European Union (c2017). Migration: Towards a European agenda on migration. [Online] Available at: https://ec.europa.eu/commission/priorities/migration_en [Accessed 25 April 2017].

Frontex (2015). FRAN Quarterly: Quarter 3 – July-September 2015. [Online] Available at: http://frontex.europa.eu/assets/Publications/Risk_Analysis/FRAN_Q3_2015.pdf [Accessed 29 April 2017].

Frontex (2016). Risk Analysis for 2016. [Online] Available at: http://frontex.europa.eu/assets/Publications/Risk_Analysis/Annula_Risk_Analysis_2016.pdf [Accessed 29 April 2017].

International Organization for Migration (IOM) (2016). Migration Flows – Europe. [Online] Available in http://migration.iom.int/europe/ [Accessed 29 April 2017].

Law No. 4375/2016 "On the organization & operation of the Asylum Service, the Appeals Authority, the Reception& Identification Service, the establishment of the General Secretariat for Reception, the transposition into Greek legislation of Directive 2013/32/EC".

Metcalfe-Hough, V. (2015). 'The migration crisis? Facts, challenges and possible solutions', Overseas Development Institute (ODI) 2015/10 Briefing Paper.

Neville, D., Sy, S., Rigon, A. (2016). On the frontline: the hotspot approach to managing migration. [Online] Directorate General for Internal Policies Policy Department C: Citizens' Rights And Constitutional Affairs Civil Liberties, Justice And Home Affairs: European Parliament. Available at: http://www.europarl.europa.eu/RegData/etudes/STUD/2016/556942/IPOL_STU%282016%29556942_EN.pdf [Accessed 30 April 2017].

Tomaszewski, B., Tibbets, S., Hamad, Y. and Al-Najdawi, N. (2016). Infrastructure Evolution Analysis via Remote Sensing in an Urban Refugee Camp – Evidence from Za'atari. Procedia Engineering, 159, pp.118-123.

UNHCR (2017a). Operational Portal Refugee Situations - Mediterranean Situation. [Online] Available at: http://data2.unhcr.org/en/situations/mediterranean/location/5179 [Accessed 23 May 2017].

UNHCR (2017b). UNHCR – The UN Refugee Agency | Emergency Handbook – Camp strategy guidance. [Online] Available at: https://emergency.unhcr.org/entry/36257/camp-strategy-guidance-planned-settlements [Accessed 22 April 2017].

ID 1562 | CLIMATE ADAPTATION IN REGIONAL PLANNING IN GERMANY

Hanna Christine Schmitt[1]
[1]TU Dortmund University, School of Spatial Planning, Institute of Spatial Planning (IRPUD)
hanna.schmitt@tu-dortmund.de

1 INTRODUCTION

The legal basis of the German spatial planning system is the Federal Planning Act (Raumordnungsgesetz des Bundes, ROG), which defines the core task of spatial planning to be the "anticipatory, comprehensive, supra-local and cross-sectoral organisation of the spatial and settlement structure for the medium and long term" (ARL, 2005, p. 965). Within the German planning system, regional planning is the intermediate level of comprehensive planning, bridging the (political) frameworks of the national level, sectoral planning and the (practical) implementation at the local level. It concretises the aims and guiding principles of comprehensive spatial planning of the national and federal-state level for all planning regions and prepares regional plans in accordance with § 8 (1) no. 2 ROG.

Due to regional planning's comprehensive, supra-local and yet spatially-specific character, it is qualified for addressing impacts of climate change. This becomes especially valuable in the light of absence of a separate sectoral planning division responsible for considering climatic changes (ARL, 2013; BMVBS, 2009; Federal Government, 2008).

In 2008, climate adaptation was given concrete political and legal status through the resolution of the 'German Strategy for Adaptation to Climate Change' (Deutsche Anpassungsstrategie an den Klimawandel, DAS) and the amendment of the ROG through the supplementation of the 'Climate Protection Section' (Klimaschutzparagraph). The latter states that "the spatial requirements of climate protection must be

taken into account, both by means counteracting climate change and by serving the adaptation to climate change" (§ 2 sect. 2 no. 6 ROG). In addition to the DAS, the 'Adaptation Action Plan' (Aktionsplan Anpassung zur DAS, APA) was published in 2011, representing a national strategy with objectives and measures for climate adaptation (Federal Government, 2008). Additionally, the 'Conference of Ministers on Spatial Planning' (Ministerkonferenz der Raumordnung, MKRO) presented a concept of action regarding the spatial consequences of climate change and possible prevention, mitigation and adaptation strategies in 2009, respectively 2013. The MKRO concept highlights the role of spatial planning in climate change adaptation and mitigation[1] and contains Fields of Action for further elaboration through regional planning.

This paper presents the status quo on the implementation of adaptation-relevant designations in German regional plans, as claimed by DAS, ROG and MKRO. First, an introduction to the methodology of the analysis is given (see subchapter 2). Subsequent, research results of the Germany-wide analysis are presented (see subchapter 3). The overall implementation rate of climate-adaptation related designations for all planning regions and all Fields of Action is presented first, before a more detailed description of the research results follows for the two Fields of Action with the least implementation rate (Coastal Protection and Protection of Mountainous Areas). The two exemplary Fields of Action are described regarding their climatic and spatial-planning relevance and existing approaches and model designations are introduced. Additionally, an in-depth presentation and interpretation of the research results is given. Last, a conclusion on climate adaptation in regional planning and remaining potentials is drawn (see subchapter 4).

2 METHODOLOGY

The formal regional plans serve as the basis for the analysis on climate adaptation in regional planning. As regional plans are both the most important (formal) spatial planning instrument at the regional level (BMVBS and BBSR, 2011) and are available for all planning regions in Germany, comparability of the results is guaranteed (Schmitt, 2014). Although informal instrument are not considered in the analysis, their importance for regional planning processes, e.g. in risk communication, has to be stressed[2].

The MKRO concept defines seven Fields of Action for climate change adaptation, which are to be implemented at regional and local planning level. For the Germany-wide analysis, these Fields of Action are further concretised into 22 action foci (see Tab. 1). Model designations are derived for each of the 22 action foci (exemplarily see subchapters 3.1.2 and 3.2.2), which are systematically analysed regarding their existence and legal validity in all regional plans.

Field of Action I – Flood Protection in River Areas	
I.i	Preservation of existing flooding areas for retention purposes
I.ii	Retrieval of flooding areas for retention
I.iii	Risk prevention in potential flooding areas
I.iv	Improvement of retention in the river catchment areas
I.v	Preservation of potential sites for flood protection facilities
Field of Action II – Coastal Protection	
II.i	Complementary risk minimisation in storm-surge protected coastal areas
II.ii	Risk minimisation in insufficiently storm-surge protected coastal areas
II.iii	Preservation of buffer zones (building development prohibited) in areas of unprotected coastal erosion
II.iv	Protection of areas for clay and marine sand extraction for coastal protection purposes
II.v	Preservation of areas in embankment foreland and hinterland
Field of Action III – Protection of Mountainous Areas (esp. Alpine Region)	
III.i	Preservation/Restoration of the protective functions of mountain forest
III.ii	Protection from natural (mountain) hazards
III.iii	Protection and development of mountain regions as living, economic and touristic areas
Field of Action IV – Protection from Heat in Settlement Areas	
IV.i	Protection of significant regional climate-effective free spaces and compensation areas
IV.ii	Spatial management of settlement and infrastructure development

[1] While climate mitigation aims to avoid or reduce further anthropogenic influences on the climate (e.g. by reducing greenhouse gas emissions and increasing energy efficiency) climate adaptation aims to adapt to unavoidable impacts of climate change (Birkmann et al., 2013; BMVBS, 2010).

[2] Informal instruments can support balancing the lack of flexibility of formal instruments, which is one reason why a combination of formal and informal instruments is recommendable in implementing climate adaptation measures.

Field of Action V – Regional Water Scarcity	
V.i	Preservation of water resources
V.ii	Endorsement of preservation and improvement of soil water balance
V.iii	Anticipatory management of highly water-consumptive land-uses
Field of Action VI – Changes in Tourism Behaviour	
VI.i	Determination of new tourism development areas
VI.ii	Protection of sites for tourism-related infrastructure
Field of Action VII – Displacement of Animal and Plant Habitats	
VII.i	Protection of a regional, functionally-connected network of ecologically important free spaces
VII.ii	Minimisation of further fragmentation of the landscape

Table 1 – Fields of Action and action foci for climate adaptation
(own depiction following Bavarian State Government, 2013; MKRO, 2013)

The legal validity of the designations within regional plans is the core element of the analysis, which allows the evaluation of the status quo and further potentials in climate adaptation. The legal validity is differentiated as follows: Aims of comprehensive spatial planning and designations of priority areas (Vorranggebiete) evolve a stronger legal validity as they are directly binding for any subsequent planning (and do not need to become subject to a weighting process). Due to the strong legal validity, aims and priority areas are evaluated with an implementation rate of 100%. Guiding principles of spatial planning and designations of restricted areas (Vorbehaltsgebiete) evolve weaker legal validity as they remain subject to weighting, which is why they are evaluated with an implementation rate of 50%[1]. The total implementation rate of a planning region results from the normalisation of the addition of the implementation rates of all action foci relevant for the region[2]. The normalization allows the comparison of planning regions with different number of relevant Fields of Action. Accordingly a planning region achieves an implementation rate of 100% if all action foci are designated as aims or priority areas6 (Schmitt, 2014).

The analysis incorporates all German regional plans that were in force on the reporting date 30. June 2014. This also includes regional plans that were temporarily invalid[3] as well as segmented plans that were not yet integrated in comprehensive regional plans. However, preparatory regional plans or amendments that were not yet adopted are neglected. Furthermore, special types of planning regions are not taken into account, as comparability cannot be provided. This applies to the city states of Berlin, Bremen and Bremerhaven, Hamburg, the Federal State Saarland, municipalities of Lower Saxony and the city region Ruhr. All in all, the analysis comprises 111 regional plans (Schmitt, 2016).

3 STATUS QUO IN REGIONAL CLIMATE ADAPTATION IN GERMANY

Figure 1 illustrates the strong heterogeneity in the implementation levels of adaptation-relevant designations in Germany's regional plans. Apart from two planning regions in Lower Saxony (temporarily invalid) and the planning regions of Brandenburg (solely segmented plans), all planning regions reveal a status quo of more than 20% in regional climate adaptation. However, only one planning region in Bavaria achieves more than 80%. On average, German regional plans achieve an implementation rate of 52.71% regarding adaptation-relevant designations (reporting date 30. June 2014).

[1] Although the classification of a designation's legal validity is a simplification of the actual effectiveness of aims and guiding principles, the approach allows for quantification and systematisation of the research results. for the regionfor the regionfor the regionfor the regionfor the region

[2] However, an assessment on whether it is appropriate for an individual planning region to solely designate aims and priority areas cannot be provided and lags behind the aim of a Germany-wide analysis.

[3] According to the Regional Planning Act of Lower Saxony (Niedersächsisches Landesraumordnungsgesetz, NROG), planning regions are obligated to assess the need for amendment or updating of regional plans according to § 5 (7) NROG. If the regions do not attend this obligation, plans become temporally invalid until updating is completed.

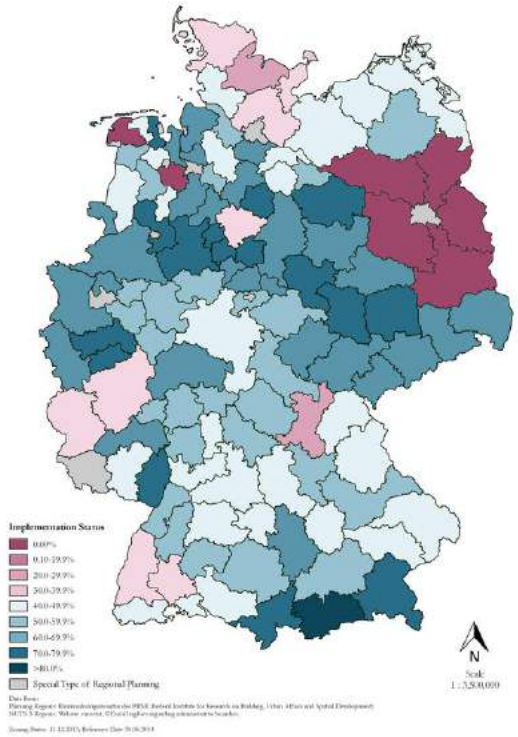


Figure 1 – Status quo of adaptation-relevant implementations in regional plans in Germany (own depiction following Schmitt, 2016)

Table 2 depicts the implementation rate of adaptation-relevant designations for each Field of Action of the MKRO concept. There are large differences between the Fields of Action that range from nearly 90% implementation rate in Fields of Action IV and VII to solely 16.0% in Field of Action III.

	FoA I	FoA II	FoA III	FoA IV	FoA V	FoA VI	FoA VII
	Flood Protection in River Areas	*Coastal Protection*	*Protection of Mountainous Areas (esp. Alpine Region)*	*Protection from Heat in Settlement Areas*	*Regional Water Scarcity*	*Changes in Tourism Behaviour*	*Displacement of Animal and Plant Habitats*
Implementation Rate	43.6%	18.2%	16.0%	88.5%	44.3%	52.5%	89.5%

Table 2 – Implementation rate per Field of Action (own depiction following Schmitt, 2016)

An explanatory approach for the differences between the Fields of Action is that the action foci of Fields of Action IV and VII, which achieve the highest implementation rates, lie within the core task of spatial planning according to § 8 (5) ROG, i.e. settlement development, preservation of free space and infrastructure development (see e.g. IV.ii and VII.i). The high implementation rates in both Fields of Action are achieved mostly indirectly, e.g. through securing regional green corridors rather than by direct addressing climate adaptation. In contrast, the Fields of Action II and III traditionally lie within the responsibilities of sectoral planning and do not yet seem to be addressed in formal regional plans (Schmitt, 2016). In the following, Fields of Action II and III are investigated in more detail.

3.1 FIELD OF ACTION II – COASTAL PROTECTION

Field of Action II – Coastal Protection covers flood protection from storm surges on the one hand and the prevention of coastal degeneration through erosion on the other hand. The contents of this MKRO Field of Action shall supplement the (informal) Integrated Coastal Management as introduced by the European Commission (European Commission, 2016). Germany has an Integrated Coastal Management (Integriertes Küstenzonenmanagement, IKZM) since 2006, which already complements the formal sectoral plans (BMUB, 2006).

3.1.1 CLIMATIC AND SPATIAL-PLANNING RELEVANCE

The most important climate-change related variables in coastal areas are the rise of the sea level, frequency and magnitude of storm surges and swell. As a result of the expected rise of the sea level, a stronger hydrodynamic load as well as an increasing coastal erosion are to be expected. However, the extend of these impacts is highly uncertain (MKRO, 2013). Secondary consequences of the sea level rise may be flooding of insufficiently protected areas, the need for larger (technical) effort for coastal protection measures as well as land-loss due to erosion. Additionally, the increase in extreme precipitation, which leads to larger runoff, the average rise in temperature, which may lead to intensified tourism in coastal areas, as well as the increase of nutrients and pollutants into the coastal sea are results of climatic changes (BMVBS and BBSR, 2013).

The spatial-planning relevance of Field of Action II presents in the fact that the protection from storm surges and erosion are indispensable prerequisites for settlement development in coastal areas, as both reduce the damage potential. Coastal protection is a matter of land preservation and accordingly lies within the responsibilities of spatial planning. Regional planning can contribute to protection from flooding and erosion in particular through active and passive coastal protection measures as well as through the coordination of land-use demands in coastal areas (MKRO, 2013; BMVBS and BBSR, 2013). The most essential regional planning instrument for avoiding damages is the management of land uses through designations in regional plans.

The MKRO identifies five action foci for Field of Action II – Coastal Protection:

- II.i – Complementary risk minimisation in storm-surge protected coastal areas
- II.ii – Risk minimisation in insufficiently storm-surge protected coastal areas
- II.iii – Preservation of buffer zones (building development prohibited) in areas of unprotected coastal erosion
- II.iv – Protection of areas for clay and marine sand extraction for coastal protection purposes
- II.v – Preservation of areas in embankment foreland and hinterland (MKRO, 2013)

3.1.2 EXISTING APPROACHES AND MODEL DESIGNATIONS

The designation of coastal protection measures in regional plans strongly depends on the accuracy of climate change projections and their spatial resolution. Therefore, both an assessment of the current situation (detection of areas endangered by storm surges and erosion) as well as the integration of present and future sensitivities and impacts is necessary. Only then, appropriate measures can be identified and implemented, which are liable with respect to competing land-use demands.

Measures of preventive coastal protection can generally be classified as suitable if they are of flexible and extendable character. Good examples are temporal land-uses as well as temporally compatible, revisable land-uses in buffer zones. The designation of restrictive covenants in especially risky areas (e.g. low-lying areas) can also be an adequate measure. In addition, spatial planning can contribute to the sensitisation and information of population through designation of flood-prone coastal areas and thereby gives incentive for private risk protection (MKRO, 2013; BMVBS and BBSR, 2013). The following designations are suggested by the MKRO and were used for the analysis of regional plans (see Tab. 3)

Action Focus	Model Designations
II.i Complementary risk minimisation in storm-surge protected coastal areas	Complementary risk minimisation in storm-surge protected coastal areas may be carried out using text or designations in maps, e.g. by assumption of risk-prone areas according to flood risk maps of EU FRMD. • Designation of risk areas • Rebuilding of roads to higher elevation (dikes) in order to improve accessibility of potential dike damages and for building polders for further protection • Covenants on use for particularly low-lying areas (potential longer and deeper inundation); e.g. through restrictive covenant

II.ii Risk minimisation in insufficiently storm-surge protected coastal areas	• Designation of restricted areas for development of buildings, infrastructure and other land-uses without additional protection from storm surges
II.iii Preservation of buffer zones (building development prohibited) in areas of unprotected coastal erosion	• Designation of priority areas for buffer zones (safety distances) in erosive coastal areas • Designation of priority or restricted areas for permitted land-uses in erosive coastal areas • Designation of land-uses securing free space, e.g. priority and restricted areas for nature and landscape In addition, temporal, compatible and revisable land-uses may be permitted in buffer zones.
II.iv Protection of areas for clay and marine sand extraction for coastal protection purposes	• Designation of priority and restricted areas for the protection of clay extraction sites in embankment foreland and dike-protected coastal marshland • Designation of priority and restricted areas for the protection of clay extraction sites in embankment foreland
II.v Preservation of areas in embankment foreland and hinterland	• Designation of priority and restricted areas for coastal protection planning in front of and behind coastal protection facilities as well as for the exclusion or restriction of other land-use demands (e.g. settlement, tourism, nature protection)

Table 3 – Model designations for Field of Action II – Coastal Protection
(own depiction following MKRO, 2013; BMVBS and BBSR, 2013)

3.1.3 RESEARCH RESULTS FOR COASTAL PROTECTION

For the analysis of Field of Action II, it was insufficient to solely address planning regions adjacent to the sea, as e.g. coastal protection facilities (action focus II.v) may present in form of a second dike line in the hinterlands. Also, clay extraction points (action focus II.iv) are usually located in the coastal marshes (MKRO, 2013; BGR, 2008). For this reason, flood risk maps according to the EU Flood Risk Management Directive (FRMD) were used for identifying planning regions for which Field of Action II is of relevance. According to the EU FRMD and the German Federal Water Act (Wasserhaushaltsgesetz, WHG) flood risk maps were to be prepared also for coastal areas by 31. December 2013 and were analysed for the planning regions of the federal states of Mecklenburg-Western Pomerania, Lower Saxony and Schleswig-Holstein[1] (Schmitt, 2014).

The analysis comprises 23 coastal regions. Eight of the 23 regions do not provide any designation regarding coastal protection in their regional plans. On average, only one out of the five action foci is implemented by the coastal regions (see Fig. 2).

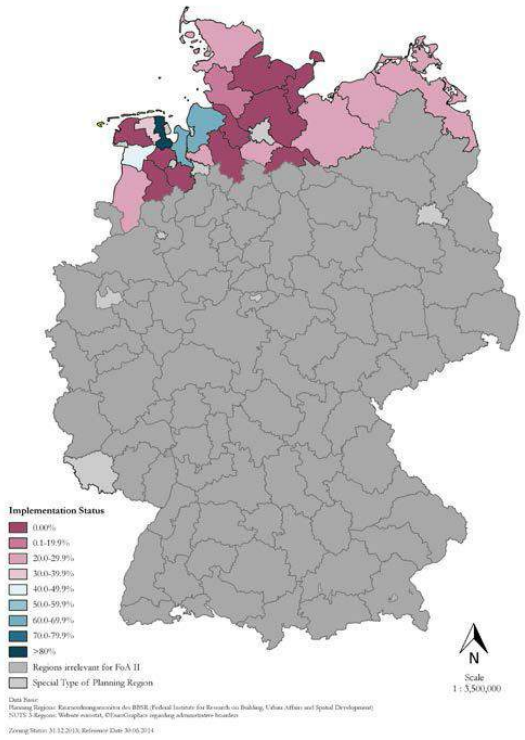


Figure 2 – Status quo of implementations in Field of Action II (own depiction following Schmitt, 2016)

[1] The city states Hamburg and Bremen are also 'coastal areas' but are not considered in the analysis as both are special types of planning regions.

There is great variation among the five action foci of Field of Action II. While action focus II.i (Complementary risk minimisation in storm-surge protected coastal areas) is covered by more than half of the planning regions, mainly as a guiding principle, only one region covers action focus II.ii (Risk minimisation in insufficiently storm-surge protected coastal areas). Designations regarding marine sand extraction for coastal protection purposes, as a part of action focus II.iv, are – so far – non-existent in Germany's regional plans.

A comparison of the federal states shows that Schleswig-Holstein has by far the least designations regarding coastal protection, which is, amongst others, subject to the following critical reflection of the research results. The planning region with the most designations in Field of Action II is Friesland, located in Lower Saxony (see Fig. 2).

3.1.4 REFLECTION AND FURTHER ADAPTATION POTENTIAL

In previous studies, e.g. by the Federal Ministry of Transport, Building and Urban Development (2010), coastal protection was understood to be relevant only for planning regions with a coastline. This analysis uses the EU FRMD flood risk maps as the basis for determining the Field of Actions' relevance for planning regions, i.e. also includes planning regions in the hinterlands. But as all regional plans relevant for Field of Action II entered into force before the deadline for flood risk map implementation, none of the plans uses the advanced definition, which is why especially the hinterland regions achieve poor results in the analysis. Accordingly, the long continuance of regional plans as well as the elaborate perpetuation process seem to be reasons why amendments are not implemented in shorter time. It can be assumed that with the next perpetuation of regional plans, coastal protection (as subject to the EU FRMD) will be integrated also in regional plans of the hinterlands.

Regarding action focus II.iii – Preservation of buffer zones in areas of unprotected coastal erosion, the research results need to be corrected in retrospective, as this action focus is only of relevance for planning regions with coastlines. Accordingly, the analysis results are slightly negatively biased, as II.iii is relevant only for 15 instead of 23 planning regions.

Furthermore, currently sectoral planning seems to cover more adaptation-relevant implementations than comprehensive spatial planning. Mecklenburg-Western Pomerania and Lower Saxony have a 'Coastal and Flood Protection Plan' (Generalplan Küsten- und Hochwasserschutz), which covers all of the action foci of the MKRO concept. Schleswig-Holstein also has a 'Coastal Protection Plan', which contains sectoral development aims that simultaneously serve as aims for comprehensive regional planning (Ministry of the Interior Schleswig-Holstein, 2010). This seems to be the major reason, why the federal state shows the least implementation rate within Field of Action II. However, the 'Coastal Protection Plan' determines that the sectoral aims need to be further concretised in regional plans, e.g. regarding individual coastal protection measures and dike lines, which is currently missing in the regional plans, as the analysis proves.

Further adaptation potential can especially be seen in action focus II.ii – Risk minimisation in insufficiently storm-surge protected coastal areas, as so far this action focus is subject to only one of the regional plans. However, as uncertainties are risk-immanent, the management of risks is a challenging task which deserves to get more attention; not only in Field of Action II – Coastal Protection.

Concluding, the lack of integration of designations in sectoral plans into formal regional plans hints at a lack of cooperation between sectoral and comprehensive planning, which leaves room for further improvement. Additionally, there is a need for revision of coastal protection strategies and measures in order to allow adaptation to climate-change induced impacts (MKRO, 2013). In summary, the results of the analysis remain plausible since the (informal and sectoral) instruments and strategies that exist in coastal protection in Germany have so far been widely disregarded in the regional plans (Schmitt, 2014).

3.2 FIELD OF ACTION III – PROTECTION OF MOUNTAINOUS AREAS

Field of Action III – Protection of Mountainous Areas (especially Alpine Region) addresses the climate-change induced change in hazard potential in mountainous areas as well as the handling of geogenic hazards.

3.2.1 CLIMATIC AND SPATIAL-PLANNING RELEVANCE

Strong climate change impacts are to be expected for mountainous areas in Germany, particularly in the Alpine region. An above-average temperature rise is projected, which is accompanied by an increase in the average annual temperature, an increase in winter half-year temperatures, as well as an increase in days with maximum temperatures above 30°C. Warming is accompanied by a decrease in permanent and partial frost days, a decrease in snow safety for winter sports areas and a significant degeneration of glaciers. In consequence, an upward shift of the vegetation zones and adverse effects on the alpine flora and fauna are to be expected. In addition, an increase in the frequency and magnitude of severe precipitation and thus an increased flood risk is predicted. Severe precipitation can moreover lead to a change in geogenic hazards such as rockfall, mud slides and avalanches (MKRO, 2013; BMVBS and BBSR, 2013). According to the Bavarian Environmental Agency, the following natural hazards are of particular relevance in mountain areas: flood, subrosion (eluviation, leading to sinkholes and subsidence) and karsting, soil deformation (subsidence/uplift) and mass movements (Bavarian Environment State Office, 2014).

These geogenic hazards call for a supra-local and comprehensive management capable of respecting the spatial diversity of mountainous areas, which is why Field of Action III is spatial-planning relevant (BMVBS and BBSR, 2013). Mountain areas are both ecosystems, as well as living, cultural and economic areas. Regional planning can in particular influence the protection of the population against natural hazards. It is also capable of influencing the economic (especially touristic) and settlement-related development possibilities (MKRO, 2013; Federal Government, 2008).

In contrast to the other Fields of Action, the MKRO concept does not contain action foci for Field of Action III, but refers to the contents of the 'Alpine Plan' (Alpenplan), which has been part of the Bavarian Regional Development Programme (Landesentwicklungsprogramm, LEPro) since 1972 and serves as the major instrument for the development of the Alpine region. The following action foci were derived from the ‘Alpine Plan’ and used to analyse the regional plans in mountainous areas:

- III.i Preservation/Restoration of the protective functions of mountain forest
- III.ii Protection from natural (mountain) hazards
- III.iii Protection and development of mountain areas as living, economic and touristic areas (Bavarian State Government, 2013).

3.2.2 EXISTING APPROACHES AND MODEL DESIGNATIONS

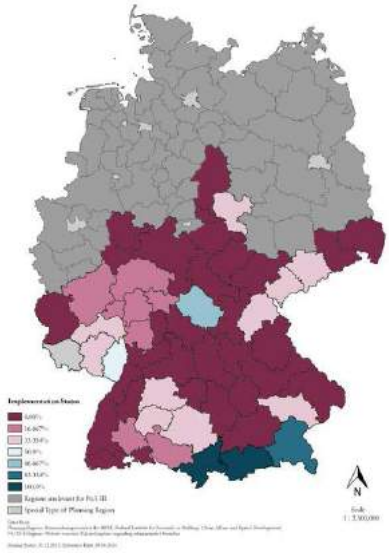
The Federal Geological Service (Staalicher Geologischer Dienst, SGD), respectively State Offices, can provide hazard maps on geogenic natural hazards for regional planning. Although these maps do not contain statements on the probability of ocurrence and the damage potential of natural hazards, they may serve to identify the spatial extent of potential hazards (Bavarian Environment State Office, 2014). Furthermore, sectoral planning devisions can usually provide hazard maps or management plans (e.g. avalanche maps) (MKRO, 2013). Tsectoral planning devisions can usually provide hazard maps or management plans (e.g. avalanche maps) (MKRO, 2013). Tsectoral planning devisions can usually provide hazard maps or management plans (e.g. avalanche maps) (MKRO, 2013). T he following designations are suggested within the ‘Alpine Plan’ by the Bavarian State Government and were used as criteria for the analysis (see Tab. 4).

Action Focus	Model Designations
III.i Preservation/Restoration of the protective functions of mountain forests	• Designation of priority and restricted areas for securing mountain forests and their protective functions[9]
III.ii Protection from natural (mountain) hazards	Designations for preservation of areas prone to mountain hazards, e.g. by • Designation of priority and restricted areas of protective forest (for minimising alpine hazard potentials, especially avalanches, rockfall and mud slides)[10]
III.iii Protection and development of mountain areas as living, economic and touristic areas	Designations for securing and development of special functions (settlement, economy, tourism) of mountainous areas

Table 4 – Model designations for Field of Action III – Protection of Mountainous Areas (own depiction following MKRO, 2013; BMVBS and BBSR, 2013) [12]

3.2.3 RESEARCH RESULTS FOR THE PROTECTION OF MOUNTAINOUS AREAS

The identification of planning regions for which Field of Action III – Protection of Mountainous Areas (esp. Alpine Regions) is relevant, is ambiguous. First, the three German alpine regions are considered, as indicated by the title of the Field of Action. However, since all action foci are equally relevant for the German low mountain ranges, all planning regions with an altitude of at least 500 meters are analysed.



Accordingly, Germany has three Alpine regions and 47 low mountain range regions (see Fig. 3). While the regional plans of the three Alpine regions reveal aims and priority areas for (nearly) all action foci, more than half of the remaining mountainous regions currently do not consider any action focus of Field of Action III. In total, 28 of the 50 mountainous regions do not provide any designations in their regional plans concerning Field of Action III.

Figure 3 – Status quo of implementations in Field of Action III (own depiction following Schmitt, 2016)

With 16.0% Field of Action III shows the lowest implementation rate of all MKRO Fields of Action. The comparison of implementation rates of the three action foci within Field of Action III shows, that action focus III.i – Preservation/Restauration of the protective functions of mountain forest is designated most often, while III.ii – Protection from natural (mountain) hazards is designated least often.

3.2.4 REFLECTION AND FURTHER ADAPTATION POTENTIAL

One explanatory approach for the low overall implementation rate in Field of Action III can be seen in the relatively broad definition of mountainous areas (existence of mountains with an altitude of at least 500 metres), which can, nonetheless, be considered appropriate as negative impacts of climate change can also be expected for low mountain ranges (Schmitt, 2014). In the light of increasing climate change-related

[1] Guiding Principle 2.3.2 LEPro Bavaria: “Forests and their protective functions together with the cultivation of the cultural landscape shall be secured in the Alpine regions, in particular through agriculture and forestry.”
[2] Guiding Principle 2.3.3 LEPro Bavaria: “The Alpine region shall be sustainably developed, structured and secured so that a) the diversity, character and beauty of its landscapes as well as the natural diversity of its wild living animal and plant species are preserved by securing and developing their habitats and sustaining their network b) its functions as cross-border areas for living, recreation, economy and transport are secured while respecting its importance as natural and cultural areas of European importance, c) alpine hazards are minimised.

risks, the need for dealing with challenges for mountainous areas in regional plans becomes even more urgent.

A reason why action focus III.i – Preservation/Restoration of the protective functions of mountain forest is designated most often is § 12 of the Federal Forest Act (Bundeswaldgesetz, BWaldG). The BWaldG states that “the designation of protected forest particularly comes into consideration for the protection against adverse environmental effects […], erosion by water and wind, drying up of soil, harmful surface runoff and avalanches.” (§ 12 sect. 2)

The key challenge in Field of Action III seems to be that currently there are no established formal regional planning instruments. If at all, informal instruments are used for the protection of mountainous areas (e.g. regional management). Generally speaking, the use of informal instruments is an important approach in dealing with mountainous areas in the light of climate change. Regional management initiatives and risk governance processes can e.g. contribute to an increase in risk awareness, better risk communication and the implementation of risk concepts (MKRO, 2013). However, the analysis shows that there is great remaining potential and need for implementation also within formal instruments, especially regarding action focus III.ii – Protection from natural (mountain) hazards.

4 CONCLUSION

The analysis represents the current status quo in implementation of climate adaptation in (formal) regional planning and demonstrates remaining adaptation potentials. It becomes clear that regional planning has a “profound knowledge” (BMVBS, 2010, p. 79) regarding climate adaptation but most often lacks a direct implementation within regional plans. The analysis shows that there are great differences in the implementation rates of the MKRO Fields of Action. Those Fields of Actions, that achieve a high implementation rate, lie mostly within the key responsibilities of spatial planning, as e.g. the management of settlement and infrastructure development. On the other hand, especially in the two Fields of Action with the lowest implementation rates (Coastal Protection and Protection of Mountainous Areas) there are planning regions that do not address relevant action foci within regional plans at all, which hints at a lack of awareness of comprehensive spatial planning for these tasks.

Both examples reveal further adaptation potential: In Fields of Action that currently address climate adaptation rather indirectly, the importance of climate change needs to be stressed so that climate adaptation can soon serve as the justification for regional planning actions. In Fields of Action that are currently barely addressed by regional planning, the cooperation between sectoral and comprehensive planning needs to be strengthened and perpetuation procedures need to be enhanced. Therefore, further adaptation potentials cannot only be seen in raising the implementation rates for each action focus alone but in additionally strengthening the relevance of climate adaptation in regional planning so that it is perceived and handled as an independent action requirement (Schmitt, 2016).

BIBLIOGRAPHIC REFERENCES

Academy for Spatial Research and Planning [ARL] (2005). Handwörterbuch der Raumordnung (4th ed.). Langenhagen: VBS Verlagsservice Braunschweig GmbH.

Academy for Spatial Research and Planning [ARL] (2013). Raumentwicklung im Klimawandel – Herausforderungen für die räumliche Planung. Forschungsberichte der ARL (2). Hannover.

Bavarian Environment State Office (2014). GeoFachdatenAtlas (Bodeninformationssystem Bayern). Abfrage Georisiken Berchtesgadener Land. Retrieved from https://www.lfu.bayern.de/umwelt daten/kartendien ste/umweltatlas/hinweis_gfa/index.htm?role=bis, last updated 2016, accessed 31.05.2017.

Bavarian State Government (2013). Landesentwicklungsprogramm Bayern. Retrieved from https://www.landesentwicklung-bayern.de/fileadmin/user_upload/landesentwicklung/Bilder/Instru mente /Landesentwicklungsprogramm_Bayern.pdf, last updated 22.08.2013, accessed 31.05.2017.

Birkmann, J., Böhm, H.R., Buchholz, F., Büscher, D., Daschkeit, A., Ebert, S., Fleischhauer, M., Frommer, B., Köhler, S., Kufeld, W., Lenz, S., Overbeck, G., Schanze, J., Schlipf, S., Sommerfeldt, P., Stock, M., Vollmer, M., Walkenhorst, O. (2013). Glossar Klimawandel und Raumentwicklung (2nd ed.). Hannover.

Conference of Ministers on Spatial Planning [MKRO] (2013). Umlaufbeschluss Raumordnung und Klimawandel. Handlungskonzept der Raumordnung zu Vermeidungs-, Minderungs- und Anpassungsstrategien im Hinblick auf die räumlichen Konsequenzen des Klimawandels. Retrieved from http://www.klimamoro.de/fileadmin/Dateien/Transfer_KlimaMORO/Beratungsmodul/Leitf%C3%A4den/Leitf%C3%A4den%20mit%20Ma%C3%9Fnahmenvorschl%C3%A4gen%20in%20relevanten%20Handlungsfeldern/MKRO-Handlungskonzept%20der%20Raumordnung%20.pdf, last updated 06.02.2013, accessed 31.05.2017.

Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks [EU Flood Risk Management Directive].

European Commission (2016). Integrated Coastal Management. Retrieved from http://ec.europa.eu/environment /iczm/index_en.htm, last updated 08.06.2016, accessed 30.05.2017.

Federal Forest Act [BWaldG]. Gesetz zur Erhaltung des Waldes und zur Förderung der Forstwirtschaft (Bundeswaldgesetz) in der Fassung der Bekanntmachung vom 2. Mai 1975 (BGBl. I S. 1037), zuletzt geändert durch das Gesetz vom 31. Juli 2010 (BGBl. I S. 1050).

Federal Government (2008). Deutsche Anpassungsstrategie an den Klimawandel. Vom Bundeskabinett am 17. Dezember 2008 beschlossen. Retrieved from http://www.bmub.bund.de/fileadmin/bmu-import/files/pdfs/allgemein/application/pdf/das_gesamt_bf.pdf, last updated 17.12.2008, accessed 31.05.2017.

Federal Institute for Geosciences and Natural Ressources [BGR] (2008). Bodenübersichtskarte der Bundesrepublik Deutschland 1 : 5000000 (BÜK5000). Retrieved from https://www.bgr.bund.de/DE/Themen/Boden/Informationsgrundlagen/Bodenkundliche_Karten_Datenbanken/BUEK_2000_3000_5000/BUEK5000/buek5000_node.html, last updated 2008, accessed 31.05.2017.

Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety [BMUB] (2006). Integriertes Küstenzonenmanagement in Deutschland. Nationale Strategie für ein integriertes Küstenzonenmanagement. Bestandsaufnahme, Stand 2006. Bonn.

Federal Ministry of Transport and Digital Infrastructure [BMVBS] (2009). Entwurf eines regionalen Handlungs- und Aktionsrahmens Klimaanpassung („Blaupause“) - Ein Zwischenergebnis der Vorstudie für Modellvorhaben zu Raumentwicklungsstrategien zum Klimawandel. BBSR-Online-Publikation, 17/2009.

Federal Ministry of Transport and Digital Infrastructure [BMVBS] (2010). Klimawandel als Handlungsfeld der Raumordnung - Ergebnisse der Vorstudie zu den Modellvorhaben „Raumentwicklungsstrategien zum Klimawandel“. Schriftenreihe Forschungen, Heft 144. Bonn: Bundesamt für Bauwesen und Raumordnung.

Federal Ministry of Transport and Digital Infrastructure & Federal Institute for Research on Building, Urban Affairs and Spatial Development [BMVBS and BBSR] (2011). Querschnittsauswertung von Status quo Aktivitäten der Länder und Regionen zum Klimawandel. BMVBS-Online-Publikation 17/2011.

Federal Ministry of Transport and Digital Infrastructure & Federal Institute for Research on Building, Urban Affairs and Spatial Development [BMVBS and BBSR] (2013). Methodenhandbuch zur regionalen Klimafolgenbewertung in der räumlichen Planung - Systematisierung der Grundlagen regionalplanerischer Klimafolgenbewertung. Berlin/Bonn.

Federal Planning Act [ROG]. Raumordnungsgesetz in der Fassung der Bekanntmachung vom 22. Dezember 2008 (BGBI. I S. 2986), zuletzt geändert durch Artikel 9 des Gesetzes vom 31. Juli 2009 (BGBI. I S. 2585).

Federal Water Act [WHG]. Wasserhaushaltsgesetz in der Fassung der Bekanntmachung vom 31. Juli 2009 (BGBI. I S. 2585), zuletzt geändert durch Artikel 4 Absatz 76 des Gesetzes vom 7. August 2013 (BGBI. I S. 3154).

Ministry of the Interior Schleswig-Holstein (2010). Landesentwicklungsplan Schleswig-Holstein 2010. Kiel: hansadruck.

Regional Planning Act of Lower Sayony [NROG]. Niedersächsisches Raumordnungsgesetz in der Fassung der Bekanntmachung vom 18. Juli 2012 (Nds. GVBl. S. 252 - VORIS 23100 -), zuletzt geändert durch Artikel 1 des Gesetzes vom 25. Juni 2014 (Nds. GVBl. S. 168).

Schmitt, H.C. (2014). Analyse der Anpassungskapazität der Regionalplanung an den Klimawandel. Masterarbeit an der Technischen Universität Dortmund. Dortmund.

Schmitt, H.C. (2016). Klimaanpassung in der Regionalplanung - Eine deutschlandweite Analyse zum Implementationsstand klimaanpassungsrelevanter Regionalplaninhalte. Raumforschung und Raumordnung, 74(1), pp. 9-21.