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Climate change impacts across Europe and the role of EU regional policy in adaptation

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Summary

In order to better prioritise adaptation decisions concerning impacts from a changing climate, there is a need for quantitative regional level assessments. In this policy update we provide insights from an impact assessment for three climate-related hazards (heat stress, river flood and forest fire) that is systematic and comparable across different countries in the European Union.

The results show strongest increases in impacts for heat stress and forest fires. Hotspot regions are found in eastern and southern Europe due to their low adaptive capacity. The assessment of risk and capacities to adapt could be a basis to inform the allocation of financial resources in EU regional policy. Yet the reactions of policy makers are sceptic still.

Introduction

Projections of future shifts in extreme weather events have become a concern to decision-makers at all jurisdictional levels. At the EU level in the context of on-going adaption planning and mainstreaming, insight is required into the unequal distribution of expected climate impacts across Europe.

Hazard-specific information may help to better understand possible regional variations in magnitude and effects of climate change impacts, and to develop adequate adaptation strategies. In particular, such information may help to decide on priorities for funding adaptation through financial instruments available in the European Union, and solidarity principles to allocate resources to Member States that are disproportionally impacted.

As part of the RESPONSES research project, one work package has been devoted to assess the distribution of projected climate impacts, and to analyse the contribution to climate goals of the current (2007-2013) Structural and Cohesion Funds (SCF).

In this policy update we provide some the most relevant insights from a climate change impact assessment based on indicators for heat stress (in relation to human health), river flood and forest fire at a pan-European NUTS 2 level. We identify potentially most vulnerable regions by comparing the overall hazard impact with an assessment of current adaptive capacity.

Perspectives from a policy workshop in Brussels are included to reflect on the usefulness of such assessments for EU adaptation efforts.

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Projected changes in risk for heat stress, river floods, and forest fires

Heat stress

The spatial distribution of the heat stress indicator for the (current) baseline period situation shows the highest potential impact for Italy, for parts of Greece, southern France, and major parts of Germany (see Fig. 2; upper left map). Other regions classified as high or very high are found in the southern UK, Belgium, Portugal and Spain. Also highly urbanised regions, such as London, Hamburg, Berlin, Prague, Vienna, Budapest, Bucharest, Athens, and Madrid stand out as (very) high impact regions in relation to their neighbouring regions.

For the medium-term future (scenario 2041-2070), the trend towards increasing heat stress is projected to continue for most parts of Europe, but especially in central Europe, such as in Germany, the Netherlands, and Belgium (Fig. 2, upper right map). All Hungarian and most Spanish regions exhibit high or very high impacts, while the southern Scandinavian regions have changed from low to medium impact.

River flood risk

Baseline river flood risk reveals a scattered picture throughout Europe, with highest risks in central Europe, parts of England, eastern Europe, and northern Italy (see Fig. 2, middle left map). The patchy risk pattern reflects the fact that flood-prone areas (i.e. areas used for residential or industrial purposes) are in particular found in close vicinity to the large European rivers. Consequently, clusters of high or very high risk are found along major river systems, such as the Danube, the regions along the Rhine, and for the Po basin in northern Italy. The Alpine regions e.g. in Austria, are at high risk too.

Comparing the baseline situation with the scenario 2041-70, a slight increase in flood risk is seen for a number of regions in particular in western Europe and in the Po basin, whereas some other regions (e.g. most Polish regions) show a slight decrease of flood risk (see Fig. 2, middle right map).

Forest fire risk

The forest fire indicator shows a very high current risk for virtually all regions in southern European countries, including Portugal, Spain, Italy, Greece, and parts of Bulgaria (see Fig. 2, lower left map). Within France, a gradient from very high fire risk in the south to a medium risk in the north is seen. Single, scattered areas of high risk are further found in central and eastern Europe, in particular in (south)-eastern Germany, Poland, Czech Republic, the lowland areas of Austria, and Hungary.

A northward expansion of very high and high fire risk occurs for the scenario period 2041-2070, with major parts of Germany, Poland, Czech Republic and Hungary now highly affected (see Fig. 2, lower right map). However, the strongest increases in fire risk for the southernmost are found in the southern regions of Europe such as south Spain, Portugal, Greece (not seen in Fig. 2, as those regions are already in the highest risk category in the baseline situation).

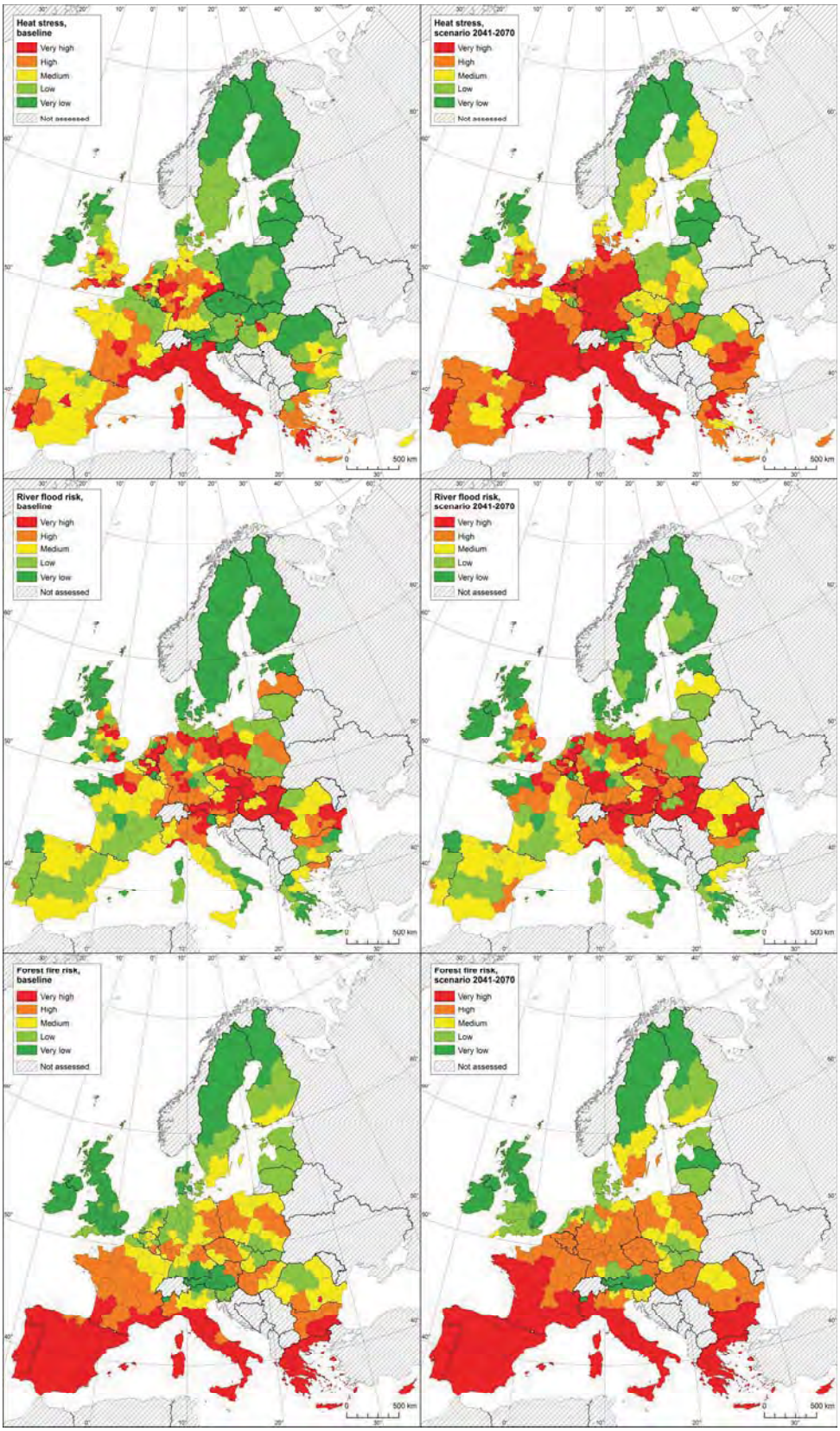

Figure 2: Impacts of heat waves, river flood risk, and forest fires in the EU; baseline situation (left) and future scenario (2041-2070) (source: Lung et al., in press).

Methods for the impact analysis of changing weather hazards

The units of analysis are the NUTS-2 regions for 26 of the Member States of the European Union. Climate impacts are determined by exposure and sensitivity to climatic drivers (Figure 1). For details on the transformation of the indicators and the aggregation see the publication by Lung et al. (in press). An assessment was made of impacts for three time windows: the baseline situation for the period 1961-1990, a short-term scenario for 2011-2040, and a medium-term scenario for 2041-2070. This study uses a set of high-resolution regional climate model projections (from the FP6 ENSEMBLES project), integrates spatial variations in current and projected non-climatic sensitivity factors, and follows an approach that allows for comparisons between different hazard impacts, and between and within European regions.

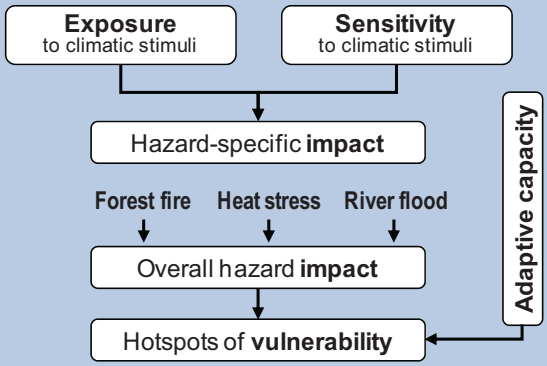

Figure 1: Conceptual approach for the indicator-based assessment of potential hazard specific climate change impacts and the identification of vulnerability hotspots

Adaptive capacity and hotspots of vulnerability in Europe

Hotspots of vulnerability were identified by aggregation of heat stress, river flood risk and forest fire risk. For the baseline situation, the aggregate impact indicator shows very high or high overall impact in Italy and Greece, the southern parts of Portugal, Spain and France, and most parts of Hungary (see left map in Fig. 3). Other high impact regions are in southern Romania/northern Bulgaria, eastern and (south)-western Germany, Belgium, the Netherlands and the UK. Comparing the baseline situation with the medium-term scenario of 2041-2070, a strong projected increase of overall impact is seen for almost all regions in southern Europe and France, as well as large parts of Germany, Czech Republic, Belgium and the Netherlands falling into the two high impact categories. In contrast, for Ireland, Scandinavia, north-eastern Poland and the Baltic countries, and most regions of the UK, the overall impact remains (very) low.

An overlay of the overall impact with the adaptive capacity indicator for the current situation shows a total of 47 regions that might face a particularly high vulnerability compared to the baseline climate variability, among which: Portugal and Greece, the

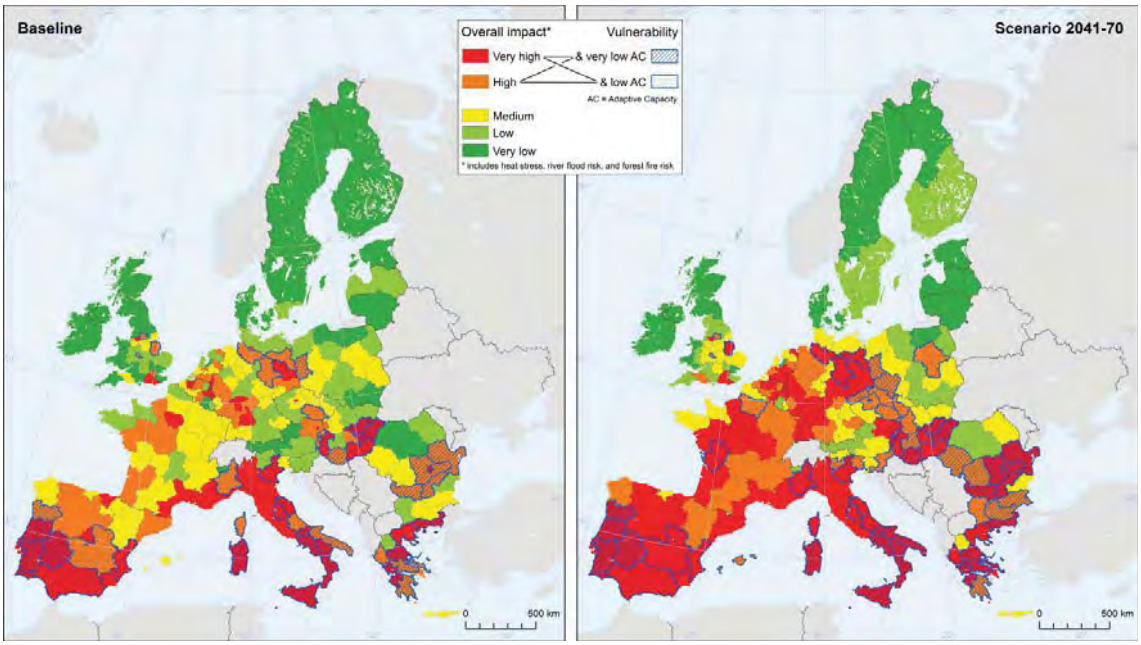

Figure 3: overall change in impacts and adaptive capacity distribution in the EU (source: Lung et al., in press)

southernmost regions of Spain and Italy, in Hungary and in parts of (north)-eastern Germany (regions with blue signatures in left map in Fig. 3). A total of 15 crucial areas, with very high impact but very low adaptive capacity, are found in southern Portugal, Spain and Italy, in Greece and in Hungary.

For the future scenario for 2041-2070 an increase is seen in the number of potentially most vulnerable regions to 66 (right map in Fig. 3), given adaptive capacity at current levels. New hotspot regions would be found mainly in Bulgaria, Romania, Czech Republic, Poland, and France, while other regions are projected to turn into 'more severe' hotspot regions, that change from high to very high impact, such as southern Romania and northern Bulgaria or in (north)-eastern Germany.

Adaptive capacity in Europe

We defined adaptive capacity as a function of the three components (1) financial capital, (2) human capital, and (3) technological capital, each covered by two variables. Financial capital involves aspects of economic productivity (GDP) and income equality (GINI coefficient). Human capital captures educational achievements (share of people with tertiary education) and health services (doctors per capita), whereas technological capital covers research and development investments as well as internet use.

Implications for European regional policy

Our assessment predicts growing disparities in impacts and vulnerabilities across Europe. In the light of the core EU objective to achieve economic, social and territorial cohesion, this would require the redistribution of resources and aid to counteract such developments.

During a workshop in Brussels (14 October, 2011) policymakers from different jurisdictional levels and researchers critically discussed the usefulness and the implications of this impact assessment and the need for European regional policy to address adaptation.

The workshop did not aim to create a consensus, but we distilled the following important messages:

- There is a lacking agreement on what vulnerability is and who is vulnerable: Policy makers fear the abuse of assessments to gain additional funding.
- The missing definition for adaptation and the problem with attribution of adaptation problems to climate change are barriers for any adaptation relevant EU policy. The EU should take up the lead in providing a common conceptual framework.
- Particularly in cases of climate impacts with cross-national implications, EU intervention is considered important.
- Some form of European solidarity is necessary to help those regions adapt that have not sufficient adaptive capacity.
- Participants proposed that no new instruments are needed, but existing policies such as EU cohesion policy and insurance mechanisms need to be adapted to fit the new needs under the circumstances of climate change

Further work within the RESPONSES project will address the contribution of the current Structural and Cohesion Funds (2007-2013 budget) to mitigation of and adaptation to climate change. Climate impact analyses, such as the one presented here, may help to identify vulnerabilities and inform decisions on investments for adaptation in Europe.

Scientific innovation and limitations of the climate impact study

The spatial and temporal patterns of projected impacts to some extent confirm existing studies. However, the results are likely to underestimate the actual future risk of damages from river floods for the period 2041-2070, due to a limited availability of suitable projected sensitivity data, and only changes in extreme flood events are taken into account. The assessment of forest fire risk could not take into account location-specific parameters that are usually considered in fully grid-based bio-physical models.

The indicator for heat shows somewhat different results compared to previous studies that have identified southern Europe as generally most heavily affected in the future. The current study indicates that the largest projected future impacts will occur in central Europe (e.g. Germany, France), because of the expected demographic changes - i.e. increase in the share of old-aged people and old-aged people living alone - which is projected to be more rapid for instance in Germany, compared to Spain.

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About the

RESPONSES

Project:

The RESPONSES project addresses EU policy challenges by: developing new global low emissions scenarios, placing EU efforts in a global context; building an approach for assessing EU policies against mitigation and adaptation objectives and for developing alternative policy options; applying this framework in five EU policy sectors (water and agriculture, biodiversity, regional development/ infrastructure, health and energy), linked by a set of cross-sectoral integrative activities; and synthesizing the results to new policy strategies.

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IVM, Institut for Environmental Studies

UEA, University of East Anglia

IIASA, International Institute for Applied Systems Analysis

PBL, Planbureau voor de Leefomgeving

ISI, Fraunhofer Institute for Systems and Innovation Research

CSIC, Consejo Superior de Investigaciones Cientificas

CAS-IPM, Institute of Policy and Management, Chinese Academy of Sciences

TERI, The Energy and Resources Institute

JRC, Joint Research Centre - European Commission

UH, University of Helsinki

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