

# Spatial sensitivity of national climate adaptation policies in Eastern-Central Europe

*First results of national comparative studies*

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## KEYWORDS

- spatiality
- climate change
- strategic planning
- adaptation policy
- strategic planning tools

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## ABSTRACT

There is a strong link between climate adaptation and the geographic space: climate change impacts differ from region to region, and its spatial consequences require appropriate, region-specific adaptation responses. It is important to plan these measures in a spatially conscious way and to monitor their effectiveness, spatially varying impacts and adaptation results. The question arises whether spatial/territorial characteristics are adequately taken into account in adaptation policy activities, especially at national level, which spatial scale has so far received less attention in the literature than the local level. To investigate this topic, a new concept of spatial sensitivity and its applicability in adaptation policy is introduced and its role and extent in national adaptation planning and MRE activities in European countries is analysed by the research. The aim of the paper is to provide a brief overview of the research results to date, including the methodological background. The paper concludes with the first empirical results of the analysis for the Eastern-Central European region: that adaptation policy and planning are growing in importance in many countries, but the related monitoring/assessment activities and the emergence of spatial considerations in these and in planning itself are still in their early stages.

*JEL-codes: Q5, Q54, Q58, R58*

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## KULCSSZAVAK

- területiség
- éghajlatváltozás
- stratégiai tervezés
- alkalmazkodási politika
- tervezési eszközök

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## ABSZTRAKT

**Nemzeti alkalmazkodási politikák klímaszemponú térérzékenysége Kelet-Közép-Európában. A nemzeti összehasonlító tanulmányok első eredményei.** | Az éghajlati alkalmazkodás és a földrajzi tér között szoros kapcsolat áll fenn: az éghajlatváltozás térségenként eltérő hatásokkal jelentkezik, térbeli következményei megfelelő, térségspecifikus alkalmazkodási válaszokat követelnek. Fontos feladat ezen intézkedések térben tudatos tervezése,

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valamint hatékonyságuk, a térben eltérő hatások és a helyileg eltérő alkalmazkodóképesség nyomon követése. Felmerül a kérdés, hogy a területi jellemzőket megfelelően figyelembe veszik-e az alkalmazkodási politikában, különösen nemzeti szinten, amely területi lépték eddig kisebb hangsúlyt kapott a helyi szinthez képest a szakirodalomban. A téma vizsgálatához egy új fogalom, a területi érzékenység fogalmát hozzuk létre, valamint annak alkalmazhatóságát, szerepét és mértékét elemezzük az európai országok nemzeti alkalmazkodási tervezési, monitoring és értékelési tevékenységeiben. A tanulmány célja, hogy rövid áttekintést adjon a kutatás eddigi eredményeiről, többek között a módszertani háttérrel. A tanulmány az elemzés első eredményeivel zárul a Kelet-Közép-európai régió kapcsán: az alkalmazkodási politika és tervezés súlya számos országban növekszik, de a kapcsolódó monitoring/értékelési tevékenységek és a térbeli szempontok megjelenése ezekben és magában a tervezésben még csak korai fázisban van.

*JEL-kód: Q5, Q54, Q58, R58*

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## **Introduction**

This study is the third part of a series of presentations/articles published in the framework of international conferences held by the Lámfalussy Faculty of the Sopron University. The first part presented a comprehensive literature review of European climate adaptation planning and monitoring/reporting/evaluation (MRE) activities (Sütő, 2023); suggesting that spatial viewpoints and special emphasis on geographical characteristics should be of key importance in the mentioned activities. The second study went through space interpretations and approaches of space-oriented disciplines and practical fields to create a new concept for spatial sensitivity in adaptation policy, as a basis for further empirical analyses (Sütő, 2024). According to these first two studies, it is clear that climate adaptation policy cannot be treated independently from the geographical space. Consequently, integration of geographical/spatial perspectives into adaptation policy activities are of key importance and raise the question: how and to what extent do these spatial considerations emerge in climate adaptation policy-related tools?

Climatic factors are ab ovo among the most important geographic endowments together with topographic, hydrographic, biogeographic or soil characteristics – they influence spatially different climate impacts and consequences. Several studies conclude that climate change and adaptation occur in the geographical space (Davidse et al., 2015; Sütő, 2023; Taylor, 2023). Planning and implementation of adaptation measures require adequate knowledge base about spatially different effects and search for regionally different adaptation responses. Spatially determined impacts are described often

by objective geographic dimensions, e.g. in the form of risk maps (Koks et al., 2014, Davidse et al., 2015). Climate risk and vulnerability assessments, as providers of these maps are basically spatial, monitoring relative spatial/territorial differences and indicating that spatial/territorial approach and the emphasis on geographical features, spatial differences play essential role in climate (adaptation) policy. Several Hungarian authors and articles deal with the methodological background of quantitative spatial climate vulnerability analyses (Pálvölgyi et al, 2010, Pálvölgyi et al, 2011) or assess the impact chain-based vulnerability of given sectors [e.g. Sütő & Fejes (2019, tourism), Pappné Vancsó et. al (2014, drought management), Pappné Vancsó et. al (2016, rural development), Uzzoli et. al (2019, human health), etc.].

Linkage between climate policy and spatial issues has started to be studied in the last two decades, but the total number of such literature-related items is still low. Majority of the few articles concentrates on mitigation [e.g. Gustaffson et al., 2009; McGloughlin & Sweeney, 2011; von Lucke, 2021]; or spatial/territorial differences and spatial specification in climate adaptation attitudes & awareness (e.g. Weckroth & Ala-Mantila, 2022, or from Hungary Bús et al., 2021, Bodor & Grünhut 2021, Kiss et al., 2021, Kiss et al, 2022). Directly adaptation's spatiality-focused articles are rare and rather case study-like (Jensen et al., 2013; Skryzhevskaja et al., 2015; Cobbinah & Adnaney (ed.), 2019; Berke et al., 2021; Yarnal., 2021). Larger proportion of the related studies concentrates on adaptation planning and MRE activities in general. These are studies from the grey literature (e.g. EEA, 2020; EEA, 2022), as technical reports introducing national level adaptation planning and MRE in Europe with the most crucial challenges and current processes. Beyond these evidence-base reports real scientific studies focused mostly on the regional (Heidrich et al, 2016; Wright et al, 2021; Ottaviani Aalmo, 2022; , Birchall et al, 2022) or the local level (Salvia et al, 2021 a; Salvia et al 2021 b; Reckien et al (2023). National level comprehensive studies are rare (e.g., Morgan et al, 2019; Woodroff & Regan, 2019; Leiter, 2021). Hungarian authors deals mostly with municipal or county level strategic analysis and planning in climate policy (e.g. Botos & Sütő, 2018; Kiss et al., 2018; Óvári et al, 2024).

Spatiality in adaptation is dealt with in a rather implicit form. Several authors deal with the role of geography as a spatial science in understanding climate change, climate adaptation and their spatiality (Randalls, 2017; Farbotko, 2018; Chang & Wi, 2018; Colven & Thomson, 2018; Taylor & O'Keefe, 2021); or analyse the role of adaptation and risk analysis in spatial

planning (Sapountzaki et al. 2010, Greiving & Schmidt-Thomé 2013, Storbjörk & Uggla, 2014). Others focus on the growing connection between urban planning and adaptation planning (Uittenbroek et Al., 2013; Birkmann et al, 2014; Burnette & Caldarice, 2018; Salamin, 2018) again others on the assessment of the relationship between environmental and climate policies and regional policy (Greiving & Fleischhauer, 2010 and 2012; Davidse et al., 2015, Weckroth & Ala-Mantila, 2022).

However, the importance of proper, spatially conscious adaptation planning, monitoring and evaluation; the role of spatial thinking and aspects do not appear directly in the reviewed literature items. Those few studies that concentrate on these spatial issues (Schuster, 2008; Swart et al, 2009; Greiving and Fleischhauer, 2010; Roggema, 2009; EEA, 2022) conclude that although some special characteristics/focuses can be identified in national adaptation strategies' situation analyses in the late 2000s – early 2010s, their addressed sectors and actions are quite similar. No geographical specificities are reflected neither by the objectives nor the type of actions of given national strategies (Swart et al, 2009; Greiving and Fleischhauer, 2010; EEA, 2022). These findings point unambiguously to the direction of a new research gap: the spatiality of adaptation policy instruments has not been studied in sufficient depth, especially at national level, from a scientific point of view (Sütő, 2023).

## **Objective of the article**

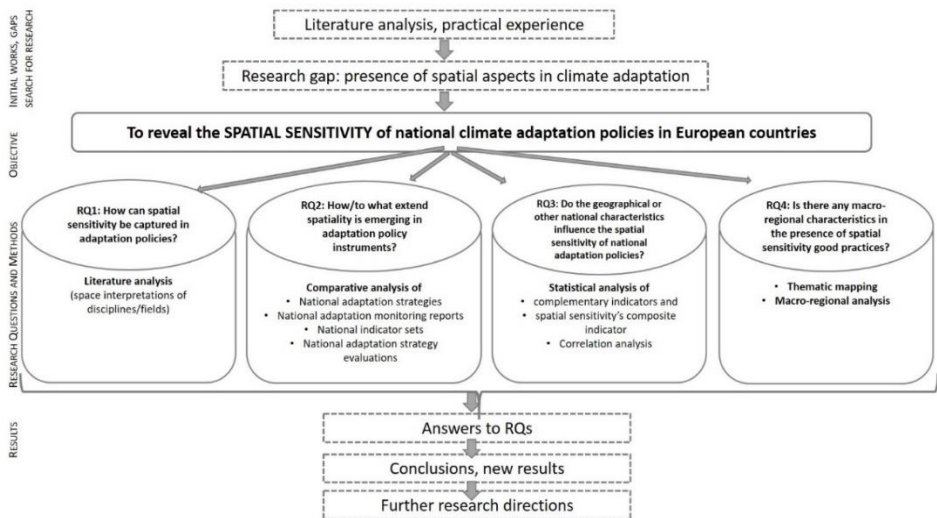
As we saw it, climate adaptation and spatiality are strongly related concepts: special climatic factors of geographical places determine the geographically / regionally different effects of climate change. Long- medium and short term changes of the climatic factors occur in the reality of space and show significant spatial diversity between the different geographical locations, resulting in spatially different climate change impacts and consequences. Policy responses to these challenges could be appropriate and effective if these spatial/territorial aspects/differences are taken into account properly. My wider research plans to increase the capabilities of climate adaptation policies and strengthen further their potentials to tackle the geographic reality of the present and future implications of climate change.

To respond to the research gap identified by the literature review, the importance of the geographical space and spatial elements in climate adaptation, the wider research is to reveal the sensitivity to spatial dimensions of

national climate adaptation policies in European countries. It aims at finding out whether climate adaptation, as a strongly geographical space-oriented area put significant weight on these matters or not. To reveal this spatial sensitivity of policies it analyses and evaluates the role and degree of spatial content and sensitivity to spatial dimensions in national climate adaptation policy planning and MRE instruments, providing aspects capable of measuring this spatial sensitivity. The article itself introduces the empirical results of the first analysed group of European countries, Eastern-Central Europe.

## Methodology

The essential element of the empirical work phase is the comparative document analysis, concentrating on existing national planning documents, such as national adaptation strategies (NAS), national adaptation programmes



**Figure 1: Structure and logic of the wider research.**

*Source: own editing.*

(NAP), action plans, evaluation and monitoring materials); monitoring and evaluation reports, indicator sets and MRE systems. In the centrum of the analyses are the NAS documents<sup>2</sup>. On the other hand, I also examine nati-

<sup>2</sup> Under the term NAS, similarly to Timo Leiter's 2021 analysis and using his umbrella definition, I understand national planning documents comprising both national adaptation

onal level monitoring methodological background documents, reports, evaluation concepts and products, indicator set descriptions elaborated or commissioned by national governmental organizations.

In countries having already implemented more than one adaptation planning cycle only those documents were analysed that are currently in force. Considering that adaptation is a relative new field (the community level strategic frameworks has been recently established and the national/regional/local regular planning cycles has begun only since the early 2010s in Europe) the research concentrates on the period of the last 1-1,5 decades, comparatively analysing results of the first MRE cycle.

In a third step, I try to identify the main influential factors of adaptation tools' spatial performance, through comparing the elaborated national spatial sensitivity composite indicators to other national social/economic/geographic/spatial administration-related indices. In the fourth step, macro regional determination is also sought in spatial sensitivity values of European national adaptation activities (*Figure 1*).

### ***The concept and model of spatial sensitivity***

To define the above-mentioned policy instruments' spatial content and the degree of spatiality within them, a new concept, namely spatial sensitivity of adaptation policy is introduced by the research. This model integrates the most important utilizable elements of the space interpretations and concepts of different scientific disciplines and practical fields into a complex definition as an appropriate basis for analysing spatiality's presence and weight in adaptation activities<sup>3</sup> (Sütő, 2024).

Summarizing the usability of approaches of the examined disciplines, we can draw the conclusions in the form of an indicative definition for spatiality / spatial sensitivity in adaptation policy (*Figure 2* visualises this). We –

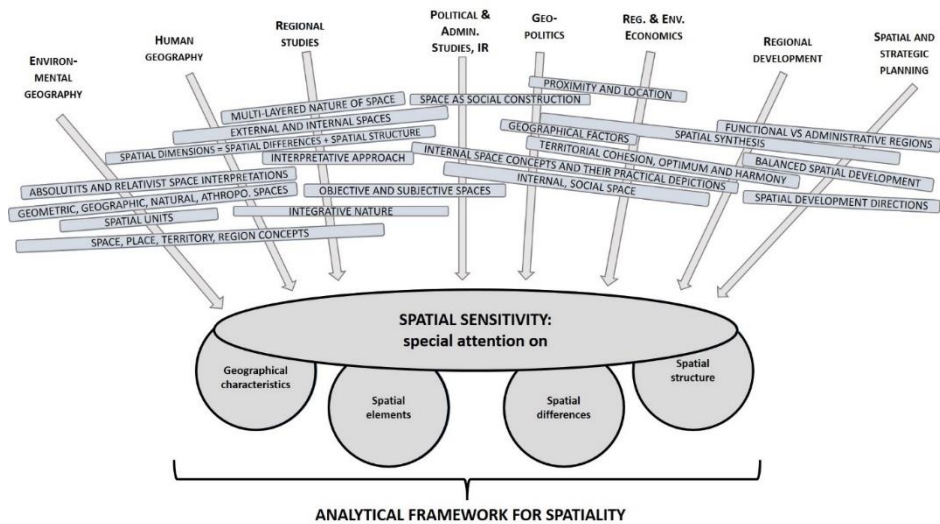
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plans and national adaptation strategies. These can be either documents covering both mitigation and adaptation or strategies concentrating only on adaptation.

<sup>3</sup> A wide variety of space interpretations of relevant disciplines and policy domains emerges before us. Out of these, the planned empirical analysis it concentrates mostly on absolute and objective space interpretations of natural sciences and environmental geography; on the relative approach of social and economic geography, regional geography, geopolitics, and regional studies; and on those disciplines that focus on (mostly internal) space concepts implicitly (political and administrative studies, and partly even the regional studies). On top of these even some practical fields' (regional development policy, strategic spatial and land use planning) spatial approaches and related concepts were also examined.

at least during this research – understand under the term “spatiality in policy activities” the conscious, constant and consequent taking of external and internal spatial elements and their characteristics, territorial/spatial differences, and spatial order into consideration within the absolute or relative space and the place-based approach in the examined activities, namely planning and MRE.

Consequently, we consider an adaptation policy activity spatially conscious/sensitive if it puts significant weight on these spatial aspects/dimensions both in their evidence seeking phases, during decision making (vision and objective planning and elaboration of measures), setting up indicator sets and conducting evaluations or establishing decision supporting systems. If these aspects are at least equal with the weight of the traditional sectoral approach (separated handling of different thematic fields parallel with each other) or even dominate it, then can we talk about a spatially oriented approach, or spatial sensitivity of these activities.



**Figure 2: Main sources of the concept of adaptation’s spatial sensitivity in the research.**

*Source: own editing.*

### *Delimitation of the analysed area*

The geographical framework of the wider research is primarily Europe. More exactly the majority of the continent's countries (all EU countries + EEA states, completing the list with Western-Balkan states as countries that strongly strive for EU accession). From the former Central-European socialist bloc and Soviet successor states, I focus rather on the former group and leave the second out of the analysis due to their lesser focus on climate policy-related topics and the even more "low-priority development policy field" status of adaptation. The only exceptions are the Baltic states, which region, due to their historical and social roots are closer to the Central-European region than to the former Soviet-Union. The mini states (Lichtenstein, the Vatican, Andorra, Monaco, San Marino, with the exception of Luxemburg, which is somewhat bigger than the others) were also left out, because the main topic of the research, spatiality and spatial differences cannot be adequately interpreted at national level in such small countries.

During the analysis of spatial sensitivity of European national adaptation policies, an interesting issue is whether this spatial sensitivity is depending on the macro regional location of a given European country or not. To answer this question European macro regions must be delimited in the research. Grouping the analysed European countries this way, as a practical side effect, we also can split the empirical work phase into different sections, the first of which is concentrating on the topic of this article, Eastern-Central Europe.

The most frequent type of macro regions in the different books/articles are basically the traditional North/West/South Europe division, completed with Eastern Europe. The first three regions' delimitation is more or less clear and similar group of countries are classified into these regions in the different works, meanwhile the latter's is a bit tricky. Probáld after having overviewed the several nomenclatures, delimitations and the social, economic and geographic characteristics of European countries, grouped the states into 5 main regions (Western, Southern, Northern Europe and Eastern Europe and the Baltic states). The fourth group was split into 2 additional subgroups: Western-Central and Eastern-Central Europe. Regarding the latter Probáld said it comprises the Eastern part of Central- and South-Europe (the Balkan Peninsula without Greece) (Probáld et al., 2000). Similarly, Illés also collected the different history-, ethnography-, politics- and economics-oriented Eastern- and Central-European delimitations, especially emphasising the role of politics. He mentioned that some concepts even differentiate a third region between East and West, an area with special geopolitical position and unique

strategic challenges<sup>4</sup>. After 1990, the ex-satellite states of the Soviet Union compose this group, which countries often emphasised their differences from Balkan states then. (Illés, 2002).

If we are looking for practice-oriented delimitations, approaches of EU-level strategic documents/regional policy tools can be mentioned. The 2011 Territorial State and Perspectives of the European Union (TSP) document<sup>5</sup>, as the background document of the then actual Territorial Agenda of the EU dedicated an individual chapter for the spatial potentials and challenges of Europe, presenting Europe's four main macro regions facing special challenges (Figure 3). Beside Western, Southern and Northern Europe, the Eastern part of Central-Europe („the Central-Eastern”) was also identified. It included most of the then new (post-2004) EU Member States<sup>6</sup> (TSP, 2011).

The EU's regional development policy has dealt with European macro regions since the middle of the 2000s (Illés, 2002). In the current programming period, transnational cooperation, coordinated by the Interreg B programme, allows for collaboration over larger transnational territories or around sea basins<sup>7</sup> promoting better cooperation across countries within the designated regions. Out of the current 12 macro regions, the Central, the South-east and the Danube regions cover roughly the territory of Eastern-Central-Europe (ec.europe.eu).

The most up-to-date delimitation is that of the first European Climate Risk Assessment Report (EUCRA) that supports the identification of adaptation-related policy priorities. The EUCRA considers four subcontinental

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<sup>4</sup> One group of this approaches focuses on “Central-Europe” based on the German “Mitteleuropa” concept, under which they initially understood the eastern territories inhabited by German population, later the territories of the German and Austro-Hungarian empires, depicting the German orientation of Central Europe. The other main subgroup is called “Zwischeneuropa” or “In-between-Europe” concepts. These have weaker historical but stronger geopolitical roots. The essence of the idea strived for counterweighing the influence of German and Russian dominancy. The creation French-based cordon sanitaire of Petite Entente states after 1918 is a good example for this.

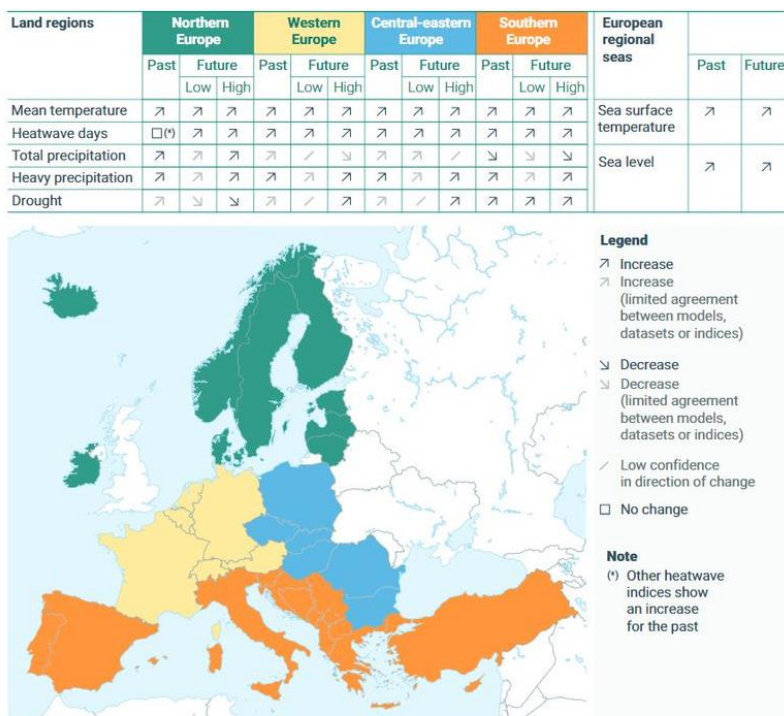
<sup>5</sup> Presented at the Informal Meeting of Ministers responsible for Spatial Planning and Territorial Development on 19<sup>th</sup> May 2011 Gödöllő, Hungary

<sup>6</sup> Regarding their characteristics, similar features emerged than in the studies of Probáld and Illés, completed with demographic, economic and settlement network-related development endowments.

<sup>7</sup> In some programmes, even non-EU countries (third countries such as Iceland or Lichtenstein), enlargement and neighbourhood partner countries, and OCTs (The Overseas Countries and Territories) are also involved, with the aim of achieving stronger territorial integration.

regions (see *Figure 3*). The Baltic states in this delimitation belong to Northern Europe and all the West-Balkan to Southern Europe, otherwise the logic follow those of the above introduced ones (EEA, 2024).

Eastern-Central Europe, as we experience, is among the vulnerable parts of the continent. In the region highly vulnerable sectors (e.g., water management, agriculture, forestry, energy infrastructure, tourism) and vulnerable territories (e.g., mountainous areas, landlocked plains, urban agglomerations and even coastal zones) emerge. The first part of the empirical analysis deals with this group of states. In My delimitation of the region follows the mixture of the above-mentioned Eastern-Central European delimitations and the EU-CRA delimitation, practically completing the latter with the Baltic states and the three southern Slavic countries of the Carpathian-basin.



**Figure 3: Observed and expected major climate risk factors in different European macro regions interpreted by the EUCRA.**

*Source: EUCRA, based on Copernicus climate change service (C3S)*

### ***Aspects of the comparative analysis of national adaptation policies' spatiality***

The comparative assessment of the country-level adaptation policies' spatial sensitivity is based on a predefined analytical aspect system, with 9 main factors and 2-9 sub-factors under each factor. The comparisons takes a critical lead, not just the description of the national characteristics - the explicit system of analytical aspects serves this. The planned analytical aspects and sub aspects are as follows:

*Weight and character of spatiality in climate adaptation policy in general* is examined through the "space phraseology" (quantified emergence of space-related concepts in the documents' text) and the basic logic and structure of climate adaptation in a given country (are adaptation activities organised according to sectors or to territorial units/region types?).

*Spatial levels of adaptation planning* aspect assesses whether the NAS documents identify the main territorial levels of adaptation planning activities. We also searched for signs of propagation of adaptation planning at lower spatial (regional/local) levels in the NAS/NAP documents.

*Spatial aspects are examined in evidence base-related work phases*, exactly in the situation analyses and assessments (including SWOT analyses) of NAS/NAP documents. Here the basic logic (sectoral or spatial) of the situation analyses as well as degree of their spatial visualization (use of maps and regional figures/diagrams) is analysed. Spatial content is examined through the degree of appearance of region types, spatial units, spatial difference-searching logic and settlement-network related issues in the respective chapters' texts. The spatial planning focus is also interesting: to what extent do situation analyses/assessments deal with the connection between adaptation planning and spatial planning? The consideration of the given countries' position within Europe or their own macro region from adaptation point of view in the respective chapters were also examined.

*Spatial aspects in objective systems* are similarly in the focus of the empirical research. The basic logic (sectoral or spatial), the general spatial content and spatial visualisation of the adaptation visions and objective systems are analysed. Spatial content of specific and lower-level objectives (fields of intervention) and horizontal goals are analysed through the degree of appearance of region types, spatial units, spatial difference-searching logic and set-

tlement-network related issues. Emphasis on spatially oriented MRE activities within the objective system- and vision-planning is evaluated as well and the emergence of basic territorial cohesion-related concepts in these chapters.

*Spatial aspects and content in adaptation actions* is examined similarly to that of the objective system and vision. Degree of spatial aspects, spatial monitoring, and spatial planning focus of adaptation measures are part of this analytical aspect.

The *geopolitical content of adaptation planning* aspect examines the emergence of geographically climate-related risks (migration, potential competition for resources, etc.) as aspects for national security within the introduced challenges of NAS/NAP documents. The presence of strengthening macro regional / international co-operations between countries is also identified in some documents, meanwhile the appearance of the intention of exerting influence on other countries in the form of adaptation knowledge export or financial supports were also identified in some cases.

Traces of *spatiality in adaptation-related monitoring activities* are analysed through the identification of spatial levels of data connection and monitoring activities through the description of MRE activities in NAS/NAP documents or monitoring background materials. Where they exist, we try to identify spatial content of adaptation indicator sets. The presence of geo-information-based decision support system in adaptation activities, or the idea to develop such a systems is also examined.

Similarly to the previous main aspect, the *spatial aspects in adaptation related evaluations* identifies the degree of spatial focus/content in adaptation evaluation products as well as their spatial visualization. Where a system of evaluations exist, identification of the spatial levels are also examined.

The last aspect is based on planning hierarchy and concentrates on the *emergence of higher level spatial or adaptation objectives in national adaptation planning*. It follows the appearance of European-level adaptation directions (appearance of priorities of the actual EU Adaptation Strategy), European-level spatial directions (emergence of priorities of the actual Territorial Agenda of the EU) and finally the appearance of national spatial/regional development objectives within the NAS/NAP documents objective system.

As a next step, a complex spatial sensitivity indicator is calculated for each analysed country based on the enlisted aspects. For each sub-factor, a country gets a given value: 5 points in the best, 3 in the upper-middle, 1 in the lower-middle and 0 in the worst category. Attributed to each sub-factor the proper principles/rules of classification were defined in advance to avoid

subjectivity as much as possible. As examples, two main types of classification, a quantitative and a qualitative one are introduced below. In case of the “*space phraseology of the documents*” we analysed how a NAS uses space and other related concepts. If the concepts<sup>8</sup> appear relatively frequently (with more than 400 mentioning), it goes into the best category; if the number of mentionings is between 399-150, it goes to the upper-middle, between 149 and 10 into the lower middle category; the weakest group is under 10 mentionings. As for the *spatial content of adaptation measures*, the best category means that a dedicated nominally spatial unit- or regional type-related or generally spatial logic-based group of measures is present among the actions. Upper-middle category means that a few separated (but not a group of) nominally spatial unit- or regional type-related or generally spatial logic-based measures emerge. In the lower-middle category only implicit territorial contents (e.g. monitoring system development targeting ecosystem mapping but reference to these mapping actions is weak or implicit in the text) appear. The lowest category means that no territorial implications can be observed among the measures. For the whole list of sub-aspects and the rules of the categories’ classification in each one, see the annex.

## **Results: spatial sensitivity of national adaptation policies in Eastern-Central Europe**

The following chapter goes through the first Eastern-Central-European results of the empirical analysis. It is divided into subchapters according to different blocks of the analysis. Summarizing tables also help the understanding. In them, a particular colour scale was applied: dark grey indicates the best, medium-grey the upper-medium level and light grey the lower-medium level spatial performances. White cells indicate the lowest national performances in a given sub-aspect; diagonal hatching indicates the irrelevance of a sub-aspect in a given country (e.g. lack of vision, SWOT, etc. in a NAS/NAP document). At the end of the analysis spatiality (spatial sensitivity) of national adaptation policies has been measured by a composite indicator, calculated by adding the scores corresponding to the classification for each sub-criterion of a given country together. Best categories (dark grey cells) means

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<sup>8</sup> The examined concepts were: place, region, regional(ity), territory, territorial (ity), space, spatial(ity), geography, geographic, local, location.

5 points; upper-middle categories (medium-grey cells) 3; lower middle (light-grey cells) 1; meanwhile the lowest and irrelevant categories 0 point.

### ***General information, general spatiality, spatial levels of adaptation***

The first sub-aspects deal generally with adaptation strategies at national level in the given countries (*Figure 4*). Adaptation planning (mostly due to the urge from the first EU Adaptation Strategy) at national level is present in all analysed countries, in most of the cases in the form of a dedicated NAS and NAP. Croatia, Poland and Latvia have only strategies without action plan according to the accessible materials; meanwhile Lithuania applies an integrated mitigation-adaptation strategy.

In Hungary is the situation similar, but here the adaptation module of the integrated strategy can even be interpreted as a dedicated, separated NAS. The function of the documents are basically similar: the assignment of the highest hierarchical adaptation directions at national level, with defined vision, objectives, measures based on proper evidence base. Only Lithuania and Slovenia are exclusions with their legal and institutional framework documents.

| Main aspect  | Sub-aspect  | CRO        | CZH        | EST        | HUN        | LAT        | LIT        | POL        | ROM        | SLK        | SLN        | BUL        | SRB        |
|--|---|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| <b>Weight and character of spatiality in adaptation policy</b> | <i>Space ontology of the document</i>                             | Dark grey  | Dark grey  | Light grey | Dark grey  | Light grey | Light grey | Dark grey  | Dark grey  | Light grey | Light grey | Light grey | Dark grey  |
|  | <i>Spatial /sectoral character of adaptation policy</i>           | Light grey | Light grey | Light grey | Light grey | Light grey | Light grey | Light grey | Light grey | Light grey | Light grey | Light grey | Light grey |
| <b>Spatial levels of adaptation planning</b>                   | <i>Spatial levels of adaptation planning</i>                      | Light grey | Light grey | Light grey | Light grey | Light grey | Light grey | Dark grey  | Light grey | Light grey | Light grey | Light grey | Light grey |
|  | <i>Propagation of adaptation planning at lower spatial levels</i> | Light grey | Light grey | Light grey | Dark grey  | Light grey | Light grey | Dark grey  | Light grey | Light grey | Light grey | Light grey | Light grey |

**Figure 4: General spatiality and appearance of spatial levels of adaptation planning in Eastern-Central European national adaptation strategies.** Dark grey cells indicate the best performing countries, medium-grey the upper-medium, light grey the lower-medium and white cells the lowest national performances in a given sub-aspect. Source: own editing.

The *spatial phraseology of the documents* aspect concentrates on the presence of the space-related phrases in the documents. The highest values (more than 400 mentionings) are observed in Hungary, the Czech Republic, Serbia and Romania, meanwhile the group of followers consists of Croatia, Poland, Slovakia and Bulgaria (between 150 and 400 mentionings). The rather framework-like, general documents (Lithuania, Slovenia) performed weaker. Out of the mentioned countries Hungary is performing especially strong, all examined definitions get several mentionings. Other countries show outstanding results in given concepts (Romania: place and location; Serbia: territory, local; Czechia: region, territory/territoriality).

*Emergence of adaptation activities at lower spatial levels and actual propagation of lower level adaptation planning* are strong in Poland, Hungary and Romania and slightly weaker in Bulgaria and Estonia. This weak emphasis can be explained by the mostly unitary structure of the analysed country administrations. In Hungary, a specific sub goal mentions the need for elaboration of vulnerable regions' strategies; some action lines in the settlement development chapter mentions local strategy building; chapter V.2.2. directly urges the planning of local and county strategies. In Romania importance of national, regional and local policy makers' role is mentioned already by the Introduction, furthermore the introductory part of the objective system chapter talks about local CC planning's importance, and some sub-objectives and measures mention the topic, too<sup>9</sup>.

### ***Spatial content in the evidence-base work phases***

Situation analyses, SWOT chapters and (where it were applied) situation assessment chapters were examined as "evidence base work phases". The basic logic of the analysed document parts follows mainly a sectoral logic (*Figure 5*).

Some signs of spatial thinking is stronger in Hungary and Poland (Hungary's NAS is well equipped with maps and spatial vulnerability assessment results; Poland applies quasi-consequent spatial unit- or regional type mentionings in all sectoral situation analysis subchapters) but the majority performed weaker or showed the lack of spatial aspects. Concrete visualization

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<sup>9</sup> Sub-objective 7.1. directly urges local adaptation planning; 11.5. and 12. 3 sub-objectives too, in connection with tourism adaptation and industrial adaptation respectively. Measure 5.3.1. urges involvement of citizens in local planning; 3.4.4. propagates natural habitat management-oriented local planning. The second part of Chapter 8 consequently emphasises the importance of local planning (Local Adaptation Action Plans, tourism destination-related planning, connections with settlement planning were also emphasised).

was the strongest in Hungary (14 maps), the Czech Republic (12), Poland (9+ one regional table), Serbia (9) and Latvia (7) with relatively larger number of maps. Slovakia and Bulgaria follow these leaders a bit lagging behind.

| Main aspect   | Sub-aspect                                      | CRO               | CZH               | EST               | HUN               | LAT               | LIT               | POL               | ROM               | SLK               | SLN               | BUL               | SRB               |
|---|---|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Spatial aspects in adaptation related evidence base | Basic logic of the situation analyses           |                   |                   |                   |                   |                   | Diagonal hatching |                   |                   |                   |                   |                   |                   |
|   | Spatial visualization of the situation analyses |                   | Dark grey         |                   | Dark grey         |                   |                   | Dark grey         |                   | Medium grey       |                   | Medium grey       | Dark grey         |
|   | Spatial contents of situation analyses          |                   | Medium grey       |                   |                   |                   | Diagonal hatching | Medium grey       | Medium grey       |                   |                   |                   | Medium grey       |
|   | European position                               |                   |                   |                   |                   |                   | Medium grey       |                   |                   |                   |                   |                   | Medium grey       |
|   | Spatial contents of SWOT                        | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching |                   | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching |
|   | Spatial content of situation assessments        | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching |                   |                   | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching |
|   | Spatial planning focus                          |                   | Medium grey       | Dark grey         |                   | Dark grey         |                   |                   |                   |                   |                   |                   |                   |

**Figure 5: Spatial content in the evidence-base work phases in Eastern-Central European national adaptation strategies.**

Dark grey cells indicate the best performing countries, medium-grey the upper-medium, light grey the lower-medium and white cells the lowest national performances in a given sub-aspect; diagonal hatching indicates the irrelevance of a sub-aspect in a given country.

Source: own editing.

The *concrete spatial content* (mentioning of national level spatial vulnerability inequalities, nominating concrete territorial/spatial units, special geo-

graphic areas, region types, or settlement network elements, functional areas<sup>10</sup> and their vulnerability characteristics) is medium level in the Hungarian, Estonian, Romanian, Polish, Czech and Serb NAS situation analyses. The Polish NAS includes consequent spatial content throughout the whole situation analysis, mixing sectoral and spatial logic, some subchapter is sectoral (energy, forestry, etc), some regional (mountain areas, coastal zones, urban areas & spatial development).

*Spatial planning*, as an important tool of adaptation or as a related field is mentioned particularly by Czechia and Serbia, in the form of dedicated chapters. Latvia put on the topic particularly great emphasis (one of the NAS's 6 main risk areas is "tourism and landscape planning"), as well as Estonia (the NAS situation analysis urges the taking into consideration of climate change and resilience aspects in spatial planning decisions, meanwhile land use and planning has a separated situation analysis chapter).

*Consideration of their own geographic position within Europe* gets weak emphasis in the documents generally. Only Lithuania performed in mediocre way with the consequent mentioning of its Baltic position throughout several points of the NAS. Estonia, Czechia, Bulgaria and Serbia show only weak signs of this kind of considerations in their climatology subchapters, the others even less. *SWOT analysis and situation assessment* chapters emerge only in two countries, Lithuania and Bulgaria, but the spatial content in these chapters is weak, anyhow.

All in all, regarding all sub-aspects, among the generally weak results, Serbia performed the best (13 points out of 35), followed by Czech Republic, Latvia Poland and Hungary (10-12).

### ***Spatial content in the classic planning subchapters***

The vision and the different hierarchical elements of the objective systems compose an important part of strategies, as the manifestations of actual planning activities. Regarding the *basic logic of visions*, 3 documents do not contain such chapters; the others do but only Romania mentions "areas" in general.

The *overall objectives* are always thematic (only Estonia's overall objective mentions explicitly regional and local levels); the specific objectives usually (the only exclusions are Croatia, Poland and Estonia). Especially good example is Croatia, whose objective system is a mixture of sectoral and spatial

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<sup>10</sup> Functional Urban Areas, cross-border territories, macro regions.

specific objectives<sup>11</sup>. Poland also applies mixed types of objectives, out of which two (“Efficient adaptation in rural areas”; “Sustainable regional and local development”) are directly spatial. Coastal areas, mountain areas, urban zones and spatial planning are recurring topics through the entire objective system; however, their nominated presence is scarce, only appearing in the narrative descriptions of objectives. Estonia’s sub goals (=specific goals) are basically thematic, only one sub goal deals with regional types, but this at least directly. *The lower level objectives* (sub-objectives, fields of interventions, action lines, etc.) show stronger spatial content in the generally well performing Hungary and Poland, plus Latvia, Lithuania and Serbia. The other countries’ lower-level objectives touch spatiality weakly and implicitly, and Croatia even lacks this level of objectives. *Real horizontal objectives* are missing from the majority of documents: in these cases, we analysed the horizontal principles identified in the NAS documents. Croatia’s, Estonia’s and Slovenia’s guiding principles mentions the importance of spatial planning/regional development, while Lithuania nominates adaptation monitoring and geopolitical aspects as horizontally important activities/factors during adaptation.

*The importance of spatial MRE is especially emphasised in the objective system* of Croatia (the country’s NAS Priority #4 explicitly aims at strengthening management capacities with a networked monitoring and early warning system; while Priority #5 focuses even on geo-information-based monitoring activities and decision support), Hungary (in the country’s NAS the 4th specific objective explicitly aims MRE and geo-information system development and vulnerability assessment-related knowledge base development), Latvia (a dedicated NAS chapter and Appendix deal with MRE issues of adaptation policy) and Slovakia (specific objective #4 partly and sub-objective 4.6. directly deal with MRE issues, but not particularly spatial aspects of them; the NAP strategic priority #4 urges development of knowledge base, data collection, monitoring and research related to data dissemination and information). Out of the *basic territorial cohesion concepts* multilevel governance is present everywhere, meanwhile some countries (Estonia, Hungary<sup>12</sup>,

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<sup>11</sup> It has two spatial objectives (#1 aims at sustainable regional and urban development; #2 focuses on rural areas, coasts and islands), the others thematic ones. Objective #3 is for energy development, objective #4 for monitoring and early warning system development, #5 for R&D). Objectives #4 and #5 even include implicit contents (#4: importance of local/regional level in risk management; #5: GIS-based monitoring development).

<sup>12</sup> The emphasis on integration of adaptation objectives into sectoral planning in Hungary’s NAS can be understood as a paraphrase of territorial optimum.

| Main aspect   | Sub-aspect   | CRO               | CZH               | EST               | HUN               | LAT               | LIT               | POL               | ROM               | SLK               | SLN               | BUL               | SRB               |
|---|--|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Spatial aspects in adaptation related objective systems | Basic logic of vision  |                   |                   | Diagonal hatching |                   |                   |                   | Diagonal hatching |                   | Diagonal hatching |                   |                   |                   |
|   | Spatial content of adaptation visions                              | Light grey        | Light grey        | Diagonal hatching |                   | Light grey        |                   | Diagonal hatching | Medium grey       | Diagonal hatching |                   |                   |                   |
|   | Basic logic of objective system                                    | Medium grey       |                   |                   |                   | Light grey        | Light grey        | Medium grey       |                   |                   |                   | Light grey        |                   |
|   | Spatial content of overall / strategic objectives                  | Dark grey         | Light grey        |                   |                   |                   | Light grey        | Dark grey         |                   | Light grey        |                   |                   | Light grey        |
|   | Spatial content of lower-level objectives (fields of intervention) | Diagonal hatching | Light grey        | Diagonal hatching | Medium grey       | Medium grey       | Medium grey       | Medium grey       | Medium grey       | Medium grey       | Medium grey       | Medium grey       | Medium grey       |
|   | Spatiality's presence in horizontal goals                          | Medium grey       | Light grey        |                   |                   | Light grey        | Light grey        | Light grey        |                   |                   | Medium grey       |                   | Diagonal hatching |
|   | Spatial MRE focus of objective system- and vision-planning         | Dark grey         | Light grey        | Light grey        | Dark grey         | Dark grey         | Medium grey       | Medium grey       | Medium grey       | Dark grey         | Medium grey       | Medium grey       | Light grey        |
|   | Basic territorial cohesion concepts' emergence                     | Light grey        |                   | Medium grey       | Medium grey       | Light grey        | Medium grey       | Dark grey         | Medium grey       | Medium grey       | Medium grey       | Medium grey       | Light grey        |
|   | Spatial visualization of the vision /objective system              | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching |

**Figure 6: Spatial content in the visions and objective systems in Eastern-Central European national adaptation strategies.**

Dark grey cells indicate the best performing countries, medium-grey the upper-medium, light grey the lower-medium and white cells the lowest national performances in a given sub-aspect; diagonal hatching indicates the irrelevance of a sub-aspect in a given country.

Source: own editing.

Poland<sup>13</sup>, Romania, Bulgaria) mention balanced sustainable territorial development, place-based approach or territorial optimum-searching nature of adaptation planning. All in all, regarding the visions and objective systems Poland (20 points out of 45) and Croatia (18 points) are leaders with a rather medium-level performance as we see; followed by the Baltic states (13-14 points) and Hungary (11) (*Figure 6*).

### *Spatial content in the adaptation actions*

The *actual adaptation actions' spatiality* shows somehow more balanced picture than the previous aspects. Actual spatial content is present everywhere but usually implicitly, in the form of mentioning general region types (e.g. coastal areas, river valleys, mountainous areas, areas with water shortages, flood-prone areas), land use forms (e.g. forest areas, agricultural land) or some special areas (e.g. Baltic coast, Homokhátság) in the measures' texts or titles. None of the NAPs dedicate concrete group of actions for the topics. The concrete, nominally spatial unit- or region type-based measures are rare; strong implicit presence (mentionings in the action descriptions) is present in the Czech Republic, Poland, Slovakia, Croatia, Latvia and Romania. The others perform weaker. *Spatial MRE-focussed measures* show stronger presence in Croatia (where a whole priority deals with MRE issues<sup>14</sup>), Hungary (both its first and second National Climate Adaptation Action Plan dedicates one-one explicit measure for the topic, based on an MRE concept, as defined in the first Climate Change Action Plan), and Latvia (a dedicated group of 5 measures in NAP deals with MRE issues of adaptation policy), followed by Lithuania, Czech Republic and Poland. *Spatial planning-oriented measures* appear particularly in Croatia, where "Spatial planning and management" appears as a particular group of measures. The upper-medium category is filled by the three Baltic states, Poland, Slovakia and Bulgaria.

All in all, adaptation measures' spatiality show the strongest signs in Croatia (13 points out of 15) and Latvia (11), followed by Poland (9), Czechia, Hungary and Lithuania (7-7-7). The overall performance is good,

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<sup>13</sup> Poland, for example, urges integrated development strategies at different level and local integrated adaptation strategies are in harmony with the concept of territorial optimum/territorial synthesis.

<sup>14</sup> Furthermore the NAS General measure OM-01 aims at increasing the level of knowledge and capacity for monitoring the impact of climate change, risk assessment and adaptation to climate change; meanwhile a dedicated measure (RP-01) aims at developing indicators measuring the effects of the implementation of the Adaptation Strategy.

compared it to other analytical aspects, considering the maximum available 15 points, and the mentioned examples (*Figure 7*).

### ***Geopolitical content of the NAS/NAP documents***

As opposed to the previous aspect, geopolitical content in the analysed NAS/NAP documents is uniformly weak. With the exclusion of Lithuania, the country that registers at least medium-level results in all three sub-aspects<sup>15</sup>, the other countries show mostly weak results or lacking geopolitical focus. Two other exclusions are Estonia<sup>16</sup> and Slovenia<sup>17</sup>, which countries performed exceptionally well only in one sub-aspect (territorial cooperation in the field of adaptation) (*Figure 7*).

### ***Spatiality in adaptation monitoring***

*Spatiality in adaptation monitoring activities* is emerging rather weakly. MRE activities have started in the analysed countries and out of its pillars monitoring shows the strongest signs but no detailed information is available about their actual spatiality. Lithuania, Poland, Hungary and the Czech Republic shows strongest signs of MRE (actually, they are in the planning phase of their systems – however, results of these has not been available so far). For instance, Hungary’s climate strategy’s chapter V.4.5. is particularly about monitoring, introducing a special two-tier approach. The first Climate Change Action Plan aims the preparation, the second the setting up of a CC adaptation MRE system. The planned further development of the National Adaptation GeoInformation system (NAGiS) may be the basis of regional

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<sup>15</sup> Sub goal 37.11. concentrates on climate policy’s international connections, and mentions geopolitics even directly in 37.11.3.; paragraph #37.11.3.’s first part directly deals with anticipation and preparation for migratory pressures; its second part directly deals with bilateral and multilateral climate partnerships in mitigation and adaptation; meanwhile its third part directly deals with achievement of climate targets and damage loss mitigation and natural phenomena management in other countries especially in least developed ones.

<sup>16</sup> In Estonia’s NAS Sub goal 6’s Measure 6.3. aims at participating in international mitigation and adaptation cooperation and in international climate policy development to share best practices and mitigate international climatic problems.

<sup>17</sup> “Broader cooperation” specific objective mentions the importance of European and international cooperation processes in the field of adaptation; its 2.2. sub-objective “Proactive participation in European and international activities” mentions both international cooperation and geopolitical influence gathering.

vulnerability indicators and the planned MRE system could implement climate policy's MRE tasks, with territorial emphases. In Lithuania's climate policy framework the intention of such developments are mentioned among key horizontal goals<sup>18</sup>.

Regarding *actual indicator sets*, real spatial indicator collections are rare. Strong adaptation indicator sets with both impact/result and output indicators but without spatiality are planned in Croatia, the Czech Republic, Hungary<sup>19</sup>, Estonia, Poland and Serbia. Other countries applies either only output (Slovakia, Slovenia, and Bulgaria) or no indicators.

Though several countries are thinking of *development of GIS-based DS system is adaptation*, the only exclusion, where the intentions have already been implemented is Hungary, where the NAGiS has been operating and continuously developed since 2016 and has served since then as a basis of the national strategy and its action plans, the county- and settlement-level climate strategies and Sustainable Energy and Climate Action Plans. Serbia comes up in its NAS with an ecosystem-oriented GIS development idea<sup>20</sup>, meanwhile Bulgaria, Slovenia and Poland also dedicate special actions for GIS development, but no information is available yet about the implementation of these ideas (*Figure 7*).

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<sup>18</sup> 33.7. and 36.4. sub goals directly aim at developing data and information collection to continuously monitor and assess climate risks, vulnerability and adaptation options in different sectors at different spatial levels (national, regional, local).

<sup>19</sup> In the first and second Climate Change Action Plan output indicators and National Climate Change Strategy-related result indicators are enlisted, but these are not collected and spatially processed. No spatial content or breakdown is mentioned.

<sup>20</sup> The Biodiversity subchapter of the NAS Situation Analysis mentions "*The Republic of Serbia still has to implement an integrated functional national biodiversity geo-information system available to the wider scientific public and interested professionals, and consequently, the comprehensive monitoring and study of the climate change impact on biodiversity is limited. In addition, integrated lists of priority species, habitats and ecosystems for monitoring the climate change impacts on biodiversity still need to be developed*".

| Main aspect  | Sub-aspect  | CRO         | CZH         | EST         | HUN         | LAT        | LIT        | POL        | ROM        | SILK        | SILN       | BUL        | SRB        |
|--|---|-------------|-------------|-------------|-------------|------------|------------|------------|------------|-------------|------------|------------|------------|
| <b>Spatial aspects in adaptation related actions</b> | <i>Spatial content of adaptation measures</i>   | Light grey  | Light grey  | Light grey  | Light grey  | Light grey | Light grey | Light grey | Light grey | Light grey  | Light grey | Light grey | Light grey |
|  | <i>Spatial monitoring focus of adaptation measures</i>  | Dark grey   | Medium grey | Light grey  | Dark grey   | Dark grey  | Light grey | Light grey | Light grey | Light grey  | White      | Light grey | Dark grey  |
|  | <i>Spatial planning focus of adaptation measures</i>  | Dark grey   | Light grey  | Medium grey | Light grey  | Light grey | Light grey | Light grey | Light grey | Medium grey | White      | Dark grey  | Light grey |
| <b>Geopolitical content of adaptation planning</b>   | <i>The emergence of geographically climate related risks as aspects for national security</i> | White       | White       | White       | White       | White      | Light grey | Light grey | Light grey | Light grey  | White      | White      | White      |
|  | <i>The emergence of strengthening macro regional/ international co-operations</i>             | White       | White       | Dark grey   | White       | White      | Light grey | Light grey | Light grey | Light grey  | Dark grey  | White      | White      |
|  | <i>The emergence of strengthening macro regional/ international influence</i>                 | White       | White       | White       | Light grey  | White      | Light grey | Light grey | Light grey | Light grey  | Light grey | White      | White      |
| <b>Spatiality in adaptation monitoring</b>           | <i>Spatial levels of data connection and monitoring activities</i>                            | Light grey  | Medium grey | Light grey  | Medium grey | Light grey | Light grey | Light grey | Light grey | Light grey  | Light grey | Light grey | Light grey |
|  | <i>Spatial content of indicator sets</i>  | Medium grey | Light grey  | Medium grey | Dark grey   | White      | White      | Light grey | Light grey | Light grey  | Light grey | Light grey | Dark grey  |
|  | <i>Presence of GIS based DS system in planning</i>  | Medium grey | White       | Light grey  | Dark grey   | White      | White      | Light grey | Light grey | Light grey  | Dark grey  | Dark grey  | Dark grey  |

**Figure 7: Spatiality in adaptation actions of NAP documents, geopolitical content of adaptation documents and spatiality in monitoring of the Eastern-Central-European national adaptation activities.**

Dark grey cells indicate the best performing countries, medium-grey the upper-medium, light grey the lower-medium and white cells the lowest national performances in a given sub-aspect; diagonal hatching indicates the irrelevance of a sub-aspect in a given country.

Source: own editing.

### ***Spatiality in adaptation evaluation***

Evaluations' spatiality is the worst performed aspect altogether within the complete comparative analytical system. Even in those countries where proper resources and/or emphasis are devoted at all for evaluation in adaptation, these activities are following a sectoral rather than spatial/territorial logic. The few examples that can be specially mentioned are the Czech Republic, the NAS of which mentions the strong visualization of the planned/implemented evaluations. Hungary similarly enlists in its NAS and NAP a detailed list of evaluation products but their spatiality is referred to only weakly. Similarly, the Serb NAS nominates several evaluation products, too, without any special spatial references, either. Concrete evaluation products are still lacking or are not yet available in the majority of the countries (*Figure 8*).

Altogether the monitoring and evaluation aspects see the best performances in Hungary (13 points out of 18) and the Czech Republic (11), followed by Poland, Croatia and Serbia (between 7-9 points). All countries perform better due to their higher monitoring points, the evaluation sub-aspects performed uniformly weaker.

### ***Consideration of higher level spatial / adaptation objectives in adaptation planning***

The last aspect examined the appearance of higher (EU and national) level adaptation policy and spatial development objectives in the analysed NAS documents. There is no country among the analysed ones that lacks references to these higher-level objectives totally, only the degree of consideration differs. Regarding adaptation, the then-actual EU Adaptation Strategy's priorities were examined, more exactly their appearance in the NASs<sup>21</sup>. The priorities of these were taken into consideration everywhere, mostly explicitly (Hungary, Lithuania, Romania, Bulgaria and Serbia dedicate particular coherence-analytical subchapters to the EU Adaptation Strategy, and name EU Adaptation Strategy-conform objectives/priorities, corresponding to all EU adaptation priorities). Even the second best performing countries reflect to most of the EU-level adaptation priorities (Latvia, Romania, Slovakia, Slovenia).

In case of the spatial development objectives, both the European and the respective national ones appear in the NAS documents, but not directly and

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<sup>21</sup> In case of older NAS documents the connection to the 2013 EU Adaptation Strategy, in case of current NAS documents to the 2021 version was analysed.

not entirely. The majority of the EU/national priorities appears in the NAS of Croatia, Estonia, Hungary, Poland and Romania or the minority of them in the other countries. Particularly good example is Hungary, where the then-fresh National Development and Regional Development Concept contained an energy and climate policy chapter, whose content was based on the relevant NAS parts as well. Sectoral action lines of the climate strategies also reflected the relevant national spatial development lines. Within this aspect, Hungary and Poland performed well (11-11 points), followed by Estonia, Lithuania, Bulgaria, Serbia and Romania (7-7 point out of 15) (Figure 8).

| Main aspect  | Sub-aspect   | CRO               | CZH         | EST         | HUN        | LAT               | LIT               | POL               | ROM               | SLK               | SLN               | BUL               | SRB               |
|--|--|-------------------|-------------|-------------|------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Spatial aspects in adaptation related evaluations                                    | The degree of spatial content in adaptation evaluation | Light grey        | Light grey  | Light grey  | Light grey | Diagonal hatching | Light grey        | Light grey        | Light grey        | Light grey        | Light grey        | Light grey        | Light grey        |
|  | Spatial visualization in adaptation evaluation         | Diagonal hatching | Medium grey | Medium grey | Light grey | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching |
|  | Spatial levels of evaluations                          | Diagonal hatching | Light grey  | Light grey  | Light grey | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching | Diagonal hatching |
| Consideration of higher level spatial / adaptation objectives in adaptation planning | Consideration of national spatial objectives           | Light grey        | Light grey  | Light grey  | Light grey | Light grey        | Light grey        | Light grey        | Light grey        | Light grey        | Light grey        | Light grey        | Light grey        |
|  | Consideration of European spatial objectives           | Light grey        | Light grey  | Light grey  | Light grey | Light grey        | Light grey        | Light grey        | Light grey        | Light grey        | Light grey        | Light grey        | Light grey        |
|  | Consideration of European adaptation objectives        | Light grey        | Light grey  | Light grey  | Dark grey  | Dark grey         | Dark grey         | Dark grey         | Dark grey         | Dark grey         | Dark grey         | Dark grey         | Dark grey         |

**Figure 8: Spatiality in adaptation evaluation and appearance of higher level spatial / adaptation objectives in adaptation planning of the Eastern-Central-European countries.**

*Dark grey cells indicate the best performing countries, medium-grey the upper-medium, light grey the lower-medium and white cells the lowest national performances in a given sub-aspect; diagonal hatching indicates the irrelevance of a sub-aspect in a given country.*

*Source: own editing.*

### *Influential factors of adaptation policies' spatiality*

Summarizing the analytical sub aspects, Poland and Hungary stand out from the group of countries with respectively 77 and 68 point, followed by Croatia, Czechia, the Baltic states and Serbia (between 44 and 60). Altogether, these values indicate at best a mediocre or even weaker performance regarding the maximum available 175 points (*Figure 9*).

Interesting issue is whether which factors are the most influential for the spatial sensitivity values of the analysed countries. I collected some physical (size of the country, number of climate zones in a given country according to the EEA classification, urbanisation), economic (GDP/capita), social (HDI, education level), spatial governance- or adaptation policy-related (number of implemented adaptation cycles) indices to find out which have the strongest influence on spatial sensitivity (*Figure 9*).

| country    | Spatial sensitivity composite indicator (source: own calculation) | Size (km <sup>2</sup> ) (source: Eurostat) | number of climate zones (source: EEA) | GDP/pop (source: Eurostat) | HDI index (source: worldpopulatio onreview) | spatial governance (1 means unitary; 2 decentralised unitary; 3 regionalised unitary; 4 federal state. Source: ESPON) | urbanisation % (urban population / total population.) (source: World Bank- world development indicators) | population with tertiary education (%) (source: OECD) | number of finished adaptation planning cycles (source: EEA, own calculation) |
|------------|---|--|---------------------------------------|----------------------------|---|---|--|---|--|
| <i>BUL</i> | 40  | 111000                                     | 3                                     | 13270                      | 0,8   | 1   | 76,701   | 26,7  | 1  |
| <i>CRO</i> | 49  | 88070                                      | 3                                     | 17500                      | 0,88  | 1   | 58,575   | 24,8  | 0  |
| <i>CZH</i> | 47  | 78870                                      | 1                                     | 26670                      | 0,9   | 2   | 74,552   | 23,5  | 1  |
| <i>EST</i> | 53  | 45340                                      | 1                                     | 27360                      | 0,9   | 1   | 69,81  | 36  | 1  |
| <i>HUN</i> | 68  | 93030                                      | 1                                     | 17410                      | 0,85  | 1   | 72,864   | 25,7  | 2  |
| <i>LAT</i> | 44  | 64570                                      | 1                                     | 20350                      | 0,88  | 1   | 68,671   | 34  | 1  |
| <i>LIT</i> | 48  | 65290                                      | 1                                     | 23820                      | 0,88  | 2   | 68,694   | 41  | 1  |
| <i>POL</i> | 77  | 312690                                     | 2                                     | 17350                      | 0,88  | 3   | 62,18  | 33,2  | 1  |
| <i>ROM</i> | 39  | 238400                                     | 3                                     | 14920                      | 0,83  | 1   | 54,672   | 16,1  | 2  |
| <i>SLK</i> | 33  | 49030                                      | 2                                     | 20000                      | 0,81  | 2   | 54,027   | 29,8  | 2  |
| <i>SLN</i> | 29  | 20480                                      | 2                                     | 26980                      | 0,93  | 1   | 56,088   | 25,8  | 1  |
| <i>SRB</i> | 45  | 88360                                      | 2                                     | 9070                       | 0,81  | 1   | 57,113   | 23,3  | 1  |

**Figure 9 Spatial sensitivity composite indicator values and other physical, social, economic and planning-related indicators of the analysed countries.**

*Source: own editing.*

The correlation analysis of the chosen indices (*Figure 10*) with spatial sensitivity shows that mostly weaker-than-medium-level connections can be identified, with the exclusion of the size of the countries (stronger-than-medium connection) – unsurprisingly, bigger a given country is, more diverse its geography is and this fact will be reflected even in the spatiality of adaptation planning directions.

|                                | spatial sensitivity | size     | number of climate zones | GDP/pop  | HDI      | spatial governance | urbanisation | education | adapt. pl. cycles |
|--------------------------------|---------------------|----------|-------------------------|----------|----------|--------------------|--------------|-----------|-------------------|
| <i>Spatial sensitivity</i>     | 1                   |          |                         |          |          |                    |              |           |                   |
| <i>Size</i>                    | 0,539729            | 1        |                         |          |          |                    |              |           |                   |
| <i>number of climate zones</i> | -0,30867            | 0,383941 | 1                       |          |          |                    |              |           |                   |
| <i>GDP/pop</i>                 | -0,11919            | -0,43976 | -0,57812                | 1        |          |                    |              |           |                   |
| <i>HDI</i>                     | 0,135877            | -0,19798 | -0,45583                | 0,814069 | 1        |                    |              |           |                   |
| <i>spatial governance</i>      | 0,430694            | 0,473101 | -0,19002                | 0,17339  | 0,121973 | 1                  |              |           |                   |
| <i>urbanisation</i>            | 0,350626            | -0,15679 | -0,46856                | 0,213166 | 0,105064 | -0,01387           | 1            |           |                   |
| <i>education</i>               | 0,279213            | -0,21926 | -0,57832                | 0,434568 | 0,321008 | 0,383181           | 0,32408      | 1         |                   |
| <i>adaptation pl. cycles</i>   | -0,05434            | 0,154199 | -0,12574                | -0,11633 | -0,43314 | 0,039253           | -0,11409     | -0,22913  | 1                 |

**Figure 10 Correlation matrix of spatial sensitivity index and its potential influential factors in Eastern-Central European national adaptation activities.**

*Source: own editing.*

Surprisingly, the number of climate zones does not correspond with the country sizes and the spatial sensitivity of adaptation policies, due to the relative homogenous climate zonality of the bigger states (Poland, Romania, and Bulgaria) of the region. The second strongest (it is still only weaker-than-medium) connection is shown to spatial administrative structures – the more decentralised/federal a country is the stronger spatiality could be perceived in adaptation policy documents, but the strength of the connection is weak for now. Probably after the inclusion of bigger Western or Southern European countries (e.g. Germany, Italy, France or Spain) into the analysis, this connection will be linear and stronger.

### Conclusions, limitations and further steps

According to both the literature and our everyday life experience climate change is among the top priority global challenges. To its impacts and consequences climate adaptation policy can find answers. Its instruments offer solutions for the spatially determined impacts. As opposed of the other pillar of climate policy, decarbonisation, adaptation itself especially linked to the geographical space, requires explicitly local/regional responses, which fact is reflected in the main spatial levels (local, subnational, national) of adaptation planning, monitoring and evaluation. Increasing number of literature items deal with these activities in Europe, but significantly fewer with spatiality’s role in adaptation policy. These findings point to the direction of a research gap: the presence/weight of geographical/spatial dimensions in national adaptation policy activities have not been examined yet neither from a scientific point of view nor in a comprehensive way.

To fill this gap, my planned wider research aims at examining the sensitivity of European national adaptation activities for spatial issues. Based on space interpretations of spatially oriented disciplines and practical fields a new concept of spatial sensitivity of adaptation policies is introduced and a comparative analysis of this sensitivity of European national adaptation documents is conducted, based on a single system of analytical criteria. The first section of analyses targeted Eastern-Central European countries from the Baltic states to the Carpathian Basin. We can observe that adaptation policy and planning are growing in importance in these countries, but the related monitoring/assessment activities and the emergence of spatial considerations in these and in planning itself are still in early stages. Hungary and Poland show the best performances, followed by the 3 Baltic states, Croatia, Czechia and Serbia. But overall, the picture is quite mosaic-like and diverse, almost every sub-aspect show different rankings. From the potentially available 175 point the best-performing countries, Poland and Hungary reached respectively 77 and 68 points – these are only mediocre performances at the best. If we compare the complex spatial sensitivity values of the countries with environmental, social, economic and administrative structure-related indicators, the strongest connections are with the size of the countries and the spatial administrative structures – these connections are expected to be even more stronger when all EU and EEA countries will be involved into the analyses, completing the comparative examinations as the next step. In the final phase, a conclusion could be drawn whether there is any macroregional determination in national spatial sensitivity of adaptation policies in Europe or not.

As the Introduction has already referred to it, neither the international nor the domestic literature has dealt directly with climate adaptation planning's and MRE activities' spatial performance. The existing studies on national, regional or municipal level climate adaptation activities concentrate rather on methodological challenges and barriers of these activities. The few available comparative studies on national climate adaptation strategies and/or MRE activities analyse only few countries in a case study-like form [Schuster (2008); Swart et al, (2009); Greiving and Fleischhauer, (2010)] or, although compare a larger number of countries with each other, they do that from a descriptive point of view [Leiter (2021), or the studies of EEA (2020, 2021)] and concentrate to a lesser extent or not on real spatial performance, let alone its quantification.

Naturally, the research (especially in its current phase) has numerous limitations. Although it intends to cover the majority of Europe at the end of the research process, currently this study concentrates only on the Eastern

part of Central Europe, resulting in insignificant differences between the countries regarding administrative structure, size, number of climate zones, social and economic indices etc. This similarity of countries in given aspects diminishes the explanatory force of the correlation analysis. To counterweight these weaknesses, in the next phases, other macro regions of the continent (Northern, Southern, Western Europe and the West Balkans) will be included in the analysis. The research, although applying (limited) quantitative methods, they are based only on results of document analyses. There are some additional information that could be obtained through soft methods (interviews, questionnaires, surveys), and it is in question yet, whether these time-consuming methodologies could occur within the time frame of the project. At the same time, the research's inclination to experimenting with quantification of adaptation planning's and MRE's spatiality is its novelty.

Overall spatial aspects emerge in the Eastern-Central European countries' adaptation activities but not consequently and not in an overwhelming weight. Several ways can be identified to improve this geographical/spatial orientation of national adaptation policy making and hopefully the wider research currently being conducted can participate to the strengthening this spatiality of adaptation policies with some suggestions.

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## Annex

### The list of analytical aspects, sub-aspects and principles/rules of classification

#### 1. Weight and character of spatiality in adaptation policy

- **Space phraseology of the document**
  - How the Strategy use space and other does related concepts? If the strategy applies space and other concepts (place, region territory, spatiality, territoriality) relatively frequently (more than 400 mentioning), it goes into the best category; if the number of mentioning is between 399-150, it comes to the upper-middle, between 149 and 10 into the lower middle category; the weakest result is under 10 mentionings.
- **Territorial/sectoral character of adaptation policy**
  - Is the adaptation policy document behaving as a synthesizer of other sectors? Best category: the document follows a territorially oriented structure and synthesises different sectoral directions for given territorial units/region types, consequently, considering a territorial differences within the country both in the situation analysis/assessment parts and in the objective system; Upper-middle category: 1-2 territorial objectives and/or a territorial summarizing/synthesizing chapter in situation analysis, recurring implicit mentionings of territorial differences, structures Lower-middle category: basically sectoral character (situation analysis chapters, objectives, interventions) but some implicit mentionings of territorial differences, structures.. Lowest category: No territorial issues are detected in climate policy.

#### 2. Spatial levels of adaptation planning

- **At what spatial levels is adaptation planning operating in the country?**
  - Best category: A dedicated strategy chapter / part deals with the issue of national, regional and local level adaptation tasks. . Upper-middle category: Both national and lower levels (regional, local) are mentioned by the strategy/legislation as levels of adaptation actions, activities. Lower-middle category: Only vague references are there to national and regional OR national and local level. Lowest category: Only national level is mentioned.

- **Does the national level strategy propagate adaptation planning at lower spatial levels?**
  - *Best category: Yes, explicitly (as a nominated objective/measure of the strategy). Upper-middle category: Yes, strong implicitly, suggesting in the texts of the objectives/measures. Lower-middle category: only sectoral planning/regional planning is urged at lower spatial levels. Lowest category: No propagation.*

### 3. Spatial aspects in adaptation-related evidence base

- **Basic logic of the situation analyses**
  - *Best category: It has special territorial logic, structured according to territorial units/region types Upper-middle category: It has a separated territorial chapter or concentrates on territorial differences throughout its entirety. Lower-middle category: no territorial chapter but all/majority of sectoral chapters mention even relevant spatial issues. Lowest category: It is structured exclusively by sectors.*
- **Spatial visualization of the situation analyses**
  - *Best category: the situation analysis subchapters contain several thematic maps, and regional data-related figures in connection with each sector (altogether more than 5); Upper-middle category: the situation analysis subchapters contain 3-5 thematic maps/regional tables or figures. Lower-middle category: the subchapters contain 1-2 thematic maps/ figures of regional data. Lowest category: there are no thematic maps in the situation analysis subchapters.*
- **Spatial contents of situation analyses** (Does it mention national level territorial vulnerability inequalities, nominates concrete territorial/spatial units? Does it mention special geographic areas' or settlement network elements, functional areas (FUAs, CBCs, macro regions) vulnerability characteristics? Does it mention general territorial logic, spatial approach, focusing on spatial mapping, spatial differences, vulnerability characteristics?)
  - *Best category: All situation analysis subchapter deal consequently with the above mentioned topics with great emphasis. Upper-middle category: some situation analysis subchapter deal consequently with the above mentioned topics. Lower-middle category: only scattered presence of territorial/spatial references in few subchapters. Lowest category: it does not mention any of these.*
- **Consideration of European positions regarding the climatic challenges**
  - *Best category: A special, dedicated subchapter deals with the topic of climate impacts in the respective macro region and the theme is recurring throughout the whole strategy. Upper-middle category: A part of a subchapter deals with the macro regional situation of CC, the climatic chapters has a related part. Macrorregional position is a recurring topic in the document. Lower-middle category: There is global or European outlook maybe with maps, but special macro regional emphasis is lesser: Only references or scattered mentioning about macro regional situation. Lowest category: no European or macro regional outlook at all.*
- **Spatial contents of SWOT** (emergence of national level territorial vulnerability inequalities, nominates concrete territorial/spatial units special geographic areas' or settlement network elements, functional areas (FUAs, CBCs, macro regions) vulnerability characteristics, general territorial logic, spatial approach, focusing on spatial mapping, spatial differences)
  - *Best category: the SWOT mentions all of these topics and with more than one examples in each cases; Upper-middle category: it mentions 2 types. Lower-middle category: It mentions only 1 type. Lowest category: it does not mention any of these.*
- **Spatial content of situation assessments** (Emergence of national level territorial vulnerability inequalities, nominates concrete territorial/spatial units special geographic areas' or settlement network elements, functional areas (FUAs, CBCs, macro regions) vulnerability characteristics, general territorial logic, spatial approach, focusing on spatial mapping, spatial differences)
  - *Best category: It mentions all of these topics and with more than one examples in each cases; Upper-middle category: it mentions 2 types. Lower-middle category: It mentions only 1 type. Lowest category: it does not mention any of these.*
- **Spatial planning focus**
  - *Best category: The situation analysis dedicates a special chapter/subchapter to the introduction of spatial planning's role in adaptation. Upper-middle category: the situation analysis mentions spatial planning in one or more subchapters as an important activity. Lower middle category: only weak reference to spatial planning can be detected (e.g. spatial contexts of some regional/settlement type's CC-related problems are mentioned or coherence with national spatial planning is introduced). Lowest category: it does not mention anything regarding the issue.*

#### 4. Spatial aspects in adaptation related objective systems

- **Basic logic of vision**
  - Best category: the Vision chapter is structured in a spatial logic (according to spatial units/territorial types). Upper-middle category: Within the Vision a separated part/paragraph is dedicated for special spatial aspects. Lower-middle category: it mentions spatial issues/places implicitly (emphasizing diversity or different spatial levels). Lowest category: It is structured exclusively by sectors/themes.
- **Spatial content of adaptation visions**
  - Best category: the Vision explicitly mentions special geographic areas' or settlement network elements, functional areas (FUAs, CBCs, macro regions) vulnerability characteristics, general territorial logic, spatial approach, focusing on spatial mapping, spatial differences, Upper-middle category: it mentions only 1-2 type of the enlisted aspects. Lower-middle category: it mentions territorial logic, spatial approach but only vaguely (emphasizing diversity in a given sector; or tasks of different spatial levels). Lowest category: it does not mention any of these.
- **Basic logic of objective system**
  - Best category: The objective system is structured according to spatial units/territorial types. Upper-middle category: It has one or more special, explicitly territorial objectives. Lower-middle category: all sectoral objectives mention even relevant spatial sub-objectives. Lowest category: the whole system is structured exclusively by sectors.
- **Spatial content of overall / strategic objectives**
  - Best category: more objective targets at given territorial unit / regional type / generally deals with spatial differences/structures Upper-middle category: at least one objective targets at given territorial unit / regional type / generally deals with spatial differences/structures.. Lower-middle category: among the objectives one or more refers to decrease of national level spatial vulnerability inequalities/spatial structures. Lowest category: they do not mention any of these.
- **Spatial content of lower-level objectives (fields of intervention)**
  - Best category: among the lower-level objectives several objectives target at given territorial unit / regional type / generally deals with spatial differences/structures even in their title; Upper-middle category: a few objective target at given territorial unit / regional type / generally deals with spatial differences/structures even in their title. Lower-middle category: only the objective's texts mention territorial units / regional types. Lowest category: they do not mention any of these.
- **Spatiality's presence in horizontal goals (e.g., principles of sustainable land use)**
  - Best category: More special horizontal goal/goals deal(s) nominates territorial issues (use of territorial logic, focusing attention on regional vulnerability and resilience, taking into consideration territorial diversity, propagation of place-based approach). Upper-middle category: Only one special horizontal goal deals with territorial issues implicitly. Lower-middle categories: only related principles emerge (subsidiarity, decentralization, multilevel governance, etc.). Lowest category: no horizontal topic emerges.
- **Spatial MRE focus of objective system- and vision-planning**
  - Best category: among the objectives and vision paragraphs a higher-level objective and/or a Vision paragraph nominate the importance of national or regional MRE development in adaptation. Upper-middle category: one objective/vision sentence deal with the MRE aspects directly. Lower-middle category: only weak references emerge to sectoral MRE issues. Lowest category: they do not mention any of these.
- **Basic territorial concepts' emergence (territorial cohesion, territorial capital, territorial harmony, territorially balanced development, territorial optimum, place-based approach)**
  - Best category: the vision and the objective system's text mentions at least 4 out of the 6 concepts. Upper-middle category: the objective system's text mentions only 2-3 of the enlisted aspects. Lower-middle category: only 1 of the enlisted aspects are mentioned. Lowest category: the objective system's text does not mention any of these.
- **Spatial visualization of the vision /objective system**
  - Best category: the vision chapter and/or the objective system chapters contain more figures (cognitive objective maps, graphs, figures about spatial directions of adaptation interventions, photographs) in connection with the intended goal or the localization of the objectives; Upper-middle category: the above chapters contain 2-3 visual elements about spatiality; regional examples. Lower-middle category: the above chapters contain 1 visual elements about spatiality; regional examples. Lowest category: there are no thematic maps in the vision chapter and/or the objective system chapters.

## 5. Spatial aspects in adaptation related actions

- **Spatial content of adaptation measures**
  - Best category: Nominally spatial unit- or regional type-related or generally spatial logic-based group of measures are present among the actions. Upper-middle category: Several nominally spatial unit- or regional type-related or generally spatial logic-based measures emerge. Lower-middle category: only few nominally spatial unit- or regional type-related or generally spatial logic-based measures or just implicit territorial contents (e.g. monitoring system building targeting mapping of ecosystems, but reference to these mapping actions is weak or implicit). Lowest category: No territorial implications can be measured.
- **Spatial planning focus of adaptation measures**
  - Best category: A dedicated group of actions deals with spatial planning's role in adaptation. Upper-middle category: one or few actions deal nominally with spatial planning's role in adaptation. Lower-middle category: only implicit reference to the topic. Lowest category: no action mentions anything regarding the issue.
- **MRE focus of adaptation measures**
  - Best category: a dedicated group of actions deals with spatial MRE issues, system building in adaptation. Upper-middle category: dedicated action or strong implicit reference in an action's or actions' text to the need for adaptation MRE activities. Lower-middle categories: only weak implicit reference to the need for sectoral MRE activities. Lowest category: no action mentions anything regarding the issue.

## 6. Geopolitical content of adaptation planning

- **The emergence of geographically climate related risks as aspects for national security (e.g., migration, water reserves, and cross-border weather events).**
  - Best category: explicit, nominated reference to the issue among the objectives/measures' titles or in the form of a situation analysis chapter; Upper-middle category: explicit reference for the issue in the document in the description of objectives/measures or in the situation analysis; Lower-middle categories: implicit reference to the issue in the document in the description of objectives/measures or in the situation analysis; Lowest category: no reference to the topic.
- **The emergence of strengthening macro regional / international co-operations through adaptation in strategies.**
  - Best category: explicit, nominated reference to the issue among the objectives/measures' titles or in the form of a situation analysis chapter; Upper-middle category: explicit reference for the issue in the document in the description of objectives/measures or in the situation analysis; Lower-middle categories: implicit reference to the issue in the document in the description of objectives/measures or in the situation analysis; Lowest category: no reference to the topic.
- **The emergence of strengthening macro regional / international influence through adaptation in strategies.**
  - Best category: explicit, nominated reference to the issue among the objectives/measures titles or in the form of a situation analysis chapter; Upper-middle category: explicit reference for the issue in the document in the description of objectives/measures or in the situation analysis; Lower-middle categories: implicit reference to the issue in the document in the description of objectives/measures or in the situation analysis; Lowest category: no reference to the topic.

## 7. Spatiality in adaptation monitoring

- **Spatial levels of data connection and monitoring/reporting activities.**
  - On what territorial levels does adaptation MR in the country? Does it concentrate / from which levels does MR obtain data? Best category: There is a functioning monitoring system in adaptation, using lowest-as-possible level territorial data in the adaptation indicator system. Upper-middle category: MR system is planned in adaptation, in the form of an action or objective, with spatial data use. Lower-middle category: MR system is planned in adaptation, but no words of lower-than-national-level territorial data in the adaptation indicator system. Lowest category: no MR system in adaptation anyway.
- **Spatial content of indicator sets.**
  - Emergence / weight of territorial approach in adaptation monitoring systems. Best category: There are impact/result and output indicator sets, concentrating on special geographic areas/regions/administrative units. Upper-middle category: There are impact/result indicators, but no territorial breakdown can be identified nor any geographic/regional specification. Lower-middle category: only output indicators are gathered in the indicator system. Worst category: no indicator system is present in the country.

- **Presence of GIS based DS system in planning:** existence of climate policy related GIS in the country and its utilization in adaptation planning and MRE.
  - *Best category:* there is a functioning GIS-based adaptation-oriented multi-thematic GIS-based DS tool(s) in the country. *Upper-middle category:* adaptation oriented thematic GIS-based DS tool's establishment is planned in the country in the form of an action or objective. *Lower-middle categories:* adaptation website is functioning /planned but without signs of GIS system. *Lowest category:* neither thematic GIS-based DS tools nor CC adaptation websites are present in the country.

## 8. Spatial aspects in adaptation related evaluations

- **The degree of spatial content in adaptation evaluations:** emergence / weight of geographically oriented reports.
  - *Best category:* emergence of explicitly even in their title geographically/spatially oriented evaluation products, rich in territorial chapters, analytical aspects, evaluation questions *Upper-middle category:* emergence of reports with partly geographic, spatial content (use of territorial chapters, analytical aspects, evaluation, lower but existing emphasis on territorial differences in evaluations). *Lower-middle categories:* large number of adaptation evaluation products, established system but no territorial content. *Lowest category:* only the NAS/NAP aims the setting up of an evaluation system or elaboration of products but no evaluation products in practice yet.
- **Spatial visualization in adaptation evaluation:** the degree of graphic solutions' use to present territorial differences, characteristics in evaluations and reports.
  - *Best category:* consequent and frequent emergence of explicitly geographically oriented maps or diagrams, info graphs in the evaluation product(s). *Upper-middle category:* only scarce use of geographically oriented maps or diagrams info graphs. *Lower-middle category:* only diagrams indicating territorial issues emerge in the document. *Lowest category:* no use of these tools are present.
- **Spatial levels of evaluations: the emergence of different territorial levels among the regular and ad-hoc evaluation products**
  - *Best category:* consequent, regular emergence of explicitly territorially oriented evaluation reports in adaptation at subnational and local levels, and the NAS/NAP refer to these. *Upper-middle category:* only ad-hoc emergence of explicitly territorially oriented evaluation reports in adaptation at subnational and local levels, and the NAS/NAP refer to these. *Lower-middle category:* only national level evaluations exist. *Lowest category:* the NAS/NAP plan to elaborate evaluation reports at lower spatial levels, but no evaluation products in practice yet.

## 9. Consideration of higher-level adaptation and spatial/territorial objectives in adaptation planning

- **Consideration of national spatial/regional development objectives** (goals & objectives of national territorial/spatial strategic documents) **in adaptation planning.**
  - *Best category:* all or almost all national territorial objectives emerge explicitly in nominated form in the documents' vision/objective system/measures. *Upper-middle category:* strong implicit presence of national territorial objectives: majority of objectives/priorities of the national territorial development directions identified in National Spatial Development Concepts is present among the NAS objectives/measures. *Lower-middle categories:* weak implicit presence of national territorial objectives: only a minority of objectives/priorities of the national territorial development directions identified in National Spatial Development Concepts is present among the NAS objectives/measures. *Lowest category:* They do not emerge.
- **Consideration of European spatial development objectives** (cohesion policy goals) **in adaptation planning.**
  - *Best category:* all or almost all European territorial objectives from the actual TA emerge explicitly in nominated form in the documents' vision/objective system/measures. *Upper-middle category:* strong implicit presence of European territorial objectives, majority of objectives/priorities of European territorial development directions identified in the then actual Territorial Agenda of the EU is present among the NAS objectives/measures. *Lower-middle categories:* weak implicit presence of European territorial objectives only a minority of objectives/priorities of European territorial development directions identified in the then actual Territorial Agenda of the EU is present among the NAS objectives/measures. *Lowest category:* They do not emerge.
- **Consideration of European adaptation objectives** (EU Adaptation Strategy's goals) **in adaptation planning**
  - *Best category:* European adaptation objectives identified in the EU Adaptation Strategy emerge explicitly in nominated form in the documents' vision/objective system/measures. *Upper-middle category:* strong implicit presence of European adaptation objectives: majority of European adaptation objectives identified in the EU Adaptation Strategy is present among the NAS objectives/measures. *Lower-middle categories:* weak implicit presence of European adaptation objectives: minority of European adaptation objectives identified in the EU Adaptation Strategy is present among the NAS objectives/measures. *Lowest category:* They do not emerge.