

## 4. Conclusions and recommendations on future INTERREG environmental risk projects

So far only few INTERREG III programme area measures and priorities mention risk. Since natural and technological hazards, as well as resulting risk patterns, can influence regional development adversely, it is recommended that both risk patterns and vulnerability factors should be taken into account in order to reduce overall risk in future Objective 3 programmes.

Based on an analysis where INTERREG project activities are related to the hazard and risk patterns identified by the ESPON Hazards project (Schmidt-Thomé 2005), some general and large scale recommendations on future risk related actions are given below. These recommendations take the spatial relevance of hazards into account, as well as the activities that have so far been undertaken in INTERREG projects, i.e. there is a stronger highlight on areas that have had no or few INTERREG activities so far. It should nevertheless always be evaluated on regional or local levels, to what extent hazards and risk related projects could support regional development, both in areas that have not had projects yet and in areas that have already had several activities.

As mentioned above, these recommendations are based on a European-scale perspective. Other hazards than those identified here might be of great importance regionally and locally. These should be evaluated on programme area scale in order to define potential needs of actions.

### 4.1 Geohazards

Hazard sources and the potential extent of damage can be regionally better delimited for most geohazards than for meteorological hazards. Landslides are confined to valleys and slopes, and here often the geology and climate determine certain areas of risk. Volcanic activities have mostly local to regional effects, but ash plumes can reach larger over-regional to global extents. Earthquakes appear, besides those caused by underground failures and explosions, in tectonically active areas. In this sense it is possible to delineate the immediate hazard and risk of geohazards to those areas where they mainly occur. Tsunamis are confined to coastal areas and can be triggered by all geohazards mentioned above.

**Earthquakes** are extremely dangerous and affect large areas of the eastern Mediterranean and Eastern Europe. In comparison to the relative importance of earthquakes revealed by the Delphi method (see chapter above), it would be strongly recommended to take this hazard more into account in future Objective 3 activities in these areas. Many very old settlement areas have always been located in earthquake prone areas and earthquakes have always affected the European civilisation. Old structures are difficult to protect, therefore future projects should focus on enforcing appropriate engineering of new structures to be earthquake proof, the development of disaster management plans and cooperation of regions in cases of disasters. Cross-border cooperation in case of disasters can be planned well before an earthquake strikes so that relief operations can start without delay. Future projects should focus especially on the eastern and central Mediterranean region as well as overseas territories.

Among the most widespread geohazards in European regions are **landslides**. Landslides are used here as a term that summarises all kinds of gravitational mass movements (rock falls, debris flows, etc.). Landslides can occur on very small spots that are not possible to display on regional level, so that it is to be defined by the relevant programme areas, where such hazards should be taken up in future Objective 3 programmes. In general it can be said that mountainous areas, in particular those with harsh climates favouring weathering processes, high precipitation rates and a high settlement pressure, are those that are most prone to landslides. Nevertheless, locally these conditions might be very different, according to the geology, morphology and land use. Since terrestrial landslides (rock falls, etc.) into lakes or the sea can trigger tsunamis, this hazard can also play a role in the development of some settlement areas, e.g. in Norway where this hazard combination is most imminent. The need for landslide projects has to be defined locally.

The most active **volcanoes** on the European continent are found in Italy. Volcanoes are of particular relevance also for distant EU areas of France, Portugal and Spain and should be taken into account here as potentially affecting settle-

ment development. Since the active volcanoes are known, regional and local settlement development plans should respect safety zones. A considerable problem arises from uncontrolled settlement in hazardous areas, which also puts rescue teams in unnecessary danger. Appropriate land use, evacuation plans and disaster management plans in active volcanic areas, in close cooperation with neighbouring regions, should enable sustainable development of potentially affected areas.

**Tsunamis** are theoretically possible in all coastal regions, even if they were located far away from seismically active zones. The danger of tsunamis in the Mediterranean is high. It should not be forgotten that most recent tsunami catastrophe in the Mediterranean caused over 75 000 casualties in 1908 in Italy, Messina. Even though this event occurred nearly 100 years ago, a geological perspective reveals that this hazard is still imminent as large parts of the Mediterranean area are tectonically active. Many distant EU areas also show a tsunami risk pattern. It could be of relevance to see if a tsunami warning system was feasible to install and how this could support regional development and decision-making.

**Other georisks** that were not identified by the ESPON Hazards project comprise factors of geochemistry. Various rock types and sediments have elevated contents of potentially harmful elements such as arsenic, fluoride, nickel, thallium or uranium. These elements pose health risks both on local scale (related to certain mineralisations), and also on regional scale as shown in the geochemical maps of Europe (Salminen 2005). For example, the concentration of fluoride in stream waters is high in the areas of certain granite types in alkaline volcanic rocks in Italy and in Scandinavia. Elevated concentrations of arsenic are found in large areas around ore potential areas of Portugal, France and Greece as well as in black shale areas of the Pyrenees. Here the risks are mostly linked to the quality of drinking water. In the case of radiating elements, indoor radon concentrations can be high in uranium rich regions.

In coastal regions soils and sediments may locally be extremely acid leading to significant financial loss due to dissolution of concrete foundations and drainage systems. Due to extreme acidity also harmful elements such as aluminium is released, leading to mass deaths of fish popula-

tions in rivers draining through acid soils. Acid soils are typically found in land areas where sulphide-rich sediments are exposed to oxidation due to artificial processes such as ditching and land reclamation. Such regions are especially found in Scandinavia where natural land uplift (glacial isostasy) steadily exposes sulphide-rich sediments in coastal areas.

## 4.2 Meteorological hazards

This chapter analyses meteorologically influenced hazards in alphabetical order taking into account relevant hazard interactions and climate change factors. Meteorological hazards often have a wider and fuzzier impact space than geohazards. Floods can affect large catchment areas (e.g. the entire lower Rhine area), storms can hit very large regions leading to both storm surges and inland damages, droughts can even affect the entire continent. However, it is seldom only the hazard itself that influences regional development. Only in combination with disadvantageous land use practices, infrastructure and settlement patterns they lead to catastrophic impacts. In the discussion of meteorological hazards vulnerability reduction should therefore play a very important role.

The latest results of climate change models should also be taken seriously into account. As an example of a close cooperation between scientists and decision-makers in the field of climate change related issues, the INTERREG IIIB BSR project on Sea Level Change Affecting the Spatial Development of the Baltic Sea Region (SEAREG) has had close cooperation with spatial planners and other stakeholders. The sea level change assessment carried out under this project revealed that even though planning mostly concerns time periods of 10-20 years, climate change perspectives of up to 100 years are very relevant for planning, especially when talking about long-term investments and sustainable development. The resulting scenarios of the SEAREG project have found their way into many discussions and partly also development strategies of regions and towns. The follow up project INTERREG IIIB of SEAREG: "Developing Policies & Adaptation Strategies to Climate Change in the Baltic Sea Region" (ASTRA) focuses on several impacts of climate change on natural hazards and analyses those in close cooperation with local and regional authorities in case study areas around the Baltic Sea.

The **avalanche** hazard is, just as the landslide hazard described above, very much confined to particular slopes and valleys. Since the avalanche hazard received an overall rather low rating of importance in the Delphi exercise of the ESPON Hazards project, and over 90% of the avalanche accidents with casualties are triggered by human activities in avalanche prone areas, the main focus of future projects with this hazard should concentrate on the safety issue in skiing and mountainous (snowy) hiking areas.

**Droughts** are a very important hazard that affects large territories in Europe. So far there have been only few projects dealing with this hazard in INTERREG projects and it is strongly recommended to focus more on the adverse impacts of drought on regional development. It should be taken into account that droughts affect not only agriculture but also other industries, when cooling waters from rivers cause energy production plants and other industries to run on lower efficiency or even shut down due to the lack of cooling water from, e.g. rivers or lakes. Since droughts are difficult to predict, only long-term hazard management, including the sustainable usage of water resources, can prove sustainable. Hazard interactions should be taken into account, as droughts can lead to an increase of the forest fire potential, and heat waves occurring mutually with droughts can increase both the drought and the forest fire hazard. Heat waves occurring at the same time with droughts can also lead to an additional stress in the energy supply, as the water needed for energy production might get too warm for cooling processes and the use of air conditioning systems causes an increasing demand on power production. It should also be taken into account, that the latest climate change scenarios see a potential for an increase of the drought potential in the Mediterranean area and parts of central Europe.

**Extreme temperatures** are also difficult to forecast on a mid to long-term basis and therefore the regions that are most prone to this hazard should take long-term precautions. In this category fall especially the areas highlighted in the ESPON Hazards project. An important approach can be the general life and working conditions in extreme cold climates in the Northern peripheral areas, and this also accounts for areas in Eastern Europe that experiences strong variations of very hot summers and very cold winters. Materials and installations must be able to resist the temperature variations, and energy support (heating and cooling

systems) must be adaptable to extreme situations. In addition, many people suffer from extreme heat waves so that additional risks, e.g. for the health care systems, should be taken into account. Potential new projects could develop scenarios of, e.g. extreme temperatures during different periods of the year to determine the vulnerability of an area to those climatic extreme events. These scenarios can then accordingly lead to long term action and mitigation plans.

By far the highest amount of all INTERREG III projects on hazards has been focusing on the **flood** hazard. One reason for this may lie in the dramatic recent flood events across Europe, which have served as “focussing events” guiding policy-makers’ attention. In any case, this meteorological hazard, the impact of which is increased by the type and location of settlements and hydraulic engineering (e.g. straightening of rivers), etc., is one of the most mentioned in INTERREG priorities and measures. It should be evaluated on regional and local scales whether these projects have actually lead to a decrease of the flood potential and vulnerability. This should help to determine the need for more flood projects. In other words, the development of over-regional (cross-border/catchment wise) cooperation should be endorsed, with a clear focus on the development of flood retention areas and natural flood prone areas. These efforts will be conducted in relation to the implementation of the recent EU Flood Directive, which also links with the Water Framework Directive. An important aspect could also lie on climate change, as the flood patterns might change due to earlier snow melting in spring and increased precipitation, especially in central and northern Europe. Also extreme weather events appear likely to increase in the future. Since the flood potential is very high in central and eastern Europe, most of these regions should get better prepared for future extreme flood events, especially taking over-regional and cross-border policy development on river catchment management into account.

The hazard of **forest fires** has been addressed by INTERREG III projects far less than the relative importance indicated by the results of the Delphi method would imply. Forest fires are a natural hazard, but approximately 90% of these fires are caused by human activities. There are several forest fire research programmes under the EU Frameworks and also ongoing in large EU research institutions, but there should be a closer link to the actual implications of forest fires on regional development. It would

therefore be highly recommended to take up the forest fire hazard in future INTERREG programmes, especially in the Mediterranean area and parts of Central and Eastern Europe. Additionally, the potential interactions of forest fires with other hazards, such as droughts and extreme temperatures should be taken into account in terms of long term planning potentials concerning these interactions. The effect of climate change on these mentioned hazard interactions should also be respected.

**Storm surges** have so far been mostly dealt within North Sea areas with few exceptions. This pattern follows the one identified by the ESPON Hazards project. The possibility of forecasting storm surges has improved strongly in the 20th century and at the same time integrated coastal risk management has lowered the casualties of storm surges. Climate change models have so far not been able to develop any reliable forecasts on changes of wind/storm surge patterns. Nevertheless it is recommended to include hazard interactions of (winter) storms with (coastal) floods into future storm surge projects, such as already done by the INTERREG IIIB projects SEAREG and ASTRA, for example. These projects also include climate change models, a trend that is recommended to be broadened in future INTERREG activities.

There are no scenarios yet on the influence of climate change on **winter and tropical storms**. Since storms belong to the most important natural hazards on a global scale, also Europe could focus more on the financial effects of storms. In the case of storms the most appropriate mitigation from the regional development perspective could be to initiate a decrease in vulnerability, for example by focusing on the reduction of the consequences of the impacts and strengthening the coping capacity. In other words, the consequences of storms on the infrastructure and the other vital assets of regions should be taken into account. Also the interactions of winter storms with storm surges and floods can be addressed to a larger extent, especially in the North Sea and the Baltic Sea as well as cross-border cooperations to ensure timely early warning and relief operations.

### 4.3 Technological hazards

In the field of **technological hazards** the most intense focus should lie on accident prevention, e.g. by ensuring

that EU and international safety procedures and recommendations are most strictly followed. Besides these, close cross-border cooperation in cases of disaster should be further ensured, especially in the case of monitoring and relief operations (e.g. oil spills). Early and appropriate disaster management is often a decisive factor in disaster control. Appropriate land use planning can help to ensure that, in case of accidents, disasters do not affect settlements, vital infrastructure or protected nature areas. Since technological hazards occur in many places in Europe, priority could lie on areas with a high population density and those with important and/or fragile ecosystems.

### 4.4 Cooperation potential of INTERREG and ESPON

A future Objective 3 programme could cooperate more tightly with ESPON. Since ESPON has developed data and maps on all kinds of topics regarding the regional potential of future terrestrial development covering the European Union Member States, plus Bulgaria, Norway, Romania and Switzerland (EU29), this information can be used by INTERREG to define future programme strategies. In addition, ESPON can support future Objective 3 projects by their large data sets and expertise in spatial and territorial issues, e.g. on Territorial Impact Assessment (TIA). ESPON on the other hand could benefit from cooperation with Objective 3 projects to test some of the ESPON methodologies in project areas and refine those accordingly, mainly in order to support the definition of new strategies and goals as well as policy making at any relevant geographical level.

A future Objective 3 programme could take into account the large amount of policy recommendations issued by ESPON projects. The ESPON programme 2006 has been developing an integrated picture on the potentials of territorial development in Europe, based on several indicators and typologies. These indicators and typologies can be a fruitful base for INTERREG to outline the content and orientation of future Objective 3 projects, for example by identifying territorial trends that either favour or pose an obstacle on sustainable regional development. The ESPON studies are of additional value because they cover the entire programme area (EU 27+2) and have all reported on regional (mainly NUTS 3) level. Those INTERREG areas currently outside of the ESPON space can observe which

trends are of importance to them. The ESPON database could be open to all INTERREG projects so that data sets can be shared which might lead to an additional transparency and comparability of results. In general it would be recommended for INTERREG to give more guidelines on the result reporting so that an inter-comparability would nourish future projects, avoid research on similar topics and ease evaluation of programmes and results. For example, it would be of an added value if all projects had to shortly describe how they have dealt with the measure they claimed to address in the application form.

The Delphi method could play an important role if certain trends, impacts, measures, etc. have to be compared over larger areas, in both defining goals and evaluating results. ESPON could take up some ideas from the management of INTERREG activities. For example, at least for some of the measures of the programme calls for proposals could be issued instead of tendering of some pre-defined requirements. This way project teams would have more to say on how to structure research on certain issues or on how to solve particular questions/obstacles, etc. This would give another research perspective to ESPON, even if it would be only a small part of the entire programme. The strategy could be to hand over unsolved questions first to a research oriented project type and then take up the results and define the topics that are to be derived from these into ESPON standards.