ESPON 2006 Programme
Action 1.3.1

The spatial effects and management of natural and technological hazards in general and in relation to climate change

TENDER

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1. Introduction and outline

1.1 Dealing with multiple Hazards

Over the years, researchers studying national, regional and local approaches towards natural and technological hazards have recognized the difficulty of generalizing about hazards. Generalisations fail because both the areas threatened and potentially affected as well as the nature of the events themselves are unique. Cities and towns, for instance, vary in size, are situated in different regions or territories, with different economic bases and community and cultural values. The communities that are hit by natural or technological disasters are affected by different types of damages. They endure different types and extents of losses and have recovery periods unique in nature and timing. In addition, the recovery and reconstruction experiences of these communities are heavily influenced by the current forms of national disaster assistance, of which the amounts, types, and procedures have changed significantly over the years.

Natural hazards have been known to human settlements from their very beginning. Technological hazards, despite their relative novelty, are at least as manifold as natural hazards. The magnitude and destructive potential of technological disasters is comparable to, if not greater than that of natural hazards. We can remind ourselves of the tragic disaster that took place in Chernobyl in 1986 to appreciate this fact. Nuclear meltdown is probably the most severe technological disaster possible, in terms of both the extent of the affected area as well as the long lasting aftermath. Nevertheless, there are many other technological hazards, such as chemical and oil industries, mining accidents and many more.

The ESPON HAZARDS project builds on the recognition that hazardous conditions across Europe are far from homogeneous; indeed, the European "hazardscape" holds a plurality of particular conditions and discontinuities. Consequently, the ESPON HAZARDS project recognizes the need to develop knowledge and tools that match this plurality. The project will try to categorize different technological and environmental hazards and to assess them in typologised regions. The recognition of situated hazards also has implications for the responses envisaged.

1.2 Putting Climate Change in place

There are also combinations of natural and technological hazards, such as river floods that are increased in their impacts caused by hydrological engineering works to straighten rivers. In addition, climate change can have a multiplying factor upon hazards that were perceived as minor in the past but suddenly develop to being severe threats, such as droughts causing extensive forest fires or heavy storms flooding previously safe coastal areas. While global climate policy is focused on slowing down climate change by reducing greenhouse gas emissions, the option of adaptation to eventual changes at spatial levels below the global also needs serious attention.

In this perspective, the purpose of the ESPON HAZARDS project is not to solve the problem of climate change and its possible origins, but to address the possible regional and local effects of phenomena induced by climate change, e.g. rising sea-levels or changing river run-off patterns. The project assumes that climate change is not the only source of natural hazards, even though an increasing majority of the public may believe so. The project will seek to put climate change in its proper perspective by focusing on all the different variables that cause hazards and by trying to capture them with relevant typologies and categorizations. The major impact types, their causes and geographical impact areas are to be verified within the course of the project. The main focus is to address the needs of spatial planners and consequently the decision-makers on how to deal with hazards on different regional levels in Europe.

1.3 Adressing vulnerability – both natural and social

Disasters arise when hazards hit vulnerable conditions. Different communities, small and large, which find themselves at risk and struggle with hazards, are situated in different natural (geological, physical, ecological) and social (institutional, legislative, organisational) settings. Vulnerability is best understood as a combination of factors in these settings, which makes the community either vulnerable or resilient towards different hazards. In brief, vulnerability is defined as the characteristics of a person, group or community in terms of their capacity to anticipate, cope with, resist and recover from the impact of a natural or technological hazard. Similarly, larger socio-economic entities and structures, such as cities, urban agglomerations, regions and nations, face different hazards and have different capacities to cope with, resist and recover from disaster.

A key insight from the social science perspective is that vulnerability should be defined not only in terms of natural/physical conditions, but also from a socio-economic perspective. From the social perspective, vulnerability is structured in layers: deeply rooted causes in economic and political systems play upon *dynamic pressures* (such as lack of local institutions and investments), which, when combined with *unsafe conditions* (deficient infrastructure, poor construction quality) render a particular group or community vulnerable to hazards. A parallel progression of vulnerability can be seen in physical and environmental terms. As such, the idea of the progression of vulnerability is compatible with the DPSIR indicator framework. The progression of vulnerability from driving forces, dynamic pressures and unsafe conditions is a process where the natural and social factors interact. Thus, the vulnerability of a city or a region may not be fully understood merely as a product of natural conditions *or* socio-economic conditions, but as a place-specific combination of the two.

The ESPON-HAZARDS project will elaborate links between between the natural and social perspectives of vulnerability to hazards (see figure 1). The most vulnerable situations arise where vulnerable regions (e.g. in terms of flood probability) and vulnerable social settings (e.g. lack of preventive policies and resources for relief) meet. Understanding and mapping vulnerability is a precondition for developing risk management tools and targeted response measures. The project will carefully consider the major socio-economic ties that constitute different regions and their economic interdependences. This will finally lead to a vulnerability index that focuses on both the likeliness of categorized hazards as well as consequent socio-economic impacts.

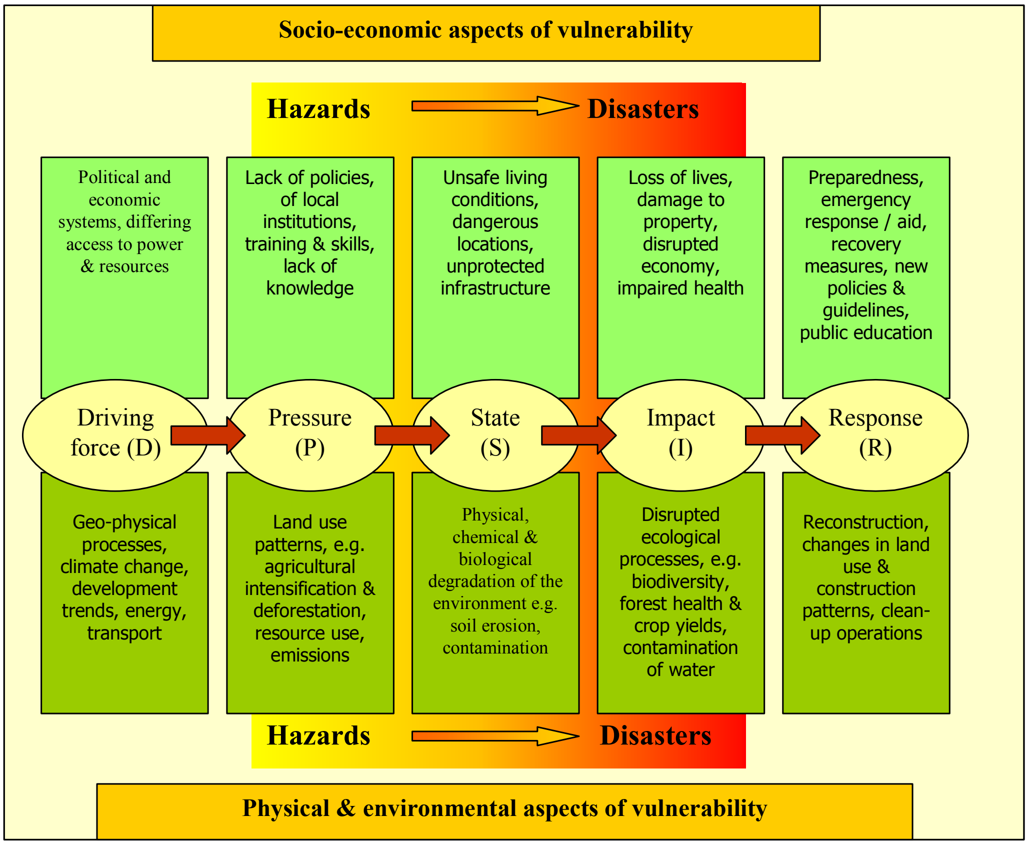

Figure 1. Socio-economical, physical and environmental aspects of vulnerability

1.4 Facilitating a targeted response – the spatial planning perspective

The aftermath of a technological or natural disaster often poses a monumental challenge to the local population and administration of the affected area in terms of recovery and restoration. Citizens whose homes have been damaged need replacement housing; water, sewage and other public services must be restored to maintain public health and support other recovery activities; and the process of reconstruction of damaged infrastructure such as dams, bridges, electric poles, schools etc. Natural disasters also pose challenges to the economy and resources of regions; their effect on developing countries is relatively more severe because of their limited capacities and resources to cope with the losses.

The impacts of disasters require response measures. Responses vary due to different capacities – but there is one constant: response to hazards and disasters is always a collective effort. This is why the quality and capacity of regional networks becomes a crucial issue. Collective efforts, involving different combinations of institutions at different levels, civil society organizations, private enterprise and individual citizens, contribute to the resilience of a region towards hazards. For this purpose, the framework concept of *response networks* will be developed in the project. The concept is prescriptive in the sense that it points to a challenge of good governance and integrated risk management.

Since response, such as prevention and recovery measures are place-specific, response networks also need to be seen as rooted in specific regions. Here, local knowledge plays a role as well. Where hazards turn into disasters, lives are lost and damages occur – but there is also learning: local mitigation measures and institutional capacities are developed. Local knowledge, arising from repeated disaster events over decades and centuries, is a valuable resource for developing responses to hazards. Even if cases are unique, lessons learned in one locality may inspire, and become adapted by other actors in other localities and regions to their benefit.

Specifically, a spatial planning response to hazards is drafted in the project. This response draws on both the scientific environmental data and a careful selection of socio-economic data and indicators. Apart from tragic human and material losses by disasters the mid- and long-term economic impacts play a major role in the development of various regions.

The ESPON HAZARDS project sees spatial planners on EU level as the key end users benefiting from the project. The main expectations of the spatial planners concerning the results of this project concern prevention. Therefore, the project will focus on how spatial planners can contribute to the mangement of hazards at different spatial scales, including the European scale. The different nature of technological or natural hazards, the possible interaction between them, and their combination with climate change require a multi-level research approach that focuses on a typologisation of possible threats to categorised areas. This typology will help planners in dealing with the uncertainty of hazards. Combined with the focus on response networks and learning from good European practice, the project allows the development of a spatial planning response that is targeted at different levels, both at the scale of local and regional land use planning and the scale of policy guidelines at national and EU levels.

2. Summary presentation of the tenderer and the consortium

2.1 Members of the consortium (the project has no subcontractors)

Partner No. 1: (Lead partner): Geological Survey of Finland (GTK), Finland
Partner No. 2: Swedish Meteorological and Hydrological institute (SMHI), Sweden
Partner No. 3: Comissão de Coordenação da Região Centro - CCRC and Instituto Geologico e Minero (IGM), Portugal
Partner No. 4: Institute of Ecological and Regional Development (IOER), Germany
Partner No. 5: Institute of Spatial Planning (IRPUD), Germany
Partner No. 6: Center for Urban and Regional Studies/Helsinki University of Technology (CURS/HUT), Finland

2.2 GTK Company Profile - Survey, R&D and Services organization / www.gsf.fi

The Geological Survey of Finland (*Geologian tutkimuskeskus,* GTK) is the national geological organization of Finland and, at the same, one of the most competent European service centres in applied earth sciences. The permanent staff amounts to 813 of which 339 are highly qualified professionals in various aspects of geology, environmental sciences, geophysics, geochemistry and information technology, many of them with strong international background. GTK´s performance power is based on a careful balance of resources between the fundamental “Survey” function, research and development of technologies, and commercial services. Scientific quality services are provided with considerable in-house R&D; competent institutional knowledge is achieved through active participation in surveying, resource assessment and dissemination of information to investors.

GTK is internationally recognized for its pioneering in granite research (since GTK´s foundation in 1885), airborne geophysical surveying (1951), chemical analyses of the first lunar samples (1970), regional geochemical mapping (1970s) and application of geophysical methods for monitoring environmental impacts (late 1980s). GTK´s problem approach and solutions are often based on practices and methods developed by itself, and always on means that are tested thoroughly before applying them for customer needs. Today GTK contributes to some twenty R&D projects within the European Commission and various other science and technology projects in different fields of earth sciences.

GTK focuses on maintaining and developing a proper geoscience information infrastructure for an economically, environmentally and socially sustainable development. In contractual undertakings GTK strives towards supporting its customer objectives and business by providing solutions for developing geological resources, improving environmental performance or producing information useful for land use planning and construction projects. GTK is an expert in all aspects of institutional building for the minerals sector and conducts research on the sustainable use of natural resources, on land-use planning and on monitoring the state of the environment. GTK expertise extends to important global issues like natural disasters and climate change.

Examples of GTK services

ENVIRONMENT: base line studies (ground, marine, airborne and earth observation techniques), mining and environment issues, site assessment, radioactive waste disposal, laboratory design and test services, institution building, indicator development, ecotourism, medical geology

WATER SUPPLY AND SANITATION: land use, conservation and environmental management related to groundwater, groundwater in bedrock structures, water quality

MINERALS SECTOR: geological training and education, information systems, assessment and feasibility of mineral potential, small-scale mining, airborne geophysics

2.3 Description of the consortium

The project consortium has been built keeping in mind the need to operationalise the basic concepts and aims of the ESDP. The three fundamental aims of European policy, i.e. cohesion, competitiveness and protection that are further elaborated in the ESDP policy guidelines, are supposed to form the basis for sustainable development and thereby transcend all projects of the ESPON Programme. The consortium presented here is capable of carrying out that task as it incorporates manifold expertise both in European spatial planning in general as well as in environmental management and risk assessment topics in particular.

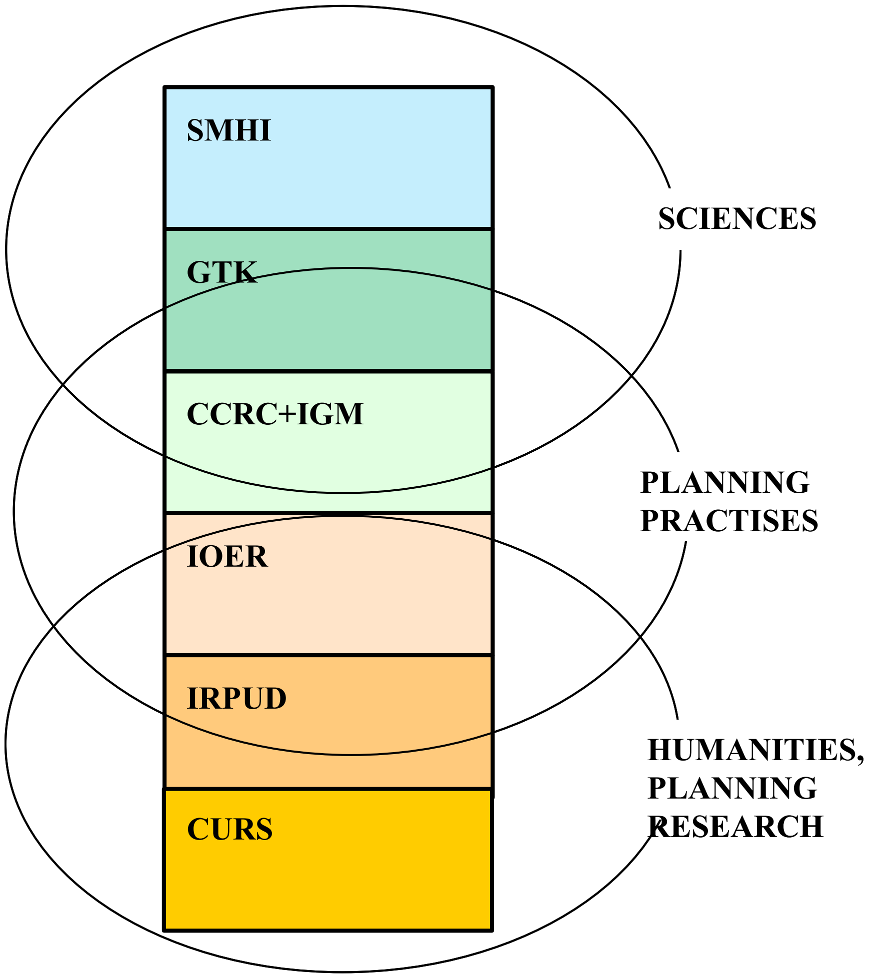

Figure 2. Main fields of expertise of the project team

The project team is very well aware of the need for concrete policy recommendations as the mere reporting of results from scientific analysis is not sufficient to support policymaking. This is why planning practitioners and environmental authorities have been incorporated to the project work. There is a regional environmental authority involved as a project partner and 2 planning authorities as discussion partners (see the Letters of Intent in the Annex IV). They are interested in testing the indicators developed in the project. They will also be engaged in the study of risk reduction through spatial planning. This communication platform between the researchers and the authorities confronted with hazards supports the formulation of reasonable policy recommendations. The strong cooperation between natural sciences and social sciences will lead to a fruitful exchange of ideas including a mutual learning process. Both sides will have to understand each other in order to get beneficial results out of the different fields of expertise (see figures 2 and 3).

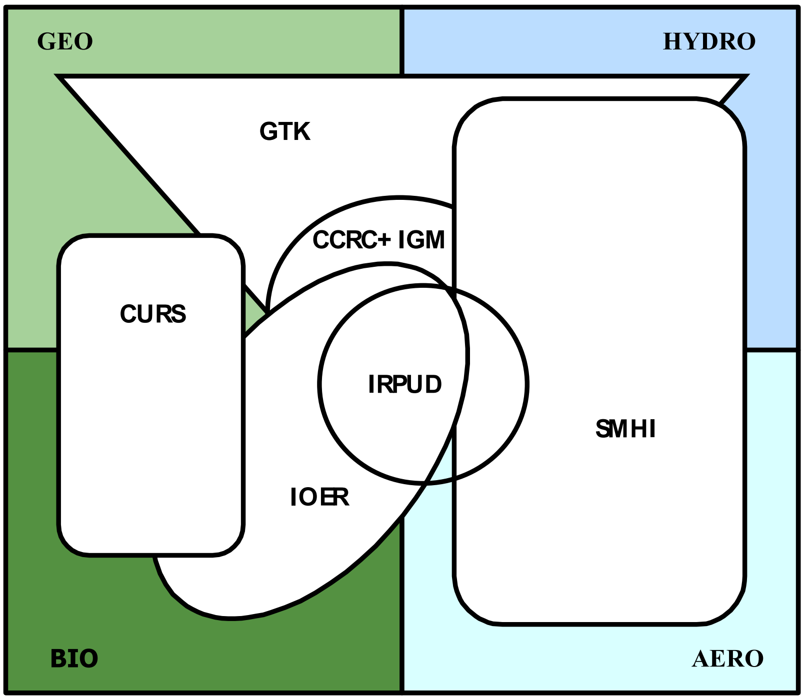

Figure. 3 The project team's fields of expertise for developing indicators

The diversity of European territory has to be taken into account as the occurrence and significance of hazards varies between different parts of Europe. Also institutional settings vary between countries and regions, affecting the ability to act in hazard prevention and after-treatment. The European-wide conceptualisation of hazards in this project team is guaranteed – having partners from Finland, Portugal, Sweden and Germany. In addition the project team has firm knowledge base on the countries outside of the EU [e.g. IÖR acting as the contact point of Interreg IIIB CADSES, GTK as a member of the ETC/TE and many other cooperations in accession countries; CURS having conducted studies on spatial planning in the Baltic countries and SMHI having projects in many countries outside the EU] (see figure 4).

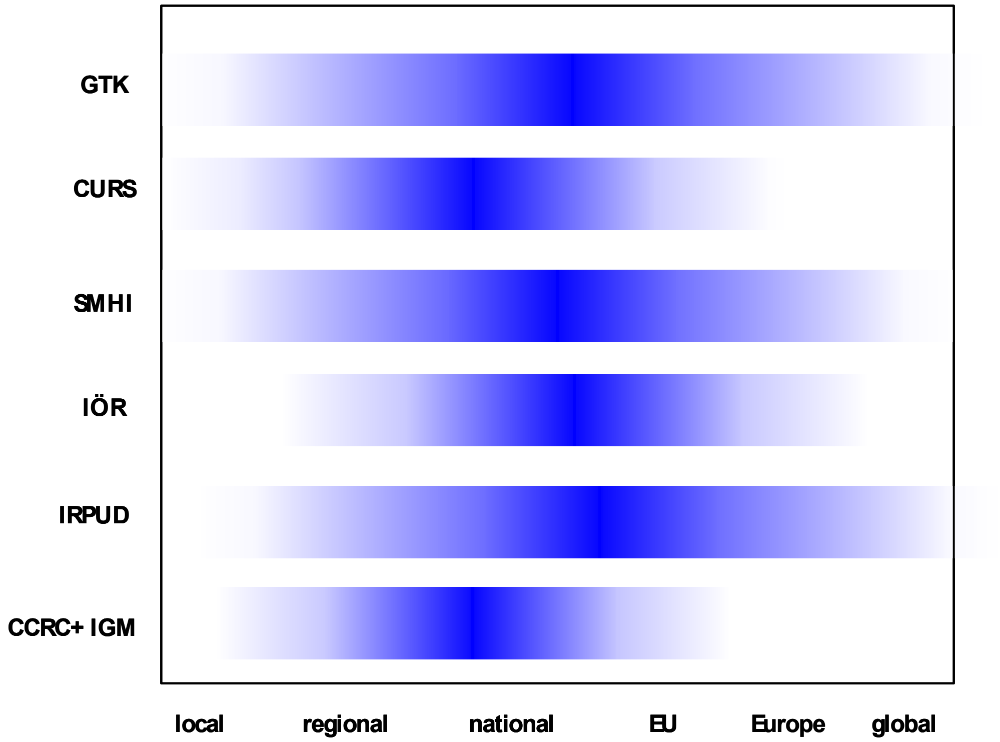

Figure 4. Geographical level of the project team activities

The horizontal projects under priority 3 will make valuable work in connecting the work done in different ESPON projects. The GTK-led hazard project has already contacted currently running project 3.1. in order to ensure a good start for the cooperation. This relates both to data base development and the use of the results of the ESPON Data Navigators.

3. Information regarding the conditions of exclusion

The consortium led by GTK consists of two universities and four public institutes with evidence of stability and good financial conduct. Being public, state-owned universities receive their basic funds from the national budget. The status of a public institute also guarantees the payment of social security fees, taxes and dues. Also the consortium members and subcontractors from institutions with another kind of status have proven efficient and reliable. Extensive additional information and various certificates are provided in the Annex II.

Neither the lead partner GTK, nor one of the five other partners of the consortium is in situations that could lead to exclusion as listed under point 12 of the restricted call for tender.

4. Information regarding selection criteria

Assurance of no conflict of interest

The Act and the Decree of GTK in the Annex II approve GTK's independency. GTK has no direct or indirect interest of type or scale that could jeopardise his independence in carrying out the tasks of this project. The same counts for the other (all public) partners.

For the **precise identification** of the tenderers, their **financial**, **technical** and **professional** capacity please see Annex I for detailed information.

5. Information regarding award criteria

5.1 Knowledge of regional policy and the European Spatial Development Perspective and of the question of transport policy in the context of the whole European Territory

The proposed project consortium represents very well the expertise required in carrying out the project of the Espon programme. The foreseen multinational project group for the "Spatial effects and management of natural and technological hazards in general and in relation to climate change", co-ordinated by the Geological Survey of Finland, has been built keeping in mind the need to operationalise the basic concepts and aims of the ESDP. The three fundamental aims of European policy, i.e. cohesion, competitiveness and protection that are further elaborated in the ESDP policy guidelines, are supposed to form the basis for sustainable development and thereby transcend all projects of the ESPON Programme. The consortium presented here is capable of carrying out that task as it incorporates manyfold expertise both in European spatial planning in general as well as in environmental management and risk assessment topics in particular.

Examples of projects (please see Annex I for detailed project reference lists):

European level (EU, candidate and neighbouring countries)

GTK: Sea Level Change Effecting the spatial Development in the Baltic Sea Region (SEAREG), Interreg IIIB
GTK: Development of indicators in Terrestrial Environment issues for the European Environment Agency
GTK: Planning Systems for Sustainable Development Interreg (PSSD) Interreg IIC
SMHI: ELDAS (Development of a European Land Data Assimilation Scheme to Predict Floods and Droughts) EVG1-CT2001-00052
IGM: The MINEO Project "Assessing and monitoring the environmental impact of mining activities in Europe using advanced Earth Observation Techniques"
SMHI: TELFLOOD (Forecasting floods in urban areas downstream of steep cathcments) EU ENV4-CT96-0257
IOER: FOCUS (The Future of Industrialized Cities and Regions undergoing Structural Changes)
IRPUD: PROPOLIS: Planning and Research of Policies for Land Use and Transport for Increasing Urban Sustainability (2001-2003), European Commission, 5th RTD Framework Programme.
IRPUD: SPESP – Study Programme on European Spatial Planning, Working Group 'Geographical Position' (1999-2000), European Commission, DG Regio
CURS: Espon 1.1.2: Urban-Rural relationships in Europe
CURS: Study Programme on European Spatial Planning (1998-2000, DG-Regio; Finnish Government)

Examples of Publications (please see Annex I for detailed information):

- Schmidt-Thomé, Philipp; Lahti, Mari and Prof.Dr. Gabor Gaál (2002): Environmental airborne radiometric surveying and monitoring possibilities of uranium mining impacts. In Bolviken, B.: Natural Ionizing Radiation and Health. Proceedings from a Symposium held at the Norwegian Academy of Science and Letters, Oslo, 6-7 June 2001.
- Jarva, Jaana & Palmu, Jukka-Pekka 2001. Geo-indicators. In: Hansen, Henning Sten (ed.) 2001. PSSD: Planning System for Sustainable Development: The methodical report. NERI Technical Report No. 351

- Lampio, E.; Gustavsson, N.; Salminen, R.; Tarvainen, T. 1996. Application of computer-aided data storage and map production methods on regional geochemical data. In: 1st European Congress on Regional Geological Cartography and Information Systems: geological cartography and information systems for land and environmental planning in European Regions: proceedings. Vol. 1. Bologna: Regione Emilia-Romagna - Servizio Cartografico e Geologico
- Carlsson, B. and Bergström, S. (1998) The TELFLOOD project. Rainfall-runoff modelling and forecasting. SMHI RH. No. 14, Norrköping.
- Bergström, S., Filatov, N., Pozdnjakov, D., Magnuszewski, A. and Bergström, H. (2000) The Baltic basin - Rivers, lakes and climate. In: Lundin, L-C. (ed) Sustainable Water Mangement in the Baltic Sea Basin, 1. The Waterscape. The Baltic University Programme - Uppsala University
- Langner, J. and Bergström, R. (2001) Impact of climate change on regional air pollution budgets. In: Transport and Chemical Transformation in the Troposphere. Midgley, P., Reuther, M. And Williams, M. (eds.). Springer-Verlag Berlin Heidelberg
- Müller, B. (2001): Urban networks and polycentric spatial development in Europe – the case of Germany. In: EUREG 9/2001, p.40-46.
- Müller, B.; Finka, M. (2001): How to manage urban-industrial change in central and eastern Europe? In: EUREG 9/2001.
- Meinel, G.; Winkler, M.; Lavalle, C.Indicators for the spatial analysis of settlement and open land trends in urban areas - studies on base of five European cities over a 50-year period In: Sustainability in the Information Society, 15th Int. Symposium Informatics for Environmental Protection, Metroplis Verlag, Marburg 2001, Part 1
- Greiving, Stefan: "The necessity of a linkage between regional planning and regional co-operation for sustainable flood prevention by the example of the IKoNE-Concept" (Report on the EuroConference „Regional Governance", Hanover, 20.04.01)
- Greiving, S./Kemper, R.: Integration of Transport and Land-Use Policies. Berichte aus dem Institut für Raumplanung Band 47. Dortmund 1999.
- Schmidt-Thomé, Kaisa & Christer Bengs (1999). ESDP and Spatial Planning and Development in the Baltic Countries. Nordregio Report 1999:2.
- Mikkonen, Leena (ed.) (2000). Multi-core metropolitan regions in Baltic Palette Project's Urban Systems; Action Group Reports. Mälardalsrådet, Sweden.

5.2 Knowledge upon spatial effects of hazards

(Referring to: Technical quality of the tender in relation to the services required)

5.2.1 Policies and policy impact analysis

The main emphasis *of the ESPON HAZARDS project* will be on designing, developing, testing and evaluating various ways of monitoring and modelling regional sustainability in relation to hazards. The practical planning and management instruments (such as indicators, models, simulations) that support the planners, policy-makers and citizens in designing, analysing and evaluation the impacts and alternatives of interventions are among the deliverables of the network. A special emphasis is given on urban areas.

The development of urban areas influences to a great extent the overall sustainability of the planet. Most of the resources and energy is used in urban areas and consequently they are also the main sources of emissions and pollution. In urban areas the ecological, economic and socio-cultural dimensions of sustainability are interacting in intense, complex and often conflicting ways. Hence the development of urban areas has a crucial impact not only on the quality of life of their inhabitants but also on the overall sustainability of regional and global development and the competitiveness of European cities – and Europe – in the world market. Many external development processes, such as globalisation and the accelerated development of the information and communication technologies influence the development of urban areas. On the one hand they create new ways to achieve sustainability but on the other hand they can also present obstacles to sustainable development.

While the relation between urban development and sustainability remains an open one, it is evident that natural and technological hazards threaten both urban development and the well-being of urban populations. Their potentiality to destroy lives and livelihoods is in sharp contrast with ecological, economic and social aspects of sustainable development. Therefore, concerted research actions are needed in order to prepare urban areas for the challenges that hazards pose to urban sustainabilityin conjuncture with ongoing development processes.

The project will take into account that natural and technological hazards could result spatial development barriers in different scales, depending on magnitude of the hazard and the existing conditions of the area. These barriers will be identified and mapped at an adequate geographical level using regional typologies together with capabilities and resources for risk reduction and management.

Other tasks of the project will concern a study of developments in the contaminated site management as a part of case-based risk assessment. For example, flooding is a natural hazard that can cause more serious problems if flooding reaches contaminated sites. Such a hazard nearly turned into a disaster in Central Europe in summer 2002 when the flooding of the Elbe reached a chemical factory in the Czech Republic. Toxic waste containing mercury and dioxines that were stored in the factory property was discharged into the surrounding areas. Spatial planning and management should consider contaminated sites with more deeply respect via appropriate case-based risk assessment, which includes the possibility of technical and natural hazards.

The key issues of the ESPON action 1.3.1, a typology of regions and a synthetic index of vulnerability as the basis for a list of highly sensitive areas, will be innovative results. Existing projects and strategies in Europe and worldwide contain only singular parts of these issues. Regarding the territorial background, the U. S. HAZUS project (Estimated Annualized Earthquake Losses for the United States) has a comparable range. However, the project focused only on one hazard: earthquakes. But for this purpose, an innovative, monetary based index of vulnerability was created. Others concentred their efforts only on floods (e. g. the International Committee for the Protection of the Rhine or the State Government of Northrhine-Westfalia).

Within the EU several scientific institutes have been developing vulnerability indicators. A few of them, like the Potsdam Institute for Climate Change, tested these indicators within vulnerability studies (in this case for the federal states Brandenburg and Northrhine-Westfalia). These studies (and others too) excluded indicators that referred to technological hazards.

Regarding to a spatial planning response several authors like David Gottschalk and Richard Burby from the U. S. have described fundamental components for this purpose. However, their work focused in the first instance on policy responses and excludes particularly the indicator tool.

All in all there is no existing scientific work or good practise which roughly developed an integrative spatial planning and policy response for the space-relevant natural and technological hazards or focused to the EU territory.

5.2.2 Indicators and data

An indicator is a tool to measure and indicate the development of various phenomena. It shows the condition of a system and changes over time. The Hazards project will use the European Environmental Agency's (EEA) definition for indicators. According to EEA, indicators can be used to express the condition of complex systems, summarizing the complex into a manageable and understandable message. Each indicator by itself tells a story as part of the wholeness, and only by combining indicators it is possible to gain a complex view. Environmental indicators provide information that is considered to be critical to understanding the development of environmental problems and hazards.

Indicators are a good tool for communication. When the indicator is understandable and definite as well as commonly agreed it can be the basis for discussions between scientists, policy-makers and the public. Policy relevance, scientific reliability and data feasibility are the most important requirements for indicators according to EEA. The indicator development uses the DPSIR framework. According to this framework, a casuality chain from **D**riving forces over **P**ressures to environmental **S**tates and resulting **I**mpacts shall finally lead to **R**esponses. All the indicators used in this project will be assimilated to DPSIR model (figures 5 and 6).

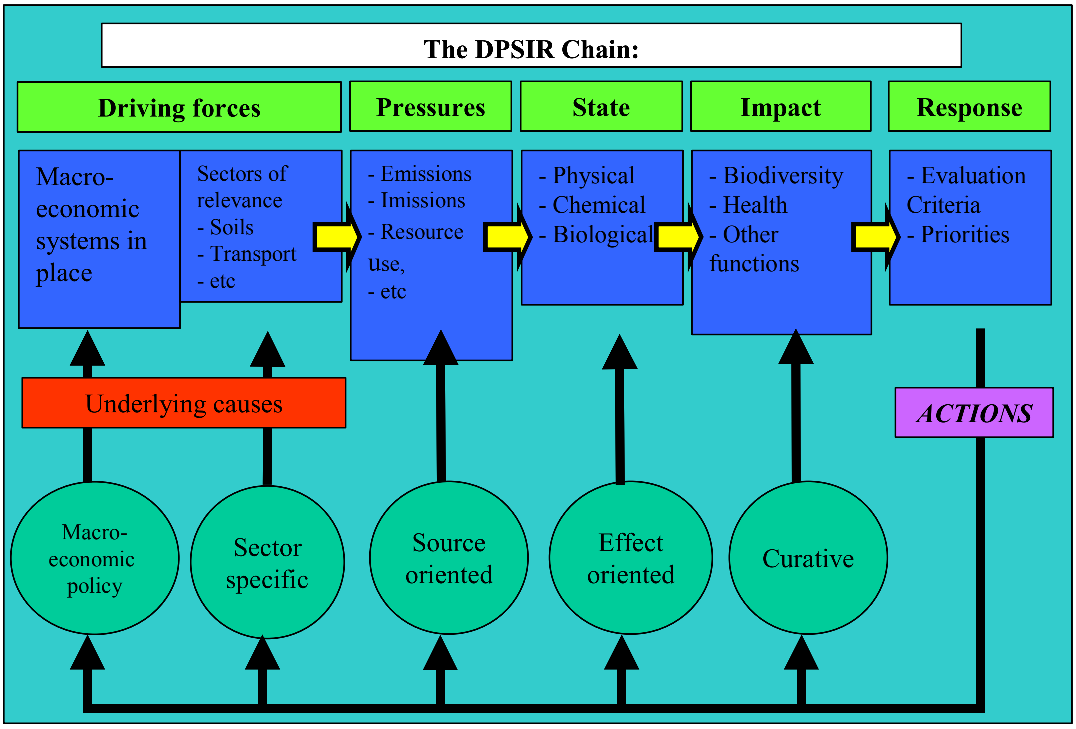

Figure 5. The DPSIR chain

The environmental as well as social and economical indicators that are related to natural and technological hazards will be listed and described within WP1. The indicators that will be used are presented and investigated by accepted European policies, such as indicators published by EEA.

The chosen indicators will be assessed by considering their geographical coverage. The levels below NUTS 2 shall be investigated and the aim is to present natural and technological hazards related indicators in different territorial levels covering the EU member states. The comparability of data from different sources will be investigated, including both accuracy and availability as well as coordinate information correspondence of data. These issues will be discussed more deeply together with database questions in WP2.

The indicators will be classified according to their general usability and timeframe. Indicators related to natural hazards together with technological hazards are listed and inventoried. These indicators will be compared to spatial planning issues and their utilization in planning process will be discussed within WP3. Again, the DPSIR concept will be in major role in these discussions.

After decision of the hazard related indicators a geographical database will be constructed (WP 2). All statistical and geographical data are going to be geo-referenced and its origin and accuracy will be documented in metadata files. A simple structured and properly created database will keep the data easy to transfer and update. This database will be linked to an appropriate GIS application. This GIS application contains general tools for generating indicators by using spatial analysis when input is statistical and geographical data. Outputs will comprise indicator maps and data sets, typologies of risks and indices of vulnerability and sensitivity. In addition, the spatial development barriers resulting from natural and technological hazards will be analysed. The frequency of hazards and their annualised losses will be defined together with management of the risks by authors. All GIS-work will be carried out with adequate geographical level. To ensure the flexible joint use and data comparability all stages will be implemented using the common standards defined by ESPON 3.1 project.

5.2.3. Assessment of broad trends of climate change

The assessment of potential impacts of climate change generally relies on projections from different types of climate models ranging from simple climate models to global Atmospheric-Ocean General Circulation Models (AOGCMs). AOGCMs have coarse horizontal resolution and are generally not capable of resolving spatial scales of less than ~300km. In recent years the development and application of high resolution, regional climate models (RCMs) has been active. These models take their boundary conditions from AOGCM simulations and provide a high-resolution picture over the area of interest. RCMs provide much better description of extreme events and a detailed spatial structure of variables like temperature and precipitation over heterogeneous surfaces e.g. the Alps, the Mediterranean or Scandinavia.

Regional climate scenarios based on RCM simulations are produced at several centres in Europe. At the Rossby Centre of SMHI work on developing regional climate scenarios have been going on since 1996. The assessment of the broad trends of climate change relevant to natural hazards in Europe will be based on:

– IPCC assessments, EU and national reports on climate change e.g. the IPCC WGII reports “Impacts, Adaptation an Vulnerability” (IPCC, 2001), “Land Use, Land Use Change, and Forestry” (IPCC, 2000).

– Assessment of the changes in regional weather and climate over all of Europe based on the output from available regional climate scenarios from different centres in

Europe combined with available information from global AOGCM scenarios.

- The results produced by several ongoing EU research projects, in particular PRUDENCE (Prediction of Regional scenarios and Uncertainties for Defining European Climate change risks and Effects), STARDEX (Statistical and Regional dynamical Downscaling of Extremes for European regions) where SMHI collaborates with several regional climate modelling centres and MICE (Modelling the Impacts of Climate Extremes). These projects are part of a co-operative cluster of projects exploring future in extreme events in response to global warming.

- Results from impact models coupled to the scenarios above and related to the indicators chosen for natural hazards. Impact models include (but are not limited to) models of large-scale and detailed hydrology, river flow and floods, crop production and water use, storm surges.

- Estimates of future changes in extreme events such as flooding and storms from RCM scenarios.

Medium and long-term scenarios concerning spatial effects of climate change on land use, land cover and resources are based on the information and models discussed previously under “Assessment of broad trends of climate change”. Impact models concerning crop production, forestry, water resources etc are coupled to the output of the global and regional climate models. The time span typically covered by the global model (AOGCMs) scenarios include present time up to the end of 2100. The scenarios are available for a range of different greenhouse gas emission scenarios. Towards the end of the 21st century the difference in emission scenarios result in a quite wide range in climate impact. The high resolution, regional climate models (RCMs) typically provide scenarios for a time slice of 30 years towards the en of the 21st century based on a limited number AOGCM scenarios (and indirectly, emission scenarios). The work done in WP 1 will follow these above mentioned results and models.

Based on the assessment of the broad trends of climate change above a second typology of regions revealing the kinds of risks as regards climate change and their degree (in terms of potential impact) will be created. The typology will be made separately for each hazard. Available impact studies will be used as far as possible to take into account the expected frequency and magnitude of occurrence of natural hazards. Where relevant impact models/studies are lacking historical records of occurrence of hazards together with basic understanding of which geophysical variables that are important for determining the risk can be used to make first order estimates of the expected frequency and magnitude of occurrence. Such assessments will be carried out where feasible depending on the availability of historical data.

5.2.4. The vulnerability index

The development of the synthetic index of vulnerability, a numerical summarisation of the degree of risk, will mainly be based on a monetary approach. All risk factors and their potential negative impacts will be used to calculate averaged annualised losses, which take into account the probability of occurrence (frequency) of a hazardous event and the losses such an event would cause. Here, the data available should allow high spatial resolution for the estimation of losses (partly down to NUTS V), resulting in AAL estimates of high geographical detail.

Based on the vulnerability index and the risk typologies, highly sensitive areas will be listed. The list will be compiled in a way that allows public authorities as well as private stakeholders to estimate not only the magnitude of risk but also the local features that mostly contribute to the region's vulnerability. Therefore, the risk profiles for each of the sensitive areas will be included in the listing. In addition, the risk typologies, risk profiles and indices of vulnerability for major metropolitan areas of Europe will be listed separately, regardless of their sensitivity.

The data collected in conjunction with the development of the vulnerability index will be analysed in detail, including factors not incorporated in the final index calculations, to investigate the relationships between vulnerability and spatial typologies. Special emphasis is placed on identifying factors that cause high vulnerability (high hazard probability or high impact) and synergistic causes of vulnerability (e.g. functions that inherently increase the probability of both hazard and damage or functions that must be located in risky areas). The relationships between such areas and the current spatial structure of Europe will be studied to estimate the spatial pressures leading to development of new sensitive areas on one hand, and prospects of alleviating existing problems on the other hand.

5.2.5. The spatial planning perspective

The research project will study linkages between hazards and spatial planning. This is mainly done through case studies of good practices. In the end of the project coherent spatial planning responses will be formulated and recommendations provided. The concept of "response network" will be used in this framework. The project will also take a close look at risk management.

Risk management

Based on the findings of the previous steps, the main components of natural and technological risk reduction and spatial planning will be reviewed and documented. For an integrative risk management it is indispensable to extend the view from only natural to technological hazards which influenced the vulnerability of regions and the necessary spatial planning response.

On the one hand several state institutions like the International Atomic Energy Agency, the Umweltbundesamt (Germany), Bundesamt für Raumplanung (Switzerland), Department of Environment, Transport and the Regions (U. K.), Federal Emergency Management Agency, Office of Managing Risk and Public Safety, Environmental Protection Agency (U.S.A.) are occupied with risk management. On the other hand well known scientific institutes, e. g. the Flood Hazard Research Centre (U. K), Asian Disaster Reduction Centre (Japan), Natural Hazards Centre, Wharton Risk Management and Decision Processes Centre (U.S.A.) published important books and papers on themes around hazards and risks. Moreover innovative intergovernmental co-operations have emerged in the field of risk management in the last years. These are in the first instance the International Commissions for the Protection of the great Rivers, the national platform "PLANAT" in Switzerland, a consultative body which is organized like an extra parliamentary commission. The results of the International Decade for Natural Disaster Reduction (IDNDR) and its successor, the International Strategy for Disaster Reduction (ISDR) must be also considered within the project.

The research in the field of practical spatial planning for risk reduction will focus on the EC member states. The last years have shown a lot of interesting examples for the integration of spatial relevant risks in the regional and urban land-use planning,

especially in the Netherlands, the U. K., France and Germany. But best practise examples have to be taken into account outside the E. C., too. In Switzerland, very innovative instruments like hazard and risk maps as an integrated part of the regional planning have been developed. In addition to natural hazards, these maps allocated hazardous chemical complexes, too. Worldwide, the U. S. has an enormous experience in managing hazards but less in regional planning. The exception to it is the Portland Metro Region and its Natural Hazards Program (Oregon is the only state with a regional planning authority in the U. S.).
An important research question that is discussed in the WP 4 is: What are the main components of natural and technological risk reduction within spatial planning?

Spatial planning could incorporate natural risk reduction in two ways. One way is to integrate hazard mitigation, preparedness, response and recovery pervasively throughout all of the components of the plan, including the assessment of existing and emerging conditions, the framing of goals and general policies, the formulation of strategies and the evaluation of plans and implementation. The other way is to include a separate chapter on hazard management with obligations for land-use. One can find both ways in practice.

Up-to-date knowledge of the predominant types of hazard is an indispensable condition for the assessment of hazardous situations. Periodic controls of the hazardous situation and the efficiency of the existing protective structures must lead to a recognition of possible modifications and sensitive zones. The concepts of protection against space relevant hazards must be elaborated on the basis of a differentiation of the protective objectives. Objects of great value like settlement areas, industrial or social complexes must be better protected that those of lesser value like agriculturally areas. A cost-benefit analysis could be an appropriate measure to calculate this relation. Furthermore retention zones must be maintained wherever possible or they must be rebuilt. All measures must be examined within a framework of weighted public and private interests. Therefore an intensive participation of private stakeholders within the risk management process is indispensable.

At the regional level, the most important task for the spatial planning is the exclusion of further settlement in risky areas. Thereby, it would be possible to reduce the uncontrolled increase of the damage potential. Hazard and risk maps with detailed information about the frequency and magnitude of occurrence are necessary prerequisites for this purpose. This basis is suitable for the creation of several zones of vulnerability. All kinds of settlement must to be prohibited within the zone of the highest risk. Opposite to this only specifically threatened objects are prohibited in the second zone of a medium risk. The third zone with only small risks contains special obligations for engineering and site-design standards for every new development. These regional planning determinations have binding effects for the local land-use planning.

At the local level, an urban-land use plan concerned with future development in hazard-prone areas require risk assessment of new land-uses and new development projects. For this purpose, a general land-use plan could change the types and densities of uses allowed within hazard zones in detail. In addition, a legally binding land-use plan could prescribe the engineering and site-design standards that are required for new development and specify building design standards to strengthen facility structures. Furthermore it is of great value to improve knowledge about the hazard’s risk and spatial variation in risk at the local level. All in all this strategy could amount to structural control of hazards and the protection of community lifeline facilities.

The allocation of potentially hazardous complexes is especially for technological hazards from great relevance. For an effective risk reduction one have to taken into account the frequency of occurrence of a probably event as well as the damage potential which exits in the threatened area around. However, nowadays several countries, e. g. Germany, oriented the allocation of industrial complexes only on a deterministic point of view and exclude the probabilistic component, which is considered e. g. in the Netherlands and Switzerland.

The information gathered in the previous steps will be complemented with demographic, societal-functional, infrastructure, and risk management information to compile a first risk typology (RT) of regions. The typology will first be made separately for each hazard taking into account its expected frequency and magnitude of occurrence. Combined, the information will be used for estimates of potential impact (physical, indirect and direct economic, ecological and social damage). Subsequently, the separate assessments for the individual hazards will be superimposed to reveal the most threatened areas (degree of risk). In addition, the multivariable data will be analysed to delineate different types of risk profiles. The final RTs of regions will be based on a combination of the degree of risk and the relevant risk profile, which includes the way in which the authorities manage these risks. In this context one has to differentiate between two fundamental types of disaster management: On one hand there is the so-called "disaster driven" process. Within that, the authorities concentrate their activities on disaster response with mainly technical tools. Spatial planning is less important within this (traditional) strategy. On the other hand we have "disaster mitigation" which means long-term prevention. For disaster mitigation, adequate land-use and, thereby, spatial planning is the crucial factor to reach the goal of disaster resilient communities. These research themes will be discussed in the WP 2.

Developing a "spatial planning response" to hazards

The research project will develop the framework concept of **response networks** for a better understanding of the management and planning practices related to different hazards. The concept will help in recognising crucial aspects in responses and laying a basis for response design. Response networks are organisational and communicative networks that deal with hazard prevention and risk management. They include an institutional component (existing legislation, policies, guidelines) and a management component (resources, skills, communications). Response networks may operate on different scales (local, regional, national, EU) simultaneously, yet they partly constitute the vulnerability of particular places to hazards. These networks enable the existence of, give rise to and carry out different structural and non-structural hazard prevention measures.

The concept of response networks is helpful in specifying aspects of responses to hazards, thus directly contributing to the ESPON goal of indicator development. Conceptualising response (in the DPSIR indicator model) from a social network perspective should result in a more detailed view of the so-called "non-structural" aspects of hazard prevention, going beyond the traditional technical/structural approach. In its totality, the response network concept includes the whole range of institutions, functions and actors involved with risk management, including prevention and recovery measures (See Figure 6).

Spatial planning functions are a crucial part of response networks. The institutional preconditions together with the planning and management capacities of the networks determine (positively or negatively) what can be achieved in terms of risk reduction and emergency risk management. The integration of risk management and land use planning can also be fruitfully considered in the network context.

A specified "spatial planning response" will be documented within the ESPON HAZARDS project framework. This will provide the basis for formulating response guidelines. The documentation of a spatial planning response relies on a review of existing literature, the application of the response network framework model, the assembly of different response indicators, and draws on lessons from documented good practice and detailed case studies. The integration of planning organisations is crucial here. These tasks, including the testing of the guidelines, are addressed in WP4.

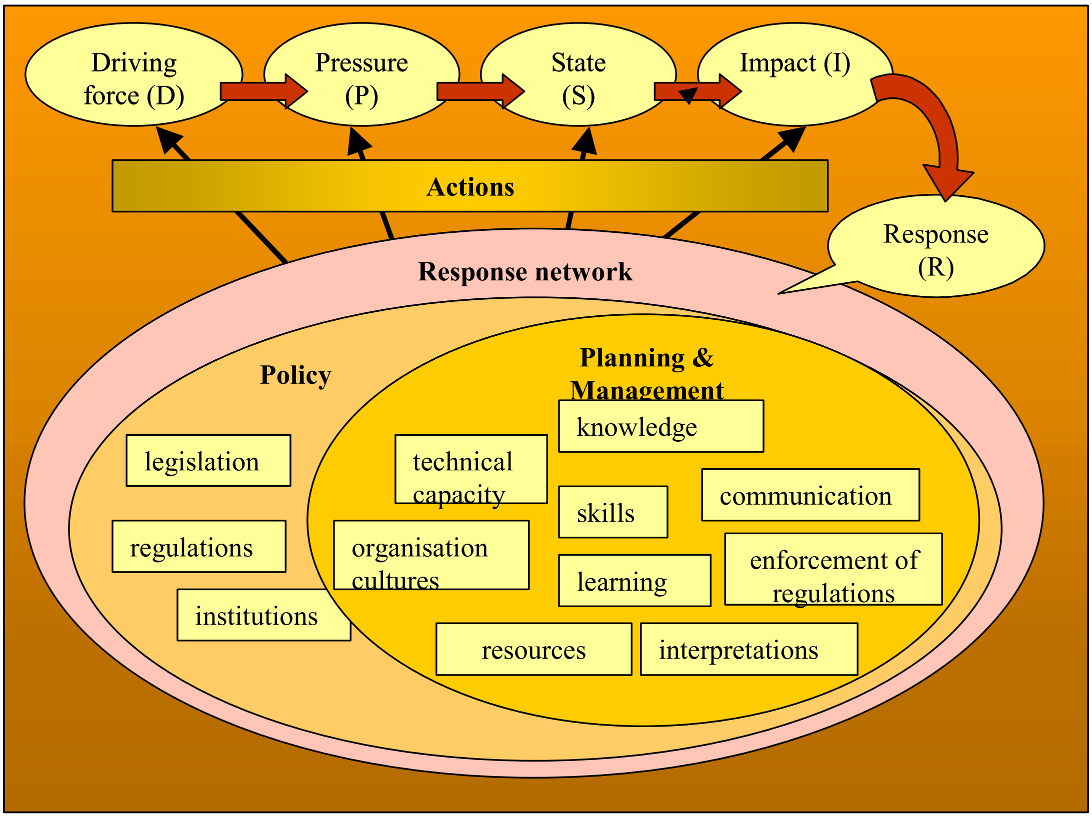

Figure 6. The response networks

The documentation of a spatial planning response needs to pay attention to different dimensions of risk reduction, which are crucial in developing response guidelines. First, risks may be reduced by either securing that spatial development does not aggravate existing hazards or by pursuing risk reduction through active preventive measures. The former *reactive* approach sets the baseline for the second, *proactive* response measures. The guidelines should reflect this duality by referring to minimal standards of risk reduction and supporting a proactive approach. Second, the different spatial scales should be considered by reference to what can be called the *subsidiarity principle of risk reduction*. Since spatial planning response needs to tackle the multi-dimensional nature of hazards, the logic of spatial scales needs to extend from local land use planning to higher levels of spatial planning. Thus, scale-specific interventions may be identified, addressing measures at different levels, from local to European. At the level of policy and institutional conditions for hazard response, one possible approach is the mapping of the data on policies and plans instaured in different regions for hazard prevention. A review of existing response indicators at the EU level is needed. Mapping of hazard prevention policies and plans will be carried out to the extent that it is feasible, depending on the accessibility of regional/ local data on such measures. Third, the relevance of temporal scales needs to be integrated to the approach. The tension between long-term changes in vulnerability and hazard patterns vis-à-vis short-term policy and planning goals deserves careful consideration. Likewise, the immediacy of disasters poses time-specific challenges to planners. Thus, the temporal horizon of planning should be considered as part of preparedness and response capacity. This aspect could also be developed into response indicators.

5.2.6 Good practices and recommendations

At the level of grassroots planning and management, case studies can be used to specify good practices. Here good practice can be understood through the accumulated experience and active mobilization of well-structured response networks. At this level, it becomes possible to study the integration of risk management and spatial planning in detail. Lessons from case studies can, further, provide fruitful input for the development of response indicators, pointing to the what and where of unavailable data.

In the beginning of the project a questionnaire will be sent to different authorities in order to gather information on different ways to manage natural and/or technical hazards, and how risks have been reduced through land-use planning. The questionnaire will be addressed to the network of ESPON contact points and the aim is to find good practice examples.

The project defines spatial planning as covering both regional and local planning. Design is not part of spatial planning, so therefore for example building design is not included in the project. Spatial planning on national and transnational level is included.

One criterion for choosing case studies of good practice examples is the significance of the relationship between a hazard and spatial planning. Good practice examples will be chosen among the cases where spatial planning has played a significant role in risk reduction and management. For example hazards related to marine transport are not as significant in the schema of land-use planning as flood management is. It is important to notice when defining the case studies that some hazards vary in size, occurrence and spatial scale. Flooding, for example, can in some cases have only a local impact, whereas in other situations the impact can be transnational. Floods can also be linked to another hazard, for example, when waste is delivered from a mining site. A local hazard such as an avalanche can be harmless in one spot, but disastrous when it occurs at a tourist site. The following questions will rise: What is the preparedness of local authorities for these hazards? Are the general national guidelines enough, or is it necessary for example to define “spatial barriers” for land-use planning? When a hazard or set of hazards takes place, what are the responses? How do authorities manage hazards? These aspects will be discussed more in WP 4.

After the formulation of response guidelines (the experiences gathered from good practises), they can then be reviewed and tested by project partners and/or affiliate planning organisations in different countries in order to define general recommendations for risk reduction and management through land-use planning. The indicators developed in WP 3 will also be tested by different stakeholders. The response guidelines should be tested through the same organisations while paying respect to different hazards. For example, the regional council of East-Uusimaa regional council can contribute to a review of “spatial planning response” guidelines in terms of Nuclear Hazards (the case of the Imatran Voima Nuclear plant in Loviisa) and Natural hazards (flooding in the Kymijoki river basin catchment area). Other testing grounds with different environmental conditions and sets of hazards can be found within the project network both in western/central and southern Europe (e.g. Comissão de Coordenação da Região Centro (CCRC), the Regional Environment Council of Andalucía). Feedback is valuable for WP 5, where final generalisations and policy recommendations will be written.

One possible insight in this context is a study on the German planning system. The outstanding feature of the decentralised German planning system is the fact that the Federal government itself has no comprehensive and legally binding spatial planning instrument. So Germany has no national plan, but in its place the Federal government has laid down principles of the 'Raumordnung' (spatial structure) which are the fundamental guidelines for the whole spatial planning and spatial policy in Germany. By a special law the Federal government is authorised to draw up principles and visions (Leitbilder) of the spatial development in co-operation with the federal states. This is a new informal planning instrument on the national level.

Legal planning instruments are reserved for the federal states. Only the federal states are obliged to draw up comprehensive plans and to determine spatial objectives which are legally binding for all organisations dealing with spatial planning and measures. The federal states have set up their independent regional planning for parts of their territory (regions) on the basis of federal laws and their own state planning laws. Regional planning has the task of putting the Federal spatial structure principles regarding their relevant state into concrete terms at the level of each individual region. These Regional plans should contain specifications concerning the spatial structure, especially with respect to the desired settlement structure, the open space structure and the infrastructure locations and routes.

In accordance with the Federal Building Code the municipalities are responsible for the two-phases urban land-use planning (Bauleitplanung). The preparatory land-use plan (Flaechennutzungsplan) includes the entire municipal territory. The preparatory land-use plan determines the main features of the different kinds of land-use on the basis of the intended urban development and of the predictable need of the municipality. The legally binding land-use plan (Bebauungsplan) makes legally binding designations on types of land-use permissible in respect of plots within the plan area. Legally binding land-use plans must be prepared as soon as and to the extent that these are required for urban development and regional policy planning. Therefore a municipality is under no legal duty to produce these plans for the entire municipal territory.

In connection with the role of spatial planning in Germany it must be stressed that the space is not only the subject of comprehensive spatial planning, but also of other space-important planning and measures of other planning authorities.

While the task of spatial planning is comprehensive, which means that particular sectoral criteria are not prevailing, but is coordinated and balanced, sectoral planning serves as the accomplishment of sectoral functions only under sectoral criteria.

The (German) planning system possesses thus a second, sectoral dimension with its own organizational units, instruments and authorities. The differences of the material purpose in connection with the different authorities permit hardly an internal harmonization through a common superior authority. Thus problems of the co-ordination and the sphere of responsibility occur in the planning.

An important problem is the relationship between comprehensive spatial planning and sectoral planning in connection with managing space-relevant risks. These two space-referred problematic fields are to be united on the basis of an integrating subject to a strategic concept, because they are two sides of the same coin. Planning means not only *the material aspect of the anticipations of consequences, but also the formal organization and authorities of this process.*

A case study has to consider both, the regional planning authority and the important sectoral planning divisions. The Regierungsbezirk Düsseldorf (an administrative unit within the federal state of Northrhine-Westfalia) would be an appropriate case study. Its innovative new regional plan integrate aspects of natural hazard management as well as technological hazards. In addition, the important sectoral planning divisions have the same territorial validity (Regierungsbezirk).

5.2.7 Policy recommendations

The project will spell out its findings in relation to the ESDP policy options. ESDP policy option 45 on soil protection is of direct relevance for the project, as well as policy option 48 concerning water resources and flooding. One notion that will be further elaborated in the project is the ESDP spirit (policy option 43) that strict protection measures can only cover a part of our natural heritage and that less sensitive areas should be the subject of economic uses if it is ecologically feasible. As the ESDP states, the natural and cultural heritage are economic factors which are becoming increasingly important for regional development, i.e. for competitiveness of an area.

The project will be actively networking with other current ESPON projects. This is unproblematic as the consortium has got the Finnish ESPON Contact Point in the team. The links to the spatial typologies that are going to be developed in projects 1.1.1. and 1.1.2 can also be established in an early phase of the work. The key link is CURS as it currently coordinates the project 1.1.2 and actively cooperates with the project 1.1.1. It will be very interesting to relate the work on polycentrism and on urban-rural relations to the questions of environmental and technological hazards. This work will be carried out in the WP5.

The project takes the challenge to formulate policy recommendations for the development of Structural Funds seriously. There is an extensive amount of studies and impact assessments available on the relation of regional policies and environmental management, but the hazard perspective is not that developed. The same applies to the Structural Funds. This was also acknowledged by the European Commission in connection with the recent flooding in Austria, Germany and several applicant countries. It was stated that in the longer term, the Commission will promote in close cooperation with Member States measures for improved prevention of natural disasters[1].

[1] Communication from the Commission to the European Parliament and the Council: The European Community response to the flooding in Austria, Germany and several applicant countries. A solidarity-based initiative Brussels, 28.8.2002 COM(2002) 481 final. http://europa.eu.int/eur-lex/en/com/cnc/2002/com2002_0481en01.pdf

6. Management and financing

6.1 Descriptions of Workpackages:

WP 1: Data search and indicator development, climate change

This workpackage makes an assessment of existing and proposed indicators related to natural and technological hazards. Two data requests will be formulated on the basis of indicator applicability and data availability. Special emphasis will be given to the relative contribution of climate change in the magnitude and frequency of natural hazards as regards potential territorial impacts.

Aims and objectives

To list and present the different kinds of indicators related to natural and technological hazards available at Community and Member State level, the technology required for data collection, and the degree of comparability of data

- The workpackage will summarize the already developed indicators (based on the DPSIR model) concerning natural and technological hazards from various sources: the EEA, EuroStat, MARS reporting system, selected regional authorities etc. The existing and proposed indicators will be classified on the basis of feasibility on regional level and data availability.

- After the analysis of the data availability and comparability, the Workpackage 1 will summarize the first list of data and indicators required and present the first list in the first interim report.

- The work will be based on literature and Internet review, direct contacts to regional planning authorities, as well as selected interviews with key people at EuroStat, the EEA and national authorities.

Main requests for statistical and geographical data

- Based on the assessment of existing indicators, the WP1 will formulate the first detailed and comprehensive list of main request for statistical and geographical data to be collected from various sources in autumn 2002. After the assessment of preliminary results, a second revised and extended request for further indicators to be collected (mainly) from EuroStat and the EEA will be formulated by summer 2003.

To assess the broad trends of climate change and its potential relative contribution to the magnitude and frequency of natural hazards; regions revealing risks as regards climate change

- The WP1 will use results from a collection of regional climate models (RCMs) combined with information from IPCC and national assessments to assess the relative contribution of climate change to the magnitude and frequency of natural hazards as regards potential territorial impacts. The results from the RCMs will be available in a cluster of ongoing EU research projects exploring future scenarios of extreme events in response to global warming. The workpackage will realise a second typology of regions revealing the kinds of risks as regards climate change specially, its degree in terms of potential impact. Available impact studies will be used as far as possible to take into account the expected frequency and magnitude of occurrence of hazards. Where relevant impact models/studies are lacking historical records of occurrence of hazards

together with basic understanding of which geophysical variables that are important for determining the risk can be used to make first order estimates of the expected frequency and magnitude of occurrence. Such assessments will be carried out where feasible depending on the availability of historical data.
- The way the authorities manage these risks will be evaluated by WP3.

Links with other relevant projects & existing access points

The EEA has already published some indicators in respect of the DPSIR model which will be useful to examine climate change and technological hazards. GTK is a member of the European Topic Centre on Terrestrial Environment and takes part in the development of European-wide indicators.

The WP1 will take into account the results of the European Commission's Major Accident Reporting system MARS; the Eurosion project; the development of the GMES initiative and several regional indicator development projects.

Timetable and milestones

- December 2002 – February 2003: Assessment of existing relevant indicators. First request for statistical and geographical data to be collected from various sources.
- February 2003: Input to first interim report
- March – August 2003: Climate change models connected to the magnitude and frequency of natural hazards. A second revised and extended request for further indicators to be collected (mainly) from EuroStat and the EEA.
- August 2003: Input to second interim report
- September 2004 – January 2004: Further assessment of the proposed indicators with special emphasis on climate change.
- January 2004: Input to third interim report, input to final report edited

WP-leader
GTK

Participating partners
IRPUD, SMHI

Outputs

- Contributions to report
- First request for statistical and geographical data to be collected from various sources.
- Second revised data request
- Internal project workshop presentations

WP 2: Database construction, GIS applications and typology creation

This *database and GIS application* concept involves a geographical database containing geo-referenced data, capability for spatial analysis and map design facilities. GIS application is a general tool for indicator generation and data analysis of statistical and geographical data. Output data will be indicator data sets, spatial typologies and indices of vulnerability and sensitivity in expected geographical levels. Entire work in WP2 from database construction to map-making will be implemented using the common standards defined by ESPON 3.1 project.

Aims and objectives

- ***To set out the data to a standardized form***

All data stored in database can be classified in four types:
Vector layers
Raster layers
Tabular data
Metadata
To facilitate linkage of tabular data to geographic layer all information will be set out under a single reference system. The new European standards about map projection and datum are also going to be followed. Conversion to a single geographic reference system is an essential requirement for being able to carry out analyses combining data from different layers. To ensure the possibility of joint use of the project results the structure of the basis data and transfer formats will be the same as recommended by project 3.1.

In co-operation with related partners the central co-ordination provides
Regional levels and general topographic information
A set of geo-references of different regional levels (NUTS)
The rest of geographical and statistical data will be collected from various sources mentioned in WP1.

- ***Documentation of metadata***

All input and output data sets are going to be documented using metadata. This metadata will include origin and accuracy of the data and description of computations and geo-processing carried out.

- ***To develop appropriate tools for the indicator generation***

The GIS application will be oriented to facilitate development of indicators in standardized regional levels. Input and output data will be stored properly in a simple structure databases to ensure functionality of the GIS.

- ***To make a spatial typology of the risks***

The typology will first be made separately for each hazard in consideration taking into account its expected frequency and magnitude of occurrence. The data needed in this step are collected and stored in the database according to the guidelines developed in WP1. This information will be used for estimates of potential impact (physical, indirect and direct economic, ecological and social damage). Subsequently, the separate assessments for the individual hazards will be superimposed to reveal the most threatened areas (degree of risk, annualised hazard probability). In addition, the data will be analysed to delineate different types of risk profiles. Multivariable methods of data analysis such as principal components analysis (PCA) will be used to reduce the dimensionality of the data. The different risk profiles, that will also include data on management of the risks, will then be presented in a cartographic form with their combined expected frequency.

- ***Development of the synthetic index of vulnerability***

Synthetic index of vulnerability will mainly be based on a monetary approach. This index takes account probability of occurrence of hazardous events and the losses such an event would cause. It is thus an extension of the frequency approach used in presenting the typologies since the expected losses will be presented as averaged annualised losses.

- ***To compile a list of highly sensitive areas***

The list of highly sensitive areas will be extracted from the databases developed, based on the vulnerability index and the risk typologies. To ensure local features will be considered, the risk profiles from sensitive areas are included here.

Timetable and milestones

- **January – February 2003:** Conversion and harmonization of requested data
- **February 2002:** Input to first interim report
- **March – August 2003:** Database construction, indicator generation, first risk typology, synthetic index of vulnerability, list of highly sensitive areas
- **August 2003:** Input to second interim report
- **September 2003 – January 2004:** Risk typology regarding climate change, development of new tools
- **January 2004:** Input to third interim report
- **February 2004 – August 2004:** Database up-dating, maintenance, presentation of the database and mapping facilities developed
- **August 2004:** Input to final report

WP-leader

Partner I GTK

Participating partners

IRPUD

Outputs

- Database encompassing statistical and geographical data
- GIS application for indicator generation, spatial analysis and map design
- Spatial typology of the risks
- Synthetic index of vulnerability
- List of highly sensitive areas
- Contributions to reports

WP 3: Application of indicators to spatial planning, applicability testing

This workpackage applies the proposed indicators to spatial planning and tests these indicators in regional scale. The indicators related to natural hazards together with technological hazards will be compared to spatial planning issues and their utilization in planning process will be discussed. The DPSIR concept will be in major role in these discussions.

Aims and objectives

- *Search for existing risk maps and regional models for flooding zones in the EU*

In several European states different organisations are working at the modelling of flooding zones. In the project an overview should be delivered.

- *Evaluate the different flood indicators in existing programms*

Several monitoring initiatives includes indicators to natural hazards. In the project an overview to flood indicators should be delivered.

- *Selecting flood indicators*

From the indicator list above, some indicators should be selected and supplemented.

- *Developing risk maps*

- *Proposal of an monitoring system*

With this indicators a monitoring system for all towns in Europe with >= 50.000 inhabitants will be proposed.

- *Testing the applicability of this monitoring system in two test areas*

For two test areas this monitoring system will be tested and risk maps constructed

- *Evaluation of European planning instruments*

to capability to implement risk maps and results of monitoring of hazard indicators

Timetable and milestones

- **January – February 2003:** - Search for existing risk maps and models
  - Search for Indicators to the theme "flooding"
  - Selection of indicators to the theme "flooding"
- **February 2002:** Input to first interim report
- **March – August 2003:** - Evaluation of European planning instruments
  - Case study: data acquisition and data analysis
- **August 2003:** Input to second interim report
- **September 2004 – January 2004:**
- **January 2004:** Input to third interim report
- **February 2004 – August 2004:** Case study: Risk maps, conclusions

- **August 2004:** Input to final report

WP-leader
IOER

Participating partners
CCRC+IGM

Outputs
- Report about existing maps of flood areas in Europe
- Indicator for risk of flooding
- GIS application for generation of flood risk maps
- Results from two case studies
- Proposal of operational methods for flood indicators
- Contributions to reports

WP 4: Risks and responses

This workpackage focuses on responses to hazards. Response measures will first be studied from a broader perspective, providing a context for a more detailed analysis of the role of spatial planning in integrated risk management. Drawing on data generated in other workpackages,WP 4 strives to elaborate a multi-dimensional spatial planning response. Finally, the spatial planning response serves as a basis for processing guidelines for planning practitioners and policy-makers alike.

Aims and objectives

- ***To study how national, regional and local authorities manage natural and technological hazards***

- Existing response indicators (based on the DPSIR model) concerning natural and technological hazards will be evaluated. In the case of deficient or unavailable indicators, there should be consideration towards a general overview of what kind of data is available at the different spatial levels (national, regional, local) in different European countries. In addition, the workpackage will also suggest some new response indicators and check their feasibility in relation to data availability.

- The way that authorities manage the different kind of hazards will be studied in the framework of response networks (described in chapter 5.2.5). This means that the project will broaden the conceptual background of the DPSIR model concerning the different factors underlying the ability to respond. The purpose is to shed light on the interrelated actors and their networks and to provide suggestions on how the responses can be integrated in the creation of indicators and typologies (in WP1 and 2).

- ***To review good practice, especially risk reduction through land-use planning***
- Data on related practises of spatial planning can also be gathered with small questionnaires addressed to the ESPON Contact Points that can act as links to the national authorities and research communities.

- As European-wide data on managing hazards is limited and to a large extent not quantifiable, hazard management can fruitfully be approached via learning from good practices. Case study areas can be chosen, reflecting the variety of hazards and institutional settings. The typologies of risk areas and vulnerability can also point to interesting case studies in some multiple-risk regions. Such regions are likely to have developed local knowledge and experiences, including physical and organisational structures which can provide invaluable lessons of risk reduction.

- ***To study the institutional preparedness in relation to hazards as an input to the vulnerability index to be developed in WP2***

As the vulnerability of a region is determined not only by certain physical characteristics, but also by the institutional responses, the vulnerability index needs to include that dimension. Mapping socio-economic vulnerability at the European scale is an immense task, which lies largely beyond the scope of this project. A more limited, but feasible approach to be adopted in WP 4 is the identification of a key set of socio-economic indicators that allow for the inclusion of socio-economic aspects in the vulnerability index. The selection of these indicators will be based on earlier research and the review of good practice. This may also result in the development of new indicators.

Institutional capacity and preparedness raise the critical question of whose hazards are being addressed and who carries the responsibility of response. A mapping exercise on institutional vulnerability may reveal institutional "voids" where no-one assumes responsibility for certain types of risk management and hazard prevention. There are more chances of moving away from vulnerability, if there is good governance and proper accountability.

- ***To develop "the spatial planning response" to risk reduction together with the WP3 and build guidelines based on such a response***

A specified "spatial planning response" will provide the basis for formulating response guidelines. The documentation of a spatial planning response relies partly on regional risk typologies and tools developed in other workpackages. It also draws on the elaboration of different response indicators, and draws on lessons from documented good practice. The integration of planning organisations (project partners and affiliates) is instrumental for developing and especially for testing the guidelines. There are specific barriers for an effective spatial planning response which are related to the different planning systems in the EU. For the background of a weak regional planning without binding effects (e. g. in the U. K. Ireland and Greece) there is a need for alternative instruments to reach a risk reduction for example. For that reason the EU member states will be grouped into several categories according to their typical characteristics referring to their planning system at regional and local level.
Finally, the guidelines are to be targeted at different levels. Thus the project would contribute to both local/regional planning concerns by providing practical guidelines for the different categories in order to make the policies towards risk reduction more applicable and the transfer of instruments and good practise more likely to succeed in the light of the considerable variation in administrate structures and planning instruments. At the national/EU levels are to be achieved by providing policy guidelines on spatial planning at these levels.

A combination of the following methods will be adopted:
- literature reviews including both academic and policy documents as well as relevant project reports
- selected interviews with key experts and practitioners at EU and national levels
- questionnaire to national authorities via ESPON Contact Points
- case study methods for studies at the local and regional levels
- expert workshops with professionals and practitioners can be held together with the WP3

Links with other relevant projects & existing access points

- The project will review and seek to complement European Environmental Agency response indicators from a hazard perspective
- The JRC-IES project on Natural hazards (in FP5) may provide useful parallels for risk assessment and vulnerability issues. The development of European Risk indicators by JRC-IES feeds into the development of response indicators of WP 4.
- The report concerning Environmental Assets in the Study Programme on European Spatial Planning can be used as one entry to the response
- The United Nations UNISDR programme (International strategy for disaster reduction) has recently finalized a global
review of disaster reduction initiatives, which serves as a valuable comparison point for reviewing

indicators and good practice

Timetable and milestones

- March 2003: Preliminary overview of concepts and methodology of the WP, literature review on risks and hazard prevention in spatial planning
- March – August 2003: A review of existing response indicators, case studies in selected areas, questionnaire to ESPON contact points
- August 2003: Input to second interim report
- September 2003 – January 2004: Mapping institutional preparedness
- January 2004: Input to third interim report
- February 2004 – August 2004: A Documented spatial planning response to hazards, with guidelines
- August 2004: Input to final report

WP-leader

Partner 6: CURS

Participating partners

IRPUD, GTK, IOER

Outputs

- Literature review
- Review of existing response indicators
- Case study reports
- Vulnerability index on institutional preparedness
- Spatial response guidelines
- Conference presentations and journal articles

WP 5: Management, reporting, links, policy recommendations

This workpackage insures that the project is managed properly from both the scientific and the financial aspect. A good management requires good reporting and good publications for interested third parties. This includes the making of proper links and networking as well as, being an important issue in the whole project, addressing policies and giving policy recommendations.

Aims and objectives

1. ***To ensure a high quality of the projects results, according to the terms of reference; to guarantee the timely delivery of the reports; to ensure a proper handling of the projects resources***

The workpackage will ensure that the research work is target oriented, according to the worklan and on schedule. The management will also ensure that duplications are avoided. It is important to keep a close eye on the progress of the work and that the main scopes are not lost by obstacles hidden in details. The manager will nominate workpackage leaders and ensure together with them the timely delivery of the reports.

2. ***To manage the finances according to the financial plan and EU-regulations***

The finances will be handled in an open and transparent way and according to EU-auditing standards. GTK is the lead partner in many National, EU and International projects. Its financial administration has a long experience with the financial handling of all type of projects and will ensure the proper management of the accounting in this project.

3. ***Steering group***

A steering group will be organized under this workpackage to accompany and steer the progress of the project from an outside viewpoint. The steering group shall meet once a year where it will receive the reports from the project manager. The steering group will be assisting the project in finding solutions in case of any problems during the project.

4. ***To dessiminate the results, create links to the ESPON community and build up a network***

The manager will nominate one person to be responsible for the dessimination of results, the creation of links and the building of a network. The results shall be made available for various European Regions that will be connected via links. A network will critically review the reports and thus ensure the acceptance on the user's side. The project will build on the work done in currently running ESPON projects in order to connect the hazard perspective with the studies on territorial development trends, especially with ESPON projects 1.1.1 and 1.1.2.

5. ***Policy recommendations***

One major outcome of the project are the policy recommendations for a proper management of hazards on a European level. Therefore the management will ensure that the policy recommendations are elaborated in cooperation with all the WP's.

Timetable and milestones

- December 2002 – or January 2003: Organisation of Kick off meeting and consequently finalisation of workplan; setup of steering committee.
- February 2002: First interim report
- August 2003: Second interim report
- September 2003: Meeting of the steering committee, assessment of progress of work
- December 2003: First annual meeting. Assessment of work done so far, revising and adjustment of workplan. Preliminary policy recommendations.
- January 2004: Third interim report
- February 2004: If required, second meeting of the steering committee.
- May 2004: Second consortium meeting, final adjustments to workplan
- August 2004: Final report, policy recommendations

WP-leader
Partner 1 GTK

Participating partners
SMHI, CCRC+IGM, IÖR, IRPUD, CURS

Outputs

- Reports
- Financial statements
- Leaflets, reports, documents
- Functioning network
- Policy recommendations

6.3 Reporting

I First interim report (editor Philipp Schmidt-Thomé, GTK)

I.I Data and indicators

Description: Consensus on the data and indicators required, after a precise analysis of the availability and comparability of data at Community level, to develop new database, including territorial indicators and the facilities needed for map-making. For the analysis, the results of the study programme and the results of other ESPON projects in course, in particular under priority 3.1, will be taken into account. Definition of the appropriate geographical level and technology required for data collection, taking into account the availability of relevant data.

Work package(s): WP1

Contributions from Timo Tarvainen (GTK), Jaana Jarva (GTK), N.N. (SMHI), Stefan Greiving et. Al (IRPUD)

I.II Data requests

Description: A first detailed and comprehensive list of main requests for statistical and geographical data to be collected mainly from Eurostat, the EEA and National Statistical Institutes and National Mapping Agencies in autumn 2002.

Work package(s): WP1

Contributions from Timo Tarvainen (GTK), Jaana Jarva (GTK), Hilkka Kallio (GTK), Stefan Greiving et. Al (IRPUD), N.N. (CCRC+IGM)

I.III Further investigations

Description: A preliminary overview on concepts and methodology and hypothesis for further investigation.

Work packages(s): WP1, WP2, WP3

Contributions from Tommi Kauppila (GTK), Hilkka Kallio (GTK), N.N. (SMHI), Stefan Greiving et. Al (IRPUD)

II Second interim report (editor GTK, Jaana Jarva)

II.I Preliminary indicator assessment

Description: Preliminary results on the basis of available territorial indicators, including European maps showing the existing spatial structure and the vulnerability of areas, as far as possible related to the degree of polycentrism:
Synthetic index of vulnerability available at an adequate geographical level;
Compilation of good practice for the management of natural and technological hazards by the authorities and risk reduction;

Two typologies of regions: the first one dealing with natural and technological hazards in general, the second dealing with natural hazards and effects specifically as regards climate change;
A list and a map of highly sensitive areas in relation to spatial typologies developed in the other projects measure 1.1.
First ideas and draft guidelines on spatial planning for natural hazard risk reduction;
First proposals to improve monitoring systems for natural and technological hazards. Preliminary overview of risks and hazard prevention in spatial planning.

Work package(s): WP1, WP2, WP3, WP4

Contributions from Jaana Jarva (GTK), Tommi Kauppila (GTK), Philipp Schmidt-Thomé (GTK), N.N. (SMHI), Stefan Greiving et. Al (IRPUD), Kaisa Schmidt-Thomé (CURS)

II.II Overview of concepts and methodology

Description: A first overview on concepts and methodology and possible final results.

Work package(s): WP3

Contributions from N.N. (IOER), N.N. (CCRC+IGM)

II.III HAZREGIS database

Description: Establishment of a new database, so far based on indicators available and with the ability to produce European maps. Database with variables related to natural and technological hazards, in respect of the DPSIR model.

Work package: WP2

Contributions from Hilkka Kallio (GTK), Jaana Jarva (GTK), Timo Tarvainen (GTK)

II.IV Second data request

Description: A second revised and extended request for further indicators to be collected (mainly) from Eurostat and the EEA, by summer 2003.

Work package(s): WP1, WP2

Contributions from Timo Tarvainen (GTK), Jaana Jarva (GTK), Hilkka Kallio (GTK), Stefan Greiving et. Al (IRPUD), N.N. (SMHI)

III Third interim report (Editor Tommi Kauppila GTK)

III.I Main results: preliminary overview

Description: A working report on the main results elaborating the approach introduced in the previous report including databases, indicators, map-making and a analysis/diagnosis in Europe, as well as the existing territorial imbalances and regional disparities based on the research questions above, including an extended number of available territorial indicators and European maps showing, as far as possible, interrelationships between the aspects concerning the and the territorial integration of candidate countries in an enlarged EU.

Work packages: WP1, WP3, WP4

Contributions: Jaana Jarva (GTK), Philipp Schmidt-Thomé (GTK), Lasse Peltonen (CURS), Stefan Greiving et. Al (IRPUD), N.N. (SMHI), N.N. (IOER), N.N. (CCRC+IGM)

III.II New tools

Description: Description of appropriate new tools for the processing of the new data base, indicators and map-making.

Work package: WP2

Contributions: Hilkka Kallio (GTK), Timo Tarvainen (GTK)

III.III Territorial development trends

Description: Applicable systems for the monitoring and benchmarking of new trends of territorial developments in the context of the European territory, including candidate countries and neighbouring countries.

Work package: WP4, WP5

Contributions: Kaisa Schmidt-Thomé (CURS), Stefan Greiving et. Al (IRPUD) N.N. (IOER), Tommi Kauppila (GTK)

III.IV Risk regions

Description: Detection of typologies of regions revealing risks and potentials for the identified types of regions.

Work packages: WP2, WP4

Contributions from Lasse Peltonen (CURS), Stefan Greiving et. Al (IRPUD), N.N. (IOER), Tommi Kauppila (GTK)

III.V Policy recommendations

Description: Policy recommendations, which could provide the basis for future focus of Community interventions post 2006, to improve an integrated territorial approach in the management of natural and technological hazards, including institutional settings and instruments. Particular attention will be paid to peripheral and ultra-peripheral regions.

Work packages: WP4, WP5

Contributions: Kaisa Schmidt-Thomé (CURS), Stefan Greiving et. Al (IRPUD), Philipp Schmidt-Thomé (GTK)

IV Final report (editor Philipp Schmidt-Thomé GTK)

IV.I Main results and recommendations

Description: An executive summary of the main results of the research undertaken and recommendations for policy development.

Work packages: WP3, WP4, WP5

Contributions Jaana Jarva (GTK), Tommi Kauppila (GTK), Leena Mikkonen-Young (CURS), Stefan Greiving et. Al (IRPUD), N.N. (IOER), N.N. (CCRC+IGM)

IV.II Trends

Description: Comprehensive presentation of trends in relation to a polycentric and balanced development of an enlarged European Union.

Work packages: WP4, WP5

Contributions Leena Mikkonen-Young (CURS), Stefan Greiving et. Al (IRPUD)

IV.III Improvement of the integrated territorial approach in the management of hazards

Description: Presentation of access points and concrete ideas for policy responses to improve an integrated territorial approach in the management of natural and technological hazards, at different scales and in different parts of the Union, that could improve territorial cohesion; including proposal for guidelines on spatial planning for natural hazard risk reduction and proposals to improve monitoring systems for natural and technological hazards.

Work package WP4

Contributions Leena Mikkonen-Young (CURS), Stefan Greiving et. Al (IRPUD)

IV.IV Indicators

Description: Presentation of the developed territorial indicators, concepts and typologies linked to transport infrastructure and services, including maps.

Work package WP1, WP2, WP4

Contributions Lasse Peltonen (CURS), Stefan Greiving et. Al (IRPUD), Tommi Kauppila (GTK), Timo Tarvainen (GTK)

IV.V Database HAZREGIS and mapping tools

Description: Presentation of the database and the mapping facilities developed, covering as far as possible an enlarged EU and neighbouring countries: Medium and long term scenarios on spatial effects of climate change on land use, land cover and resources that could be inputs to the forthcoming scenario development under ESPON project 3.2.

Work package: WP2

Contributions: Hilkka Kallio (GTK), Timo Tarvainen (GTK); Jaana Jarva (GTK)

IV.VI Further development

Description: Listing of further data requirements and ideas of territorial indicators, concept and typologies as well as on further developments linked to the database and mapping facilities.

Work packages: WP2, WP3, WP4

Contributions: Hilkka Kallio (GTK), Philipp Schmidt-Thomé (GTK); Jaana Jarva (GTK), Kaisa Schmidt-Thomé (CURS), Stefan Greiving et. Al (IRPUD), N.N. (IOER)

6.4 Timetable

	WP1	WP2	WP3	WP4	WP5
December 02 - February 03					
Data and indicators					
Data requests					
Further investigations					
First interim report					
March 03 - August 03					
Preliminary indicator assessment					
Overview of concepts and methodology					
HAZREGIS database					
2nd data request					
Second interim report					
September 03 - January 04					
Main results: preliminary overview					
New tools					
Territorial development trends					
Risk regions					
Policy recommendations					
Third interim report					
February 04 - August 04					
Main results and recommendations					
Trends					
Improvement of integrated territorial					
Approach in the management of hazards					
Indicators					
Database HAZREGIS and mapping tools					
Further development					
Final report					