agenda (Kerkow 2017: 11), partly accompanied by extensive coordination and participation processes lasting several years; 11 out of 16 federal states have also presented development policy guidelines (ibid.: 14).

With regard to spatial and settlement development, the National Sustainability Strategy of 2002 focused on reducing land take for settlement and transport to less than 30 hectares by 2020 and in the new edition of 2016 to 2030 it continued to focus on achieving this (German Federal Government 2016: 158 et seq.). Although the 2002 strategy emphasised that corresponding quantitative and qualitative steering goals for sustainable urban development should be aligned and implemented in harmony with the various dimensions of sustainability (cf. German Federal Government 2002: 290 et seq.), the debates within the spatial and planning sciences on the tasks of sustainable land management were primarily aimed at the efficient use of land as a resource and at achieving the reduction target. However, there was essentially no comprehensive embedding of ‘area’ as a subject matter in the strategies for the quality development of urban spaces. The opportunity to use space as an integration level for the merging of qualitative and quantitative sustainability goals as well as for the integration of urban development goals in economic, ecological and social terms has not yet been fully used. In the new version of the national strategy, the targets established for the SDG 11 (Sustainable Development Goal: Sustainable cities and municipalities) emphasises the special importance of cities as an across-the-board theme in and for the sustainability process and in connection with other central sustainability goals (e.g. water, energy, climate change) (German Federal Government 2016: 155 et seq.).

However, the issue of integration still appears to be precarious at both national and state level. The sustainability strategies in the federal states show a heterogeneous picture with regard to both the emphasis and the integration of the sustainability dimensions (cf. Riedel 2014: 11 et seq.). A comparison of the strategies of the federal states with regard to selected cross-sectional and specialist topics (cf. Borbonus/von Geibler/Luhmann et al. 2014) shows that the development dimensions are understood very differently in both their breadth and depth, the measures are specified on extremely different levels, there is no uniform understanding of sustainability with regard to the subject areas and instead of merging the specific targets established for the individual policy areas, they only exist side-by-side under the label of sustainability. An integrative sustainability management system, which connects the economic, ecological and social dimensions of development, has not yet been set up. As in the municipal level, sustainability

policy is not implemented across the entire territory or across sectors in the federal states, the political responsibilities and administrative embedding are not equally guaranteed and therefore the policies have very different effects (cf. Riedel 2014: 12).

### 2.6 Sustainable (spatial) development as a challenge for science

There were intense and at times controversial debates on sustainable spatial development within the fields of spatial science, environmental science and the planning discipline in the 1990s – especially just before the amendment of the Federal Spatial Planning Act in Germany. The research of the Academy for Spatial Research and Planning (*Akademie für Raumforschung und Landesplanung*, ARL) played a special role in these early debates: various Working Groups were set up to deal with issues relating to the operationalisation of the key objective in spatial planning. Ritter (2003: 2) names seven Working Groups, including Sustainable Spatial Development in Berlin-Brandenburg (ARL 1998) and The Sustainability Principle in Regional Planning (ARL 2000), in which the sustainability strategy for regional policy and planning was operationalised. The ARL's activities on the theme in the second half of the 1990s were documented and evaluated in the form of a synopsis (cf. Wolfram 2002). As part of the ARL's plenary meeting in 2002, the results of the academy's research were discussed against the background of national and international developments in sustainability policies and the research needs were recorded (cf. Ritter/Zimmermann 2003).

Scientifically, the key objective of sustainable spatial development has also been operationalised in other contexts: Hübler, Kaether, Selwig et al. (2000) developed a test framework for sustainability in a study funded by the German Environment Agency (*Umweltbundesamt*) on the 'Further development and specification of the guiding principle of sustainable development in regional planning and regional development strategies', which they applied to selected plans and strategies. On the basis of an integrative approach that links the sustainability dimensions, a substantial, far-reaching target and indicator system was developed and applied in regional policy and planning. Particular consideration of sustainability debates in spatial science found – often embedded in theoretical planning research on the topic of regional governance (cf. e.g. Fürst 2003) – issues in relation to the requirements for sustainable spatial development processes and the appropriate plural steering methods. Issues of the involvement and participation of citizens in sustainability processes as well as the appropriate cooperative planning processes were and are of particular importance.

The increasing inclusion of sustainability topics in non-university and university research since the 1990s triggered an ongoing epistemological and methodological reflection on sustainability research which, beyond spatial science and planning theory, has also led to the institutionalisation of originally sustainability-oriented research programmes (cf. e.g. BMBF 2000). There is a broad consensus that other forms for generating knowledge should be developed for this type of research: what is required is a form of scientific enquiry that does not define itself in terms of the problems and the solutions to problems that it addresses and develops, but is oriented towards social needs.

In spatial science and the planning discipline, this debate about new strategies and methods in sustainability research and education has a comparatively favourable starting point: the new forms of knowledge generation developing in the field of sustainability studies

(cf. Heinrichs/Michelsen 2014), which were characterised by breaking both disciplinary boundaries (interdisciplinarity) and the boundaries between the scientific and non-scientific world (transdisciplinarity), were able to build on many years of experience. In particular, the task of the planning science will start with non-scientific, social problems and develop solutions for planning practice. In this respect, the institutions of the spatial and planning sciences – university and non-university – tend to comprise multidisciplinary and interdisciplinary structures from the start; project-oriented research and teaching aimed at the non-scientific world are a given in these fields of knowledge. There have been many debates on the methodology and methods of transdisciplinary knowledge integration as well as the forms of interdisciplinary teaching and learning from a scientific sustainability perspective as a result of the Rio process (cf. e.g. Vilsmeier/Lang 2014). However, this process of understanding and ascertaining the forms of a discipline that is normally oriented towards the guiding principle of sustainable development is still ongoing, in particular due to a lack of theoretical development and reflection on the notion of sustainability itself. There is still an urgent need to clarify the underlying theoretical concepts, scientific theories and methods of the still relatively new field of sustainability science, as well as the structural requirements for knowledge generation in this area.

There has also been hardly any corresponding research to date on developments in spatial research and planning practice in the context of spatial sustainability policies. Still unanswered are questions about (1) which new (and old) structures in scientific institutions promote or inhibit the process of creating interdisciplinary and transdisciplinary research, (2) which new structures are required in order to successfully deal with sustainability issues scientifically, (3) what the success factors of sustainable (spatial) development are, (4) where the initially promising Local Agenda 21 processes and regional agenda processes failed, (5) how spatial sustainability processes are promoted or inhibited or blocked, (6) which structural and institutional requirements are necessary and suitable for the permanent anchoring of sustainability processes, (7) what other initiatives that do not explicitly refer to the guiding principle of sustainability contribute to the sustainability process in cities and regions. The clarification of these questions is one of the main challenges for future research between the spatial, planning and sustainability sciences.

### 3 Challenges for spatial science and spatial planning

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The challenges arising from the guiding principle of sustainable spatial development are expressed as issues of spatial science, planning theory and practical planning. In the synopsis of the approaches to planning policy implementation and the scientific debates, the following ambivalent developments emerge:

- The discussion about sustainable spatial development has become specialised rather than consolidated at all policy levels, from the municipal to the national: individual policy and planning areas are at the forefront of sustainability concepts and strategies (e.g. sustainable tourism, sustainable mobility), while cross-sectoral approaches are still lacking (or are lacking once again). An orientation towards singular solutions to problems prevails over the development of integrative approaches linking the dimensions of sustainability to sustainability issues.

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- The development of guiding principles and the operationalisation of sustainability goals often differ from each other: while the substantive, qualitatively oriented goals are given great importance programmatically, they are reduced, marginalised or even completely ignored in their operationalisation. For example, spatial development goals are prioritised very highly in the guiding principles of the National Sustainability Strategy, while the spatial reference in the section on indicators is essentially drilled down into the quantitative goal of reducing land take (cf. German Federal Government 2002: 16 et seq., 287 et seq.). In the process of operationalising sustainability goals, quantitative goals take precedence over qualitative goals and efficiency-oriented strategies take precedence over sufficiency and consistency strategies. In the context of the implementation of the 2030 Agenda in Germany (German Federal Government 2016), it remains to be seen whether and to what extent the (spatial) integration of various sustainability goals will be given greater consideration under qualitative aspects.
- While the principle of sustainability is established in programmes almost everywhere, especially in the National Sustainability Strategy and in those of the federal states as well as in the development of the guiding principles for spatial planning, there are tendencies at the regional and local level to replace these guiding principles with programmes (e.g. through labels such as ‘Citizens’ Community’ or ‘100% Renewable Energy Region’). The sustainable spatial development issues are included in new strategies, but they are rarely or no longer made explicit.

These tendencies towards the differentiation, specialisation, depletion and substitution of sustainability discussions in planning practice and policy, as well as in spatial science and the planning disciplines themselves, may have something to do with the fact that the notion and its substantial implications are still not sufficiently reflected in planning theory (cf. Hofmeister 2014). The normative premises of justice and integration that are inscribed in the key objective of sustainable spatial development as well as the understanding of the path to the future remain vague as long as thought patterns based on foresight are not sufficiently anchored in relation to the (various) uses of space. The insight derived from the sustainability notion in forestry – to shape the current use of space with regard to future options for use – requires a fundamental realignment of the time horizon. Spatial planning is supposed to facilitate the interpretation of currently planned uses as ‘pre-uses’ and to ensure that future generations can comprehensively realise their own choices for use. The necessary ecological, social and, in a broader sense, economic conditions must be secured (conservation objectives) and/or restored or renewed (design object). Spatial planning that takes into consideration the long-term nature of the spatial effects resulting from current usage requirements and that considers and evaluates these from the perspective of future generations – in other words which adopts the perspective of the ‘future presents’ (Adam 2013) – will integrate both environmental and resource planning as well as urban and regional policies. Sustainability-oriented spatial planning is understood and implemented according to an integrative approach and can combine design and conservation objectives. The main objective of sustainable spatial development therefore calls for a substantial realignment and integration of the planning and policy areas. In particular, it encounters the existing skills of spatial planning, whose interdisciplinary scientific perspective and practical, cross-sectoral action orientation enable sustainability to be seen as an opportunity and to accept the accompanying challenges in science and practice.

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